Violin Performance Teaching and Learning:

the development of technology and its role in violin pedagogy

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Statement of originality

I declare that the research presented here is my own original work and has not been submitted to any other institution for the award of a degree.

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Abstract

Music is a creative art involving the expression of feeling and spontaneity. This artistry demands the mastery of musical instruments, of which the violin is one. Traditional violin methodology has been the accepted way to develop the art of violin playing, but technology and the internet have provided different approaches to teaching methods. This thesis addresses the degree to which these different approaches may or may not enhance violin teaching and learning. In the first instance this thesis looks at the function of the online learning platform YouTube, and then at the teaching methodology of Suzuki using audio and of Zhang using online video. In order to assess the possibilities of these new learning approaches, it was necessary to research teaching methods used by traditional masters of violin pedagogy. A study into their philosophy, which was formulated from their personal teaching experience, revealed a unanimous belief in the crucial need for mental practice in the co-ordination of mind and body. Further evidence about this crucial link between mental preparation and performance can be found in research into training for sport, from amateur to professional levels. The overall results of the thesis reveal that technology, as used by Suzuki and Zhang's online method, cannot meet all the expectations of traditional methodology. In particular, technological teaching is unable to respond to the individual needs of students, nor is it able to guide students in the development of mental practice and independent learning. On the positive side, YouTube provides a platform for students to observe masterclasses and the performances of renowned musicians and orchestras.

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List of Musical Examples

Chapter One: Introduction

In the 21st century, advanced technology has revolutionized both business and personal communication. Computers can store more data than the human brain and download it with speed and accuracy. The internet provides access through the personal computer, tablet, smartphone and smartwatch. Online research and lectures are commonplace in universities and other educational institutions. Obviously, technology brings benefits and convenience to teaching and learning systems as it allows students to attend lectures, which they can repeat if needed, to enhance understanding in the home, in other cities or even overseas, via the internet. Technology is being implemented in the teaching of music, through the use of audio-visual, interactive or other computer- based teaching materials. In particular, Apps have been developed to provide interactive audio-visual teaching of music. The Aural book App for AMEB (Australian Music Examinations Board) one to eighth grade provides aural practice, analysing pitch, rhythm and giving feedback. Likewise, the ABRSM (Associated Board of the Royal Schools of Music) Sight-Reading Trainer App for piano provides training using the game structure to unlock levels. These two Apps are recent additions to the growing number of Apps used for the purpose of musical training. In addition, Blogs are a social network used to share musical pedagogical material and ideas. For instance, the blog of Goetz Richter provides his perspective on the philosophy of music in his research field and encourages readers to comment or discuss. Additionally, live interactive internet lessons are offered on websites like Violinmasterclass.com (which also has a Blog category) and on stringpedagogy.com. Technology is currently being used by teachers and students both in passive and in interactive ways.

By contrast, violin pedagogy started of course without any assistance from technology. The history of violin teaching stretches back to the middle ages, but violinists largely learnt through an apprenticeship system or were taught within the influential family in Court. Formal pedagogy commenced at the beginning of the eighteenth century when discussion emerged about posture and technique (Stowell, 1985: 32). During the twentieth century, Carl Flesch, Demetrius Constantine Dounis, Ivan Galamian, Yuri Yankelevich, and Dorothy DeLay became significant to violin pedagogy and emphasised the importance of

mental practice to achieve artistry in performance. The traditional auxiliary tools of the tuner and the metronome were used, and still are, to assist musicians to tune their instruments and to maintain their rhythm in a steady tempo. In addition, technology in the form, firstly of recording and secondly of digital film, was used to capture a concert or live performance in order to review it for the purpose of improvement. This application is quite different to the purpose that lies behind the use of technology today, as its aim is to deliver the learning material via audio and video as seen in Suzuki and Zhang methods. Imitation and repetition are used to teach the violin from the beginner to the advanced player.

Imitation and repetition are part of cognitive brain development that takes place from birth to adulthood. This involves the process of learning language, information storage and the development of understanding concepts. This development occurs as result of a child's interaction with his environment, and at all stages of development imitation and repetition are an essential feature of the learning process. There are obviously individual developmental differences between children that will influence the effectiveness of the role of imitation and repetition. Nevertheless, Jean Piaget has proposed a theory which is based both on biological functioning and on "assimilation" in which a child is responding to his environment, by using all his senses (Athey & Rubadeau(Eds.), 1970: xvi). Piaget's theory suggests that there are four stages of cognitive development in which imitation and repetition are very significant at first, but become less significant as cognition develops in its complexity. The first stage from nought to eighteen months is when specific movements are learnt through imitation and repetition of the movements of others, as for example in holding the bottle and spoon. Gradually the memory process develops so that an action can be held in the mind, the "imitation of an absent person" (Helmore, 2014: 8). In the second stage from two to four, imitation and repetition of sounds is vital for the acquisition of language. At the same time, the development of cognition is limited and it is difficult for the child to make deductions from the general to the particular (Helmore, 2014: 9), so that learning is dependent on observation and repetition. The third stage, from four to seven, is marked by the gradual development of the ability to observe and to note differences. This means that in learning the violin, a child still uses imitation and repetition, but is able to self-correct. This self-correction is due to the improvement in perception and conservation of aural and visual imagery. The fourth stage, from seven to eleven, involves the development of conceptual cognition enabling the child to classify, serialize sequence, and to see the relationship between numbers. During this stage, the child is able to understand the link between action

and result in complex thinking. For instance, in violin practice, the process of self-correction is based on the elemental understanding that correct posture, proper sound contact point between the bow and the string, and clear concept of the pitch are all interrelated. Therefore, in comparison with the previous stages, it is clear that from the fourth stage there is less dependence on imitation and repetition, because the child can now use mental practice.

Mental practice vs Imitation and Repetition

What is mental practice? This function of the brain involves visualising the movement that is to take place prior to any physical action (Driskell, Copper & Moran, 1994: 481). In other words, it is using the power of the imagination to simulate the movement. In violin practice, playing and performance, it is crucial to think through the pitch of the sound and feeling of the movement before any physical movement begins. This mental rehearsal intensifies concentration and enhances nerve connections between brain and limbs, maximising accuracy.

What distinguishes imitation from repetition? Imitation refers to copying the actions of another person or of a model. On the other hand, repetition refers to the action of repeating the same body movements or phrases. Imitation occurs when the student watches a demonstration by the teacher and then imitates these movements. Repetition is then used by the student in practice to reinforce the memory of the finger movements.

It is the mental aspect however that is emphasised by eminent violin teachers. Flesch, Dounis and Galamian recognise the need for imitation and repetition in violin practice, but Flesch (2000: 82) expresses the viewpoint that "habitual, thoughtless, and endless repetition…destroys any spontaneity of feeling in the player". He expands on his perspective by emphasising that practice of technical skill should be done "in small quantities, but very frequently to achieve mastery" (Flesch, 2000: 82). The reason provided by him is that "repetition of the required motions leads to greater fluency, but at the same time brings about a dulling of the feelings and emotions connected with the musical material" (Flesch, 2000: 157). Further to this point, he uses the example of shifting, which requires the fingers to change or slide on the fingerboard in order to change hand position. He states that although bridge notes are necessary in the shifting learning action, the use of them needs ultimately to be discarded to achieve the aesthetical musical expression of emotions and passions, such as

seduction, anger, sweetness, or despair. Therefore, technical mastery is essential and it must be gained, but using excessive repetition in practice sessions will destroy the musical expression fundamental to musicianship.

A similar perspective on repetition is shared by Dounis, an influential violin teacher and a medical doctor specializing in neurology and psychiatry. He states that " No one will ever learn how to practise by repeating day in, day out, finger exercises, scales, or, in fact, the whole compendium of daily exercises for the violin. The result of such monotonous and arid study is usually worthless" (Dounis, 2005: 8). The reason given is that this type of practice disregards the importance of the brain. Paramount to Dounis is that the brain and the memory must have "a distinct and clear picture of the movement", so that "technique is nothing but a series of brain reflected movements" (Dounis, 2005: 10). Indeed, he reinforces his perspective by a reference to psychology which has revealed the power of the memory to reproduce an image if it is the logical progression from the preceding image. This focuses on the power of the brain to memorise and to anticipate the subsequent movements.

Galamian has also expressed a viewpoint that supports the opinions of Flesch and Dounis on the role of repetition. Galamian emphasises that "mental alertness in practice" (Galamian, 1985: 94) is vital, otherwise the practice session "is a waste of time and effort". If the mind and ear are not concentrating, then not only is the feeling and sound of notes being ignored, but also any mistakes are being repeated and learnt. This emphasises Galamian's belief "that the mind always has to anticipate the physical action that is to be taken and then to send the command for its execution" (Galamian, 1985: 95).

Research questions

As traditional violin methodology is the accepted way of developing the art of violin playing, and as mental practice is so vital in traditional violin teaching and learning, then what role can technology play in this process?

Since performance in sport shares with violin playing a similar dependence on mind-body co-ordination, can violin playing benefit from mental practice approaches used in sports training?

What are the particularities that students need to bring to a teaching method strongly reliant on technology?

Methodology

As a violinist, my interest is to research the degree to which technology can be used to enhance the teaching and learning of the violin. There is no doubt that online teaching can provide imitation and repetition, a necessary part of learning the violin, however eminent violin teachers have highlighted that the mental factor is the vital component in this learning process. In Chapter two, I will introduce and differentiate the ways in which technology has been used for teaching and learning on YouTube and in the methods of Suzuki and Zhang. I will challenge Suzuki's belief on the power of imitation and repetition and that learning the mother tongue is the same as learning music. In addition, I will suggest that a major weakness in Zhang's online method is its absence of physical interaction and its encouragement of rote learning. In order to reinforce the inability of technology to meet the requirements of traditional teaching I will detail, in Chapter three, the ideology and teaching methods of Flesch, Dounis, Galamian, Yankelevich and DeLay, who all emphasise the importance of mental practice for performance. In Chapter four, I will discuss the links between the mental and the physical in sport. At the same time, I will show how the brain manages to correct mistakes by consciously relearning. In my conclusion I will draw together the findings of my research and review the use of technology in relation to cognitive development.

Chapter Two: Technology and violin learning

YouTube

The success of YouTube, created in 2005, can be attributed to the informal opportunity it offers for users worldwide to upload videos in order to share their personal interests. As an interactive platform it also enables social discourse and the formation of communities. New videos are being continuously uploaded in all fields, including music, so it is not only an entertainment platform, but also a learning platform. This structure meets autodidactic needs and facilitates informal music learning, where user generated content can be shared and performances and interpretations discussed (Waldron, 2013). For musicians, YouTube clearly has a number of functions: it encourages creativity as it provides a free platform for musicians to share their compositions and performance; it allows musicians to promote themselves through their work without employing agents. For younger musicians YouTube is used in the classroom to explore the different musical genres and to record, edit and view their own creativity in performances (Cayari, 2011). In addition, YouTube is being used in masterclass to provide students with the opportunity to watch lessons given by famous violinists from all parts of the world. Furthermore, YouTube also enables the professional musician to observe and learn from the different interpretations of the same piece by distinguished artists.

The Suzuki method

A unique approach to teaching the violin was taken by a Japanese violinist and teacher, Shinichi Suzuki. His method attracted the attention of Americans in 1958, when a film in which a thousand Japanese children were seen performing Bach's Double Concerto, was shown (Suzuki, Mills, Ferro, Schreiber et al., 1973). The impact on musical educators led to the foundation of the Suzuki movement and teachers went to Japan to study with Suzuki. The development of Suzuki's philosophy is particularly relevant to the teaching of young students, as it is based on the principle of the "mother tongue". In his autobiography, Suzuki

describes that the motivation for his method came from a request to teach the violin to a four year old student. It was 1932, and although he was teaching in the Imperial Conservatory, he had no experience in teaching a child under five. One day, while he was rehearsing with his Suzuki quartet, a flash of inspiration came to his mind: "why, all Japanese children speak Japanese!" (Suzuki, 1969: xii). It dawned on him that "all children everywhere in the world are brought up by a perfect educational method: their mother tongue" (Suzuki, 1969: xii). Every child pronounces single words before they speak the whole sentence and children copy the articulation of the words without understanding their meaning in the early stages. So learning takes place unconsciously as children listen, watch and copy what they hear and see. It is their parents' reaction, by praising or correcting them, that leads to the learning of language. Additionally, the significance of the learning environment cannot be overestimated, as a positive home environment enhances the learning process. Hence, parents, within an encouraging environment, have the greatest impact on learning at this early age. As a result, Suzuki concluded that "the key factor in the success of the mother tongue approach to education is the environment" (Bigler & Lloyd- Watts, 1979: 5). He applied this idea to the learning of music, suggesting that students should listen to fine music in the class and out of the class. So to build the music environment for the student, collaboration was needed between teachers and parents. As a result, he produced a sound recording, which became a technological tool for violin teaching and learning. Of course it could not provide visual stimulus for imitation, as the "mother tongue" principle relies on the mother to correct and encourage her child, and in so doing, provides the needed educational environment.

Suzuki requires parental involvement

Parental involvement is a central requirement in Suzuki's strategy for learning violin by ear rather than through notation. Parental involvement is common practice in the process of learning an instrument, and even young Mozart had practice assistance and support from his parents (Wagner, 1998). Indeed, Clare Bugeja has investigated the role of parents in both Suzuki and traditional home environments and discovered that, regardless of the method used, parental involvement played an integral part in the child's learning process. She distinguished two types of parents as "Suzuki" parents and "traditional" parents: "The Suzuki teacher did specify what the mother's role entailed, which was to attend lessons, take notes, supervise practice and encourage her daughter. On the other hand, the 'traditional' private teacher did

not specify the mother's role. The teacher "just engaged very personally" with the student and "didn't give me a specific role" ('traditional' mother)" (Bugeja, 2009: 22). In other words, in the Suzuki's mother tongue approach, the parent is the second teacher, helping their child to memorise the melody by singing along with him or her. Suzuki believes that this method stimulates the child's brain and enhances body coordination by connecting the mental with the physical (Suzuki, 1969:17). Certainly, to achieve Suzuki's expectation, the parent needs to learn from the teacher by attending every lesson with the child. This equips the parent to then assist with the fingering and melody at home. The issue that emerges from this method is that as the child is not yet learning to read the notes, he or she is dependent on the auditory element in order to play the melody. It is not until the child reaches "eight or nine years of age" (Bugeja, 2009: 23) that the learning of the notes commences and even then the parent still attends lessons and remains far more involved in the learning process than the traditional parent. This means the child is not independent, but relies heavily on parental participation, although this ideally decreases as the child advances in violin skills. The difficulty here lies in the fact that parents cannot always meet the changing musical skills of the child. Bugeja (2009: 24) includes the recall from a Suzuki student in her journal: "I was probably just practising myself, but with her kind of still yelling out stuff at me" from the kitchen. From Bugeja's research, it shows parental involvement has its limitations, as it works for the early stages of learning, but not later, because the parent is not familiar with the music and therefore is unable to offer specific comments to resolve any mistakes. In addition to this parental weakness in the Suzuki method, there is another serious drawback which arises as a result of the failure to learn notation from the start of students' violin learning. As observed by David Jacobson (2016: 284): "many children can read words at three or four years of age" and as it is just as easy for them to read notes, why deny them the opportunity to learn notation? Indeed, he believes that this "makes the use of material outside his (Suzuki) method books impossible, limiting the scope and therefore, the depth of approach that can be used to teach fundamental skills". From his point of view, it follows that there is no merit in instructing mothers "in an approach that is fundamentally incorrect?" (Jacobson, 2016: 285). It is clear therefore that Suzuki's approach to teaching the violin has its detractors, who believe that following his method will inhibit progress, rather than enhance it.

Regardless of the viewpoint taken on the Suzuki method, his use of a technological tool to assist the teaching and learning of the violin was an innovation. It was the possibilities emerging from the internet, together with the similar belief in the principle of the "mother

tongue", that led to Zhang's development of his method of "sound to teach sound, and motion to teach motion" (Zhang Violin Method, 2015).

Background to the Zhang method

Zhang's motivation for his use of technology in teaching of the violin arose from his trips to China in which he was invited to give masterclasses to students. While there he realized that the teachers were inadequately trained, due to the geographical isolation of towns in certain areas. It was this problem that explained why students were failing to learn not only the correct posture, but also to understand the basic techniques of the violin (Zhang & Lu, 2009: 6). In other areas there were no teachers of the violin at all. As a consequence, Zhang made the decision to use technology by devising a teaching program to assist both the teachers and the students. In 2003, he published a DVD together with a method book, to overcome the teaching and practice problems. By giving clear instructions and material to help the teacher, and by supplying demonstrations and directions to guide the students in their practice, he provided a teaching curriculum accessible for all. Designed in video format, the demonstration clips were divided into learning steps from simple to difficult with segmented bowing; from slow to fast tempo with metronome; from bar by bar; section by section and piece by piece. In addition, the piano accompaniment could be repeated, in isolation and as many times as desired by students in their practice sessions. By 2015, the widespread use of the internet saw the establishment of Zhang's method on a website: www.zhangviolin.org.

Zhang's online method

The website is user friendly for both teachers and students. There are five types of membership: Junior, Intermediate, Senior student, Teacher, School. If logging into the Teacher membership, a menu on the left hand side of the screen shows seven different listings: Dashboard, Students, Account Profile, Books, My playlist, and My Events. At the bottom of the Dashboard is a tutorials file which instructs the teachers and students on how to use Zhang's online method to suit their individual needs. The website is constantly updated with videos and music sheets. The functions of the different listings are:

1 Dashboard: shows the teacher code and membership expiry date. The teacher code is used by the teacher to list students and manage the work set for each student.

2 Students: enables students to access the work set by the teacher for their homework practice in the order that the teacher has prescribed. In addition, the students can view the notes made by the teacher during the face-to-face lessons to assist them in their practice. This function helps the teacher to organise the work for each student, and also enables the teacher to monitor and record the login practice time for each student over a seven day period.

3 Account profile: allows members to make changes or to update their personal information.

4 a) Books: includes all of Zhang's teaching materials: Scales, Etudes, Pieces, Others.

b) Scales: shows a list of the selected pages from the Gregorian Scale book. The list includes one to three octaves major and minor scales; broken third major and minor scales; one to fifth position two octaves major and minor scales; and first position double stop practice. In the video, a demonstrator plays the scale in minims with the metronome, allowing students to imitate the same bowing and rhythm; also it allows students to match the same pitch of the note to maintain their intonation. The music score is in the bottom of the screen, so the students can focus on the screen without glancing to the sheet music.

c) Etudes: shows three main etude books of Zhang's own arrangement, 88 Children Etudes, selected Mazas Etudes, and finger exercises by Sevcik, Pozycja.

d) Pieces: shows books from one to eight, which are all arranged by Zhang in the order from beginner to advanced level. Again, there is a demonstrator who plays the pieces in phrases with the metronome, from slow tempo to fast tempo. In this way students can link the phrases and then play the whole piece. To assist the students in this, there is an additional video with the piano accompaniment in which the piece is played at different speeds.

e) Others: shows additional pieces for both beginners through to advanced students. There are "Qimeng" pieces for young age students, "Violin the first 100 days" for beginners, and a collection of violin duets and sonatas for more advanced students.

All the demonstrator videos come with the music score, so it is easy for students to download and print out.

5 My Playlist: provides teachers and students with the function to create their own playlist files and to drop the pieces into the relevant files. This assists the organization of practice material in the different stages of learning.

6 My Events: provides teachers with the function to create a home concert or competition. The concert details of date, time, and venue can be filled in by the teacher, and then sent to their own students via email.

Zhang highlights that the challenge in violin teaching is the conversion of the silent score bringing the sound and the motion to life. Similar to Suzuki's concept of the "mother tongue", Zhang recognizes the importance of imitation in the learning process: "For example, they copy their parent's talk to learn how to talk, copy their parent's motion movement to learn their own action……Based on this theory, if students can listen and see how to perform violin every day, their improvement and the abilities they demonstrated in violin playing is going to be as spectacular as their ability in language learning. Learning by phrases I've designed is based on this principle."(Zhang Violin method, 2015). There is, however, a striking difference between Suzuki's use of the mother as a teacher and Zhang's use of a demonstrator as a replacement mother. Without a doubt, the personal interaction and feeling of nurture and love between mother and child, which is fundamental in Suzuki's "mother tongue" approach, is vastly different to the impersonal demonstrator on the screen of a computer. It is necessary therefore to be aware that although both methods bear a similarity in their underlying principle of imitation and repetition, their implementation is quite different. In addition, the Suzuki method allows for interaction, whereas Zhang's method is non-interactive.

Both Suzuki and Zhang believe in the importance of having a model to observe. The difference is that Zhang believes it should be a professional model rather than an amateur parent (Zhang & Lu, 2009: 19). Also, Zhang states that: "music cannot be used to teach by mouth" (Zhang & Lu, 2009: 94) and he explains that it helps students to feel the music by listening to the recording again and again, so helping them to improve more swiftly by comparing the defective parts of their playing with the recording. A teacher usually prompts students to play "faster", "softer", or "slower", but by listening over and over to a particular

piece, they will capture the feeling of the musical expression and imitate it (Zhang & Lu, 2009: 94). This is why Zhang claims that the music cannot be taught by word of mouth, but by sound and motion. Therefore, he believes the online teaching tool is the best way to use this idea.

Comparison of teaching methods of Suzuki and Zhang

Suzuki and Zhang both emphasise that their methods assist students through all stages of learning the violin. It would seem that the Suzuki method provides an appealing musical environment, as children enjoy singing and listening to music and this enhances their desire to learn the musical pieces in his books. On the other hand, this emphasis only on the auditory at the initial stages, without the inclusion of the reading of the notes, inhibits their possibilities to explore other materials and to develop independent expression. Suzuki's books have a totally different design from traditional teaching material as they are exclusive of Etude, but with some scale exercises, as the Suzuki Association asserts that his method is "not to create performing artists, but to create better human beings" (Kendall, 1985: 31). Zhang's method also aims to create an appealing musical environment, but there are many differences from Suzuki in his teaching method and the design of his books. Significantly, Zhang encourages the reading of notes by using a reality demonstration which includes the music score at the bottom of the screen, so that the students can listen, watch, and follow the notes as they are pointed out by a pencil. Zhang called this method "sound to teach sound, motion to teach motion". In comparison to Suzuki's method, Zhang's method appeals to parents because many of them have little or no musical education and because of the convenience offered by electronic products. They also approve of his method design, which includes vast scales; a large number of Etude collections from Komarovsky, Gregorian, Baklanova, Sevcik and more; and short piece arrangements from Mozart, Beethoven, Dancla and other composers. Zhang's method appears therefore closer to a traditional method with respect to its training material.

Although Suzuki and Zhang methods are both based on the power of imitation and repetition, their teaching and learning approaches are different. Suzuki uses only auditory stimulus so that the students try hard to imitate the sound, but have no knowledge as to how to make the sound on their violin with body co-ordination. Zhang uses both auditory and

visual in the imitation and repetition learning process. His method teaches phrase by phrase and students imitate the movement more than the sound because the visual instruction attracts them, but at the same time distracts them from the quality of sound.

Learning language and learning music

At the basis of the Suzuki method is the belief that learning music is the same as learning a language, but there are fundamental differences. Firstly, learning a language requires using lips, tongue and shape of the mouth to reproduce the sound made by the mother. By contrast, imitating musical sound involves manipulating the instrument, positioning and co-ordinating both hands in an effort to copy the sound. Secondly, social cues are used in learning a language. Bloom in his research article on How Children Learn the Meanings of Words states that: "In particular, there is a rich body of research suggesting that young children are exceptionally good at using mentalistic cues – such as eye gaze and emotional expression – to learn nouns and verbs, and can do so even when these cues conflict with information provided by the statistics in the scene" (Bloom, 2001: 1100). He is making the point that children make use of the social environment, in which they are interacting, to discern the difference between the naming of objects. For instance, he cites an example of a child looking at his foot at the same time that an adult says the word "dog". The child does not believe that his foot is called dog because he is using other cues, like where the adult is looking, to identify the differences (Bloom, 2001). By contrast, learning music does not provide any social cues, only the silent cues such as key signature and time signature, to indicate the melody and to transfer the silent score to musical performance. Thirdly, language is learnt by the acquisition of single words with repetition before phrases and sentences. Children begin to learn a language by repeating words like: bye-bye, yes, no, hi, dog, and they understand that individual words represent an object or an action, so that each word has meaning. In learning music however, individual notes need to be grouped into phrases in order to create the melody and the meaning. This imitation and repetition will cause rote learning which will compromise expression in both fields of learning. For instance, if students rote learn lines of Shakespearean language to take part in a play, their performance will lack expression if they do not understand the meaning and feeling of the words and phrases. Likewise, the learning of music depends on more than rote learned computer generated visual and auditory cues. Clearly, the significance of understanding in the learning

process cannot be underestimated, regardless of whether it is the learning of language or music that is being undertaken.

It must be noted that there is a strong similarity in the need for continual correction in both language and music learning. Parents and teachers correct a child's mistakes or pronunciation of words and an individual music teacher will correct students' playing. The issue that arises when students learn through technology is that there is no correction process taking place at all, as the computer is unable to hear their mistakes. Indeed, Jacobson has highlighted the danger that any errors in playing are actually stored in "muscle memory" (an integral aspect of the Suzuki method), and that students need to "first understand what is correct… This is the ground upon which all claims of pedagogical knowledge must rest" (Jacobson, 2016: 282). As a computer has no hearing or feeling, the students are entirely dependent on the demonstrator to imitate language or music without any feedback.

Accomplished musicians and technology

Research has been conducted into the degree to which accomplished musicians make use of technology when they are learning a new piece. Susan Hallam investigated the ways in which professional musicians at different levels of experience and using different instruments, approach the learning and interpretation of a new piece of music. The study included only practising freelance professionals, but each was given a piece of music with which they were totally unfamiliar. Each musician was then required to provide information as to the process they would use to learn that piece. The results showed that 77% of the musicians chose an holistic approach by listening to the whole piece because it would give them an overview, idea of the tempo, and it would allow them to identify the difficult passages for specific technique. Musicians who adopted the holistic approach were ultimately differentiated into two groups: those who chose to listen to the interpretation of the piece by different musicians, and those who chose to avoid listening to different interpretations of the piece and to "work out what I want to do for myself" (Hallam, 1995: 121). Only a few of the musicians said that they could "formulate an internal aural representation of the music without actually hearing it"; the majority of the musicians said that "I must have something to hear" (Hallam, 1995: 118). This research shows how many musicians use technology to assist them but this reflects individual need and personal approach to learning a new piece. Importantly, these results also

highlight that musicians must develop their aural perception because sometimes a recording of a piece of music may not exist.

Chapter Three: Exploration of traditional teaching and learning

This chapter explores the aspects of the teaching methodology of violin pedagogues. Famous violin teachers like Carl Flesch, Demetrius Constantine Dounis, Ivan Galamian, Yuri Yankelevich and Dorothy DeLay are representatives of the traditional violin teaching method which is a one-on-one teaching process. The purpose of this exploration is to ascertain which aspects might be used in the technological teaching of the violin.

Flesch (1873 - 1944)

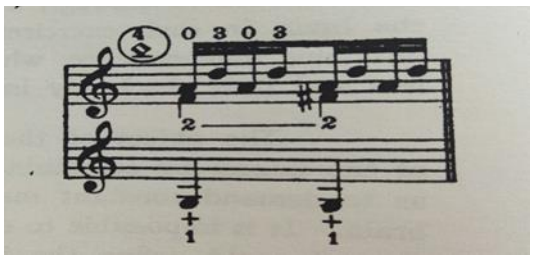
Flesch, a Hungarian violinist and teacher, was the first pedagogue to recognize the link between psychology and physiology in determining the sound production in violin playing. His method extends to very systematic and analytic approaches to the teaching of violin technique. He claims that there are three stages in the process of learning, from "conscious into subconscious motions"(Flesch, 2000: 81). In the first part of this learning process, the student looks at the notes, then the student is able to group the notes by just glancing, finally the student does not need the symbols as the notes have been memorised. This is the same process of conscious to unconscious that takes place in the learning of the movements, because finger placement and bow contact point changes the dynamics and will at first have to be consciously thought about, before they become unconscious movements. Therefore, Flesch asserts that "the more subconsciously the necessary motions are executed, the more secure the technique" (Flesch, 2000: 81).

Of course violin playing requires a clear memory of an image to firm up the conscious awareness of these various intricacies, however conscious awareness is necessary to create artistic shape and artistic forming. Without conscious thought performances would become automatic, lacking in expression and variety of interpretation. "Interpretation… is creative as it makes sense of the given and thus reaches beyond the given" (Richter, 2013: 3). As emphasised by Richter, interpretation is at the heart of musical artistry, a conscious expression of feeling. The question can be raised as to Flesch's meaning of unconscious

playing as it is not entirely clear from his theory. Does he mean the process of the finger action on the string is unconscious? Does he mean the process of playing the piece is unconscious? This theory is too simple as it ignores the different layers of conscious and unconscious functioning. Flesch cannot mean that the performance of a piece is unconscious playing, because when musicians play in the orchestra they must be responsive to the other musicians as they interpret the piece together in a co-operative way. It is important therefore to distinguish between Flesch's recognition of the unconscious mastery of technique and the conscious creativity, imagination and responsiveness that differentiates every performance.

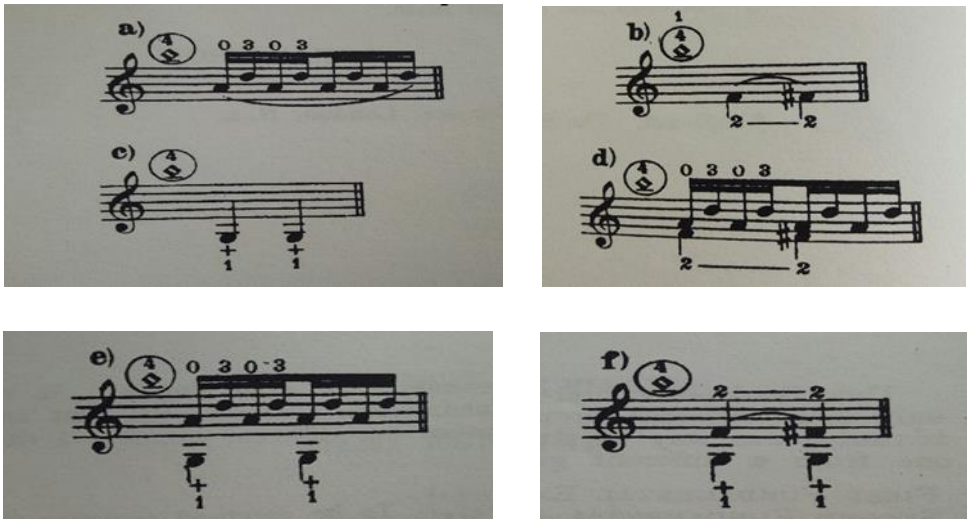
Dounis (1886 - 1954)

Dounis became an accomplished violinist at an early age and completed a medical degree. This combination of achievements influenced his violin teaching method. His individual approach to the problems of each violin student reflected his diagnostic training in medicine (Stewart, 2013: 58). As a consequence, exercises were designed to solve specific problem at the cause. Above all, Dounis' medical knowledge allowed him to understand the importance of the brain in practice sessions. "What we call technique is nothing but a series of brain reflected movements" (Dounis, 2005: 10). In other words, technique is the collection of three concentrated steps: clear mental image, brain control and movement plan, matched physical action. The practice exercises that he designed for independence of the fingers demand mental control as he states "I could define the independence of the fingers as MENTAL DISCIPLINE over the fingers" (Dounis, 2005: 89).



Ex 3.1: Dounis' independent finger training method (Dounis, 2005: 90)

From example one, all the fingers are required to do different movements for specific purpose training (Dounis, 2005: 89). As the fourth finger sustains on the finger board to achieve the horizontal movement; the third finger needs to deal with the falling movement or trill in semiquavers; the second finger is doing side or sliding up and down movements in crochet; the first finger is doing the left hand pizzicato. Overall, from the first finger to fourth finger, the finger pattern is maintained to create the position for chords playing. The difficulty is the simultaneous positioning and movement of individual fingers which must also maintain different rhythms. Mental discipline is required to achieve this, planning and executing the movements. Furthermore, Dounis outlines the six steps to follow in mental control over the fingers.



Ex 3.2: Dounis' six steps to gain independent finger control

Dounis stresses the importance for all violinists, regardless of their level of expertise, to maintain this mental discipline practice to ensure the individual strength and flexibility of the fingers.

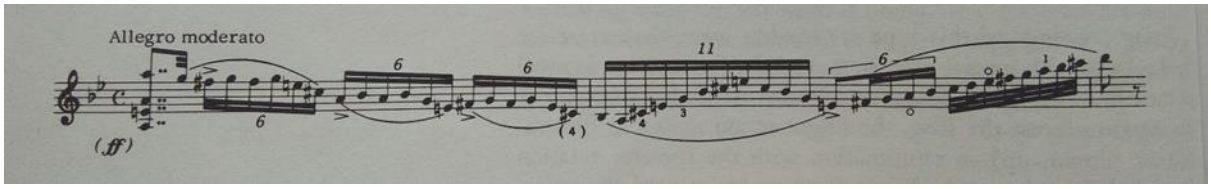
Galamian (1903 - 1981)

Galamian's methodology emphasises the point that each student is individual and therefore the rules of teaching must be adapted to take into account this individuality.

Included in the teacher's approach should be an assessment of the student's physical condition, such as short or weak fingers and joints, as this will impact on their playing and performance (Galamian, 1985: 105). At the same time, the teacher must judge the personality of the student, so as to tailor a learning program best suited to each student. Galamian outlines three different factors in the development of musicians. He believes that the physical factor, the mental factor and the aesthetic- emotional factor are essential components in the constitution of a good musician (Galamian, 1985: 3).

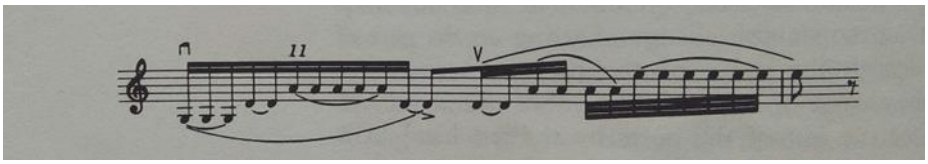
From Galamian's viewpoint, the physical factor needed to produce beautiful tone colour is reliant on the correct position of the limbs, including arms, fingers, hands, and the balance of the lower body as it cooperates in the physiological functioning between the playing movement and the flexibility of muscular action. He stresses that this physical co-ordination is dependent on the mental factor, the ability of the mind to prepare, direct, and supervise the muscles. Galamian calls this link between the mental anticipation of the physical action and the mental command for its execution "correlation" (Galamian, 1985: 95). One of Galamian's students, Elizabeth, commented on his teaching method:

"…we were taught, …to get ourselves under… absolute technical control. … His practice assignments were such that we could not accomplish them with success unless the mind was working constantly and intently. … When we used his practice methods there was no way we could avoid thinking" (Galamian, 1985: 109-110).



Ex 3.3: Bruch's violin concerto in G minor, Op.26, first movement (mm.88-89)

In order to practise correlation, Galamian (1985: 66) selected bars 88-89 from Bruch's violin concerto and suggested transferring the notes into open string. This enforced practicing string crossing while keeping the same rhythm and tempo and maintaining a fluent tone with legato; as can be seen in example seven.



Example 4: Galamian's practice guide for Bruch's violin concerto in G minor, Op. 26, first movement (mm. 89)

From the example, Galamian (1985: 100) demonstrates what he called the "building time", which was the isolation of a difficult passage to gain technical mastery. This involved simplifying the passage, breaking it up by measure, analysing the specific technique, to make the students concentrate on body co-ordination.

Galamian however stresses that building time needed to be balanced with "interpreting time" (Galamian, 1985: 100). In this "interpreting time" the passages that have been isolated for specific practice are placed together in a unified whole. Most importantly, Galamian states that when an error occurs at any stage the performer should not react or stop, but rather use mental power to continue as Galamian maintains that stopping may create a "dangerous habit" (Galamian, 1985: 100). This necessity to practise difficult passages within the entirety of the piece is seen as especially significant in the "performing time" (Galamian, 1985: 101) in which the aesthetic- emotional factor of the musician interprets the musical expression from their own understanding and feeling of the entire piece. Expression such as vibrato, dynamic and tone colour, must be an addition to the technical mastery. The key to Galamian's perspective is the correlation between the physical, mental and aesthetic-emotional factors which he believes are essential in the development of musicians to achieve the artistry in performance.

Yankelevich (1909 - 1973)

The Russian violin teacher Yankelevich also shares the view expressed by Flesch, Dounis and Galamian, that the art of violin playing lies with the "head" and not with the "hand" (Lankovsky(Ed.), 2014). Yankelevich stresses the need for correct aural

preconception of a note: “the pre-hearing of the correct pitch, the pre-hearing of the pitch in relation to the harmony of the chord and the pre-hearing of the musical phrase” (Lankovsky(Ed), 2011: 66) with dynamics. Clearly, Yankelevich uses these three steps in pre-hearing in order to engage the imagination in this new approach of violin learning. This consciousness goes beyond just understanding the purpose and nature of the movement made. Indeed, in general violin pedagogy, the main goal is to teach that the mind leads the action.

Central to Yankelevich’s methodology is flexibility, characterized by individual inspiration for his students. As a consequence, Yankelevich rejects a single method or approach as he believes that the diversity of students, in both their physiology and psychology, has to be understood by the teacher and employed in the student’s creative approach. He raises some unfortunate areas of misunderstanding in violin teaching of which two are of particular interest. Yankelevich claims that many teachers only concentrate on what they believe to be the correct posture and sound, but ignore the individuality of the student’s body. Yankelevich quoted his teacher, Yampolsky: “Unfortunately, the problem with many teachers is that they do not listen to the violinist, but only look to see whether the movements appear ‘correct.’ Yet what the hands actually create or ‘express’ completely escapes them” (Lankovsky, 2016, in Grigoryev ed.: 6). Yankelevich states that the teacher needs to help the student to find his or her own individual positioning, even if it is not ideal. From his perspective, “methodological questions, such as the setup of the right and left hands, playing movements, fingerings, tone production, choice of repertoire, musical content, and individual development” (Lankovsky, 2016, in Grigoryev ed.: 5) are all interconnected. This viewpoint supports his philosophy that psychology and physiology work together to create music, not just the expectation of “correctness” (Lankovsky, 2016, in Grigoryev ed.: 6). Not surprisingly, Yankelevich rejects the approach of teaching by copying as he believes in individual expression : “Yankelevich was generally averse to the method of demonstrating, which sometimes turns into: “Play like I do” (Lankovsky, 2016, in Glezarova ed.: 8). The problem here is not just that the student copies without delving into the essence of the problem, it also interferes with the student’s development of an individual personality. The essential goal is to uncover and maximize the use of the student’s inner resources”. Indeed, Yankelevich stresses the importance of developing a student’s independence in their learning process. He makes the following suggestions: select the repertoire according to the student’s personality and skill ability as the right style of music will suit the personality of the student, facilitating emotional expression, dynamics contrast, and violin technique. Furthermore, he

suggests that a student needs to taste the composer's style when they are starting to learn a new piece, and this can be achieved by listening to a range of the composer's work, like symphonies, quartets, and other compositions. In addition, a student should compare different interpretation of the same piece "by listening to at least three or four recordings" (Lankovsky, 2016, in Grigoryev ed.: 11), in order to consider the differing techniques and emotional expression.

DeLay (1917 - 2002)

The American violin teacher, Dorothy DeLay, believes that all students have limitless possibilities which could be developed by understanding the character of each student, using a psychological approach. Central to her teaching method was building a student's confidence through her choice of language in the violin teaching process, to ensure that the student never feels failure: "One big rule, is never, ever to make a student feel small or incompetent or untalented. The minute you do that, you stop the ability to learn" (Jepson, 1988: 112). DeLay transfers this belief into a teaching method which involved three areas: firstly, violin teaching in which the power of language is used to guide students to be aware of their mistakes instead of pointing out the problem directly. DeLay gave an example of her language with a student who has an intonation problem (Jepson, 1988: 110): "well, sugarplum, what is your concept of F-sharp?" Her use of this rhetorical question is used to arouse the student's awareness of sound, rather than using direct criticism. The second area in DeLay's teaching method, is her emphasis that she is the "helper" (Koornhof, 2001: 35), and she is fostering the student's independence by providing them with different options when facing the difficult issue of violin technique. Examples of how she put this idea into practice are given by Sand (2000: 66): "What do you think Beethoven was trying to say in this passage? Can you see a way to make a better transition from this theme to the next? Why don't you experiment a bit with the bowings and see what you can come up with to give this section more vitality? Do you think the phrase would sound better if you take more time with the down-bow?". Furthermore, DeLay instructed and encouraged her student to explore the variety of the musical direction, instead of telling her what to do directly: "What about the character of the chord? You can accent the top, you can accent the bottom, you can play it quickly or slowly... You're going to have to figure out what kind of chord you want here. What about the character of the whole phrase?" (Sand, 2000:173-174).

The questions used by DeLay to her students clarifies her own teaching technique, aimed at fostering independent thinking by providing a framework of options, so as to guide the student towards self- teaching. This approach facilitated an individual interpretation of music which reflected the differing personalities of each of her students. The third area in DeLay's teaching method was her total commitment to all aspects of her students' lives, within musical education and outside of it. This included problems from their home, employment and friendships, which meant that in reality she was using a holistic approach in order to assist their musicianship. DeLay wrote: "Young people's business is a teacher's business... I like to help in the process of change from student to professional musician" (Koornhof, 2001: 53). It is clear therefore that DeLay's teaching approach, using language and psychology, reflected her deeply- held belief in the limitless possibilities of students, and in her belief that independent teaching and thinking would guide them to reach their musical aspirations.

Conclusion

Flesch, Dounis, Galamian, Yankelevich and DeLay all share the belief that personal assessment by the teacher of each student's physical condition, mental capabilities and individual characteristics are essential to achieve the optimum standard in violin learning and playing. Obviously this approach involves personal one-to-one interaction, rather than impersonal non-interaction of teaching by the use of technology. Would technology be a useful tool for students in any respect at all? From the viewpoint of Flesch, technology would not be useful in his methodology because it is impossible for it to incorporate the process of conscious to unconscious learning. Watching and listening to a demonstrator is a learning tool that simply involves copying movements, rather than thinking about how the sound is made from the violin by the details of finger and bow pressure, sound contact point and articulations. Indeed, Dounis' insistence on completing a number of warm- up exercises that demand extreme mental control, prior to execution of a piece, makes it impracticable for technological instruction. A demonstrator can certainly show the finger exercises, but interaction between teacher and student is required to correct and to convey the feeling of articulation of the fingers. Furthermore, in order for the teacher to guide the student then "The teacher must be a good psychologist" (Galamian,1985: 106), namely be able to understand the behaviour and mental process of the student. This need means that the mental

factor and aesthetic-emotional factors can never be delivered by an online teaching method, because currently technology is unable to assess the individual requirements of the students and resolve their body co-ordination problems by specific mental exercises. Likewise, Yankelevich's methodology on the concept of "correctness", that there is not one model of correct posture, nor of the way of playing, means that the online methodology has no value. An online demonstrator is unable to judge the individual physical condition of the student and unable to make adjustments to the "correctness" in order to suit the student. On the other hand, although it is a minor aspect of Yankelevich's methodology, YouTube can provide the opportunity for students to listen to a number of compositions by a composer and also the interpretations by a range of performers, but the essential aspects of Yankelevich's methodology are not achievable through technology. Similarly, teaching by technology would not meet any of DeLay's expectations, as her approach centred on her personal involvement and relationship with her students, particularly in her choice of language to guide the student to achieve independent thinking. From the perspective of these five well-respected violin pedagogues, technology would not find a role in their teaching methodology.

Central to the teaching methodology of each of the pedagogues is not only the focus on mental control, but also on the development of independent learning. This involves guiding the student to practise pre-hearing and pre-feeling. This independent learning process will equip them for different situations in their musical career. For instance, if they are required to perform an original piece by a new composer that has never been played before, the challenge will be to pre-hear and pre-feel the piece without watching a DVD or listening to a recording. This emphasises the importance of independent skill which allows them to interpret a new piece without relying on a demonstrator. Hence, aural training is essential for pre-hearing and this skill will enhance the student's sight reading, while music theory is vital for the student to understand musical style, proper articulation, storyline of the piece and to capture their own expression of the music. Of course, the effectiveness of independent learning will depend on the practice methods used. Both Suzuki and Zhang use imitation and repetition for practice method, Suzuki advocating "parental involvement", and Zhang preferring online teaching, using a demonstrator. From the perspective of Watkins and Scott, the imitation and repetition teaching method is not an ideal practice tool: "……young musicians often feel compelled to copy the musical performance to be 'correct' while not necessarily understanding or 'feeling' it from the inside. Unless students understand the underlying concepts and expressive meaning that fostered the musical rendition, it is likely

that they will continue to be dependent on demonstration and teacher directives to make their performances sound musical" (Watkins & Scott 2012: 14). This reliance on a demonstrator will discourage the skills of independent learning as creative interpretation is required in musical artistry.

There appears therefore to be a limitation to Zhang's belief that expression can be learnt through imitation. It is true that students can copy a particular piece with the appropriate expression, but it does not necessarily mean that they understand why the musical expression occurs in those areas and could transfer this understanding to another piece of music. For example, if there is a "Ritardando" in the end of the phrase that students watch and copy from the demonstrator in the video, does it mean they understand why they need to slow down there? This identifies that learning a piece of music involves two concepts: copying the music and understanding the music. The point is that when students understand the musical expressions they will be able to use them in different pieces. If students simply imitate the musical expressions in a piece, then they will always have to rely on a video to show them the tempo and the emotion. All the musical terms and dynamic marking in the score represent the musical concept of the composer and the students need to gain the detail information from the musical terms, and then interpret the music from their own perspectives.

Technology has a role to play in the learning of the violin, but it has its limitations. Factors like the age of the student, involvement of the parents, the right time to learn the notes and the need to understand the feeling of the music, all have to be considered when assessing the degree to which technology can be used to enhance the learning process. Certainly, technology does facilitate the organization of practice pieces, but does the imitation of the demonstrator in the video assist the student to the same extent as watching an actual teacher in a face-to-face lesson? The answer seems clear, namely, that the online teaching tool can never replace a traditional lesson. This is because the teacher gives feedback on students as they play, whereas a video demonstrator tells and shows them what to do directly, but it is general instruction rather than individual instruction. The significance of this situation is articulated by Watkins and Scott (2012: 3), that "It's too easy to tell them what to do because we know and they don't." In other words, the reality of teaching sessions always involves correction by the teacher, and this correction should take the form of the teacher guiding students through interaction between teacher and student. The teacher should consider that they are auxiliary and focus on teaching students to learn self-correction, always

encouraging them to find out their existing problem. Why is that important? Because students will repeat the same mistake if their brain is not conscious of the problem. Importantly, this is a technique that can only be achieved by traditional teaching.

Chapter Four: Mental and Physical aspects of learning

The art of the musician is gained by understanding the relationship between the mental practice and the physical aspects of learning. The importance of consistent correction in the learning process has been discussed in chapter two, however this was a correction made by an outside observer. This leads to a closer examination of how the brain itself consciously recognises errors and corrects mistakes. The brain processes sensory information, seeing, hearing and feeling, to generate knowledge and understanding. This process of cognition includes factors of conscious and unconscious awareness, in which the brain focuses on what it specifically wants to learn, building on familiar elements of knowledge. In the article *How the brain learns from Mistakes* by Kayt Sukel (2012), the importance of identifying mistakes is highlighted. Furthermore, researchers at Michigan State University have published a new study pointing out that to learn from mistakes there must be a conscious awareness of the mistakes to improve future performance. To test this connection between mistakes and conscious awareness, Moser and graduate student, Hans Schroder, devised a trial in which students had electrodes placed on the scalp in order to measure event-related brain potentials (ERPs), or the brain's electrophysiological response to stimuli as they looked at a string of the letters M and N. "If the letter M was in the middle of the string, participants were to press a button on the left; if the letter N was in that position, they were to press one on the right" (Sukel, 2012). After 50 trials, the rules on which button to press for M and N were reversed. The result showed that this led to errors being made twice or more in a row, showing that the brain had to work hard to control the learned response and replace it with the new response. The importance in this trial was the number of times, 50, that the students had repeated a response so that it became a habit, and when the rules were reversed, the brain had to re-learn the response. The application of this research to violin teaching and learning is about brain control, because if any mistakes are made during a performance in a concert the brain consciously reacts to the error. Without mental control the performer will pay less attention to the mental preparation for the next notes. This emphasises the importance of conscious control over the primitive reflexes, in order to inhibit the reaction to

a mistake and to focus instantly on the next step in the music. This is the role of the mental factor in control over physical reactions.

As in music, mental control is a vital aspect in the field of sport in which pre-thought determines effective physical response. This means the brain forms a mental image of the actions prior to their execution by the athlete. In order to assist with this mental process, technology is being used in different ways within the training process. A range of sports, tennis, table tennis, golf and gymnastics was selected for study, because each of them has different physical demands, but for all of them mental practice is an essential component in their preparation.

Tennis

Learning the skills of tennis involves the application of mental practice in which the player visualizes the movement prior to actual physical movement. In order to ascertain the most effective means of using mental practice in the teaching of tennis, a research study was undertaken by Bill Russell Gordon, JR. Using 138 university students pretested for their same basic level of tennis, they were divided into three groups for practice method: the first group used mental imagery before physical practice; the second group used mental imagery after physical practice; the third group used no mental imagery, only physical practice. Each group had four sessions of thirty minutes each and mental practice was used for fifty percent of the time in the first and second groups. The mental imagery practice model used was the Visual Tennis Model (Yandell, 1999), which "uses scripted mental imagery directions with photo sequencing of forehand and backhand ground strokes" (Gordon, 2004: 63). The results revealed that the first group in which mental practice, prior to physical practice, had been used showed superior performance to both the other groups (Gordon, 2004: 83). The second group, in which mental practice had been used after physical practice, showed better improvement than the third group in which no mental practice had been used at all. These results indicate that visualizing movements prior to execution is the most effective approach to prepare for performance. Repetition alone does not lead to marked improvement because the brain has not necessarily created a visual image, a neural pattern of the movements. A similar comparison between using mental practice and simply physical practice in tennis training would be the difference between playing an opponent on the court or returning balls

from an automatic tennis machine. In the former situation mental practice includes not only the movement of the stroke, but also other factors in the context, like the position of the other player, ball placement and weather conditions such as wind or sun. A ball machine however, only trains the speed of reaction, is repetitive and does not involve the other cues that are essential in the development of excellence in tennis as it is passive, with the player having no control or need for any mental planning.

Table tennis

Table tennis is broadly similar to tennis because both sports involve using an implement to serve and return the ball across a court to an opponent. Although the speed, dynamics and environment of table tennis are determined by the smaller scale of the game, the need for mental practice in table tennis would also appear to be crucial. The validity of mental practice in training was explored in a research study by Peddy Caliari (2008), which focused on the role of mental practice in improving forehand skills. This involved a testing process to determine whether mental practice prior to a shot improved accuracy, and also whether mental practice focused on the movement of the racket prior to striking the ball was more effective than focus on the trajectory of the ball itself. Using 112 right-handed males between fourteen and fifteen with limited experience in table tennis, they were randomly divided into four groups: the first group was a mental practice group focused on the racket; the second group was a physical only group focused on the racket; the third group was a mental practice group focused on the trajectory of the ball; and the fourth group was a physical only group focused on the trajectory of the ball. A target circle was set up on a table and the groups either watched: visual images of the racket's movements; visual images only of the trajectory of the ball or no visual images at all. After six weeks of mental and physical training, the groups were compared in terms of their skill enhancement. The results showed that the performance of the group that used mental practice focused on the movement of the racket was superior to the group that used mental practice focused on the trajectory of the ball. The groups who had no mental practice at all showed limited improvement in accuracy. Clearly, the study establishes the effectiveness of mental practice in anticipation of the racket's movement to position the shot. The reason for this is "mental practice improved performance by acting on the preparation and anticipation of the movements" (Caliari, 2008: 88). These movements obviously depend on the cognitive processes in the brain which occur

when making “visual-spatial” judgements and then creating the coordination of the physical movements. The association between mental practice for tennis and for table tennis is clear, as training for both of these sports is enhanced by a combination of visual images prior to physical execution.

Golf

The game of golf is similar to both tennis and table tennis because it demands body coordination and precision in ball placement. Unlike the other sports, however, it is not a reactive sport on the course as each player determines his own game. As the emphasis lies entirely on the player’s placement of the ball and as it is a slow game, golf involves a high degree of mental imagery training. It is already accepted by golfing trainers that mental practice is effective for top professionals, but whether or not this mental imagery training is useful at the beginner level was the focus of a study by Brouziyne and Molinaro (2005: 1). To investigate this, twenty-three beginners were divided into three groups to practice a chip shot: the first group used a combination of physical practice and mental imagery; the second group used physical practice only; and the third group used no mental or physical practice at all, but played other sports instead. The chip shot was particular selected because it requires “fine visuomotor adjustment with respect to a target flag” (Brouziyne & Molinaro, 2005: 204). The practice sessions took place over a seven week period. The first group was instructed to keep their eyes closed and imagine the shot: the movement, the trajectory of the ball, and the destination point. The second group only practised the shot movement itself. The third group played a completely different sport, such as tennis or table tennis. After seven weeks, each of the groups played thirteen chip shots, attempting to place the balls as close as possible to the destination point which was in zone one. The results showed that there was, as expected, a significant difference between the third group and the other two groups. The first and the second groups showed similar performance in their placement of balls close to the destination point. Interestingly however, the mental and physical practice group placed fewer balls in zone four, which was the area over six meters from the destination point (Brouziyne & Molinaro, 2005: 208). This result indicates that the accuracy of the players was increased by a combination of mental and physical practice. The research also produced a positive result for implementing mental practice for beginners.

Gymnastics

Gymnastics is a sport in which balance, precision of movement, coordination and spatial judgment are critical factors in performance. Research has been undertaken to gain more information about how elite gymnasts use mental practice in the process of their training. Central to improvement for gymnasts is being able to identify weaknesses by observing themselves on video recording after a performance of sequences on the bars. This process involves mental practice because the brain has to retain images of movements, so that any errors can be corrected when the sequences are repeated. Indeed, a research study which supports the teaching practice of performance improvement through observation of self was implemented by Hars and Calmels (2007: 338). The participants in the study were ten French female gymnasts at the elite level with median age of 14.8 years. The gymnasts were video recorded completing training sessions on the asymmetrical bars. After each training session, the gymnasts immediately observed their performance as many times as they wished. They then returned straight back to the bars and completed the sequence of the movements again. This pattern was repeated several times and the gymnasts were asked to "think- aloud" in regard to their retention of the images of their movement. The gymnasts were also able to look back at the bars while observing their performance so as to facilitate mental practice without physical performance (Hars & Calmels, 2007: 341-343). As a result, the gymnasts reported that the use of imagery and mental practice helped them to improve their technical execution of the movements. Clearly, this research highlights that independent learning is fostered by the mental practice which occurs in the process of imagining the movements prior to the physical execution.

Conclusion

Evidence from the range of research studies on tennis, table tennis, golf and gymnastics supports the significance of mental practice in sport training. Furthermore, at the Olympic level, it is argued that the defining factor that separates the winners is the mental training of the athlete. This viewpoint is supported by Bruce Jenner, who was an Olympic gold medal-winning decathlon runner: "you have to train your mind like you train your body" (Afremow, 2013: 29). Factors included in this mental preparation are shielding out any distractions so as to increase concentration, to control anxiety and to build mental stamina.

The point being made is that the athletes at this level all do the same physical training, they are all talented, but "what separates the gold medalists from the silver medalists is simply the mental game" (Gregoire, 2014). Although this mental preparation refers specifically to Olympic athletes it has also been proven from the other research studies, discussed earlier, that mental practice is relevant to training regardless of the level of the sportsman, from beginner to professional.

The importance of mental preparation for any performers, whether in sport or in music, has a profound influence on their performance and this fact has been recognized by an Olympic sports psychologist Don Greene. Using a sport psychology questionnaire, which asked musicians questions on how performance pressure was effecting their skills, the computer tallied the responses and produced individual profiles on their strength and weaknesses (Greene, 2001: 2). Included in the profile was an activation score which measured physical and mental energy before and during performance. At the same time, a mental quiet score was also measured. The point of this was for Greene to analyse musicians' physical energy and mental activity from the score, so as to assist them to understand the relationship between body and mind in optimizing their performance. Interestingly, Greene explains that if the activation score was too high, then it would cause the performer to drain energy levels and make it difficult to cope "if something unexpected happens" (Greene, 2001: 12-13). Likewise, if the mental quiet score was too low, then the performer was thinking too much "about what could go wrong", and this would continue to keep the activation level high, which was negative for the performer. In essence, it all amounted to mental control or the balance between mind and body. Although Greene focussed on mental control to alleviate physical anxiety in playing, mental practice is allied to this because it focusses on visualization or imagining the feeling and movements of playing. In both cases, it is the mental rehearsal prior to the physical action that determines the effectiveness of performance either in sport or music.

Chapter Five: Conclusion

It is clear from the research in my thesis that the mental factor is key to mastering violin playing. The benefits of mental practice are enhanced body co-ordination, development of imagination, concentration, creativity, spontaneity and the skills of team work needed to play in an orchestra. Cognitive development determines the rate at which the mental factor is used by the student (Chapter one) to make their imitation and repetition increasingly effective in the learning process. This means that the teaching method must reflect the changing needs from the early learning stage, when imitation and repetition are necessary elements, through to the advanced learning stage, when understanding and interpretation become essential. As Suzuki and Zhang's methods are based on imitation and repetition (Chapter two), so technology may be a useful supplementary tool at the early stage of violin learning. Naturally, traditional teaching methodology emphasises mental control taught through the interaction between teacher and student, which enables the teacher to encourage creativity, pre-thinking and independent learning (Chapter three). In order to highlight the significance of mental practice in body co-ordination, research conducted in the field of sport (Chapter four) clarified that mental practice was the defining factor differentiating those who won first place from other contestants.

It is the development of independent learning that facilitates mental control which ideally occurs as the student moves away from the beginner level. When students have mastered basic requirements of good reading skill, various techniques for both hands (for example vibrato, different bow strokes), correction of intonation, knowledge of rhythm and musical perspective, they need to develop an increasingly individual appreciation of the aesthetic interpretation of music and express it in their playing. The independent learning process is important in their long term education and will equip them for situations in their musical career when they have to learn a new piece. In order to prepare, possibly in a short period of time, they cannot be reliant on watching a DVD or recording, but must be able to learn and interpret the music by themselves so that they can perform with confidence. This situation emphasises the need for independent learning. The role of the teacher is therefore to uncover the potential of each student, to teach them how to understand musical style, proper

articulation, the narrative structure of a work and hence to capture their own expression of the music. Indeed, the effectiveness of independent learning will also depend on the practice methods used. Both Suzuki and Zhang use mainly imitation and repetition as practice methods. Suzuki advocates "parental involvement" and Zhang prefers online teaching, using a demonstrator. Although particularly suitable for students of a young age, these methods will not be suitable for long term study in which independent learning is so important. There is a limitation to Zhang's belief that expression can be learnt through imitation as although students can copy a particular piece with the expression, it does not necessarily mean that they understand why the musical expression occurs in those areas. This means that they would be unable to transfer this understanding to another piece of music. Learning a piece of music involves two concepts: copying the notation and understanding the music. The point is that when students understand musical expressions, they will be able to transfer them to different pieces. If students simply copy the musical expressions in a given piece, they may always have to rely on a video to show them the tempo and the emotion in other pieces that they have to learn. In addition, they may have no ability to explore all the musical expression with their own interpretation when they are learning a new piece. Additionally, the imitation and repetition teaching method is not an ideal practice tool because students feel they should copy as closely as possible the sound and movement, rather than feel the music from inside. When assessing the degree to which technology can be used in the learning process, factors like the age of the student, involvement of the parents, the right time to learn the notes and the need to understand the feeling of the music, all have to be considered. Indeed, Piaget's theory of cognitive development provides an overall guideline, which reflects that the teaching method must match the learning stage of the students.

The research in this thesis has revealed that traditional violin pedagogy remains the most effective method of teaching and learning the violin. The individuality of approach, which facilitates mental control and independent learning, allows traditional violin pedagogy to shape artistic musicianship through interpretation, feeling and expression. Using technology alone as a teaching tool has its limitations, but YouTube plays a positive role in allowing musicians to observe and to learn from performances and masterclasses of renowned violinists. As a violinist and teacher, the benefit of my research has been to broaden my perspective on the various approaches in violin learning and teaching. The tenets of traditional pedagogy remain the basis of musical artistry and as technology continues to develop, the challenge for the teacher is to determine how and when to use it as a

complementary tool for the individual approach. Therefore, while enjoying the convenience of advanced multi-media and internet technology, we must also be aware that this medium can detract from the mindfulness essential in teaching and learning the violin.

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