

Factors and Abilities Influencing the Development of Musical Performance

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Zusammenfassung

Unter High-School Instrumentalisten wurde eine 3-jährige Längsschnittstudie durchgeführt. In ihr wurden Repertoirekenntnisse getestet sowie die Fähigkeiten des Blattlesens, nach dem Gehör zu spielen, Auswendiglernen und Improvisieren. Einflüsse auf diese Fähigkeiten wurden mit standardisierten Interviews gemessen; durch eine Pfadanalyse wurden vier Faktoren des Einflusses ermittelt. Die Studie ist nutzbringend auf die Verbesserung des Instrumentalunterrichts anzuwenden.

Abstract

This paper reports on a three year longitudinal study which examined the development of five distinct types of musical performance. High School instrumentalists were administered tests to measure their capacity to perform a repertoire of rehearsed music, sight-read, play by ear, play from memory and improvise. Additional data concerning a range of variables thought to influence the development of these skills were obtained in face-to-face interviews using a structured questionnaire, and a content analysis of reflective comments made by students as they completed each of the measures. Path analysis was used to test a theoretical model designed to encapsulate the flow of influences theorised to exist between the five types of musical performance and four factors derived from variables thought to influence their development (see McPherson, Bailey & Sinclair, 1997a). The study has implications for instrumental teaching which range from a re-evaluation of teaching practices that are restricted to the refinement of performance repertoire and technique, to guidance in the aural and creative styles of performance and cognitive strategies which this study shows may exert a positive influence on the development of overall performance ability.

1. Background to the study

According to Sloboda (1985), most professional performances of Western art music involve sightreading of the musical score in the first instance, followed by rehearsal of the work to reach an adequate state of readiness and, when preparing pieces for a solo recital, total memorization of the score exactly as it appears in the written notation. Consequently, the majority of discussions about musical performance have tended to focus on the ability of an instrumentalist to re-create a pre-existing musical composition.

The present emphasis of research and the focus of many instrumental programs on the realization of pre-existing music is not surprising, given the importance placed on reading music from notation in most traditional forms of music-making and the interest of many researchers in defining and clarifying the processes of so-called 'expert' performance. However, this view of musical performance represents only one facet of music-making as it exists today. Take, for example, the music of many non-Western societies, expressed in alternative modes of performance and based on an aurally transmitted tradition of music-making. Likewise, young instrumentalists are exposed to a rich variety of musical styles and genres, many of which are performed by ear or are improvised.

2. The longitudinal study

This paper reports on research undertaken over a three year period with high school woodwind and brass instrumentalists which sought to investigate the acquisition of five distinct types of musical performance. Re-creative visual styles of performance were defined as an ability to perform a repertoire of rehearsed music, and an ability to sightread music without prior rehearsal. Re-creative aural styles of performance were defined as an ability to perform music from memory, where music was memorized using notation and re-created aurally, and an ability to play by ear, where music was both learned and reproduced aurally. Creative musical performance was examined through an analysis of subject ability to improvise (McPherson, 1993a, 1993b). A review of the literature (e.g., Colwell, 1961; Elliot, 1982; Elliot & May, 1980; Fowler, 1987; Miller, 1988; Priest, 1989; Webster, 1977) resulted in the identification of 16 variables thought to influence the development of these five skills (McPherson, 1993a, 1995a).

3. Purpose of the research

The purpose of the study was to answer three research questions:

1. What degree of association exists between the five skills of performing rehearsed music, sightreading, playing from memory, playing by ear and improvising?

2. What degree of association exists between these five performance skills and a range of variables thought to influence their development?
3. What factors can be identified to help distinguish between the performance skills of students with differing ability?

4. The measures of instrumental performance

During a carefully organized period of pilot studies, three measures were developed to assess high school instrumentalists ability to play from memory, play by ear and improvise. The development and validation of these tests is reported extensively elsewhere (McPherson, 1993a, 1995a).

A *Test of Ability to Play From Memory (TAPFM)* was devised which incorporated a practice item and four test items. In the first two test items, subjects were allowed twenty seconds to memorize a short musical phrase silently. Then the notation was covered and the subject asked to reproduce the example on their instrument exactly as it appeared in the notation. The third item was a longer melody with indications of musical expression. Again, each subject was asked to study the notation silently for one minute before reproducing it from memory on their instrument. In the final item each subject was allowed to perform the melody four times and to take approximately fifteen seconds to study the notation silently between these performances before the music was covered and the subject asked to reproduce the melody from memory. For all items subjects were asked to perform the melody twice, even if their first performance was correct.

The final form of the *Test of Ability to Play by Ear (TAPE)* included two parts. In Part 1 subjects played their national anthem as a 'practice' exercise before performing 'Happy Birthday' and 'For He's A Jolly Good Fellow' twice each in two different keys. In the second part of the *TAPE*, subjects heard a taped performance of a practice item and five short melodies, each played four times with a one measure gap between performances. After listening to each performance, subjects were asked to perform the melody as it was heard on the tape in the original key. After their second performance of each item, they were asked to transpose the melody and perform it twice in a different key.

The varied tasks on the *Test of Ability to Improvise (TAI)* require subjects to provide an appropriate 'answering' phrase to a given four measure 'question' phrase, improvise an interesting melody in a set key using only the durations of a given rhythmic pattern, use an opening motif to improvise a melody, improvise an interesting melody that captures the style of a recorded piano accompaniment, and perform an extended improvisation in any style or mood that they choose.

Three judges scored the *TAPFM*, *TAPE* and *TAI* according to criteria specifically designed to assess each style of performance (McPherson, 1993a, 1995a). Inter-judge reliability correlation coefficients and the Cronbach indication of internal consistency were acceptable for all three mea-

tures (see further, McPherson, 1993a, 1995a, 1997b) for each administration of these tests.

For the purpose of this study the *Watkins-Farnum Performance Scale (WFPS)* (1954) was used to measure subject ability to sightread. Assessment of subject ability to perform a repertoire of rehearsed music was according to a specialist examiners rating during an Australian Music Examinations Board (*AMEB*) performance examination. The *AMEB* was constituted in 1918 as a national examinations body and is similar to the Associated Board of the Royal Schools of Music and Trinity College examinations in the United Kingdom. These examinations require a performer to present a comprehensive repertoire of prepared pieces with piano accompaniment, technical exercises (i.e., scales, arpeggios), études and orchestral excerpts. More than 100,000 students each year in Australia undertake *AMEB* examinations and progress from the beginning level (Grades 1 to 4) to the developing level (Grades 5 to 8), and finally on to the advanced diplomas (Associate & Licentiate).

An important reason for choosing the *WFPS* was the scoring method which focuses an evaluator's attention on reading ability to the exclusion of all other factors. Assessment for the *WFPS* is based on accuracy of performance in the categories of pitch, rhythm, slurring/articulation, tempo, expression, pause/fermata and repeats. This contrasts with the *AMEB* grade examinations which take into account a more comprehensive range of dimensions considered important in the assessment of a musician's ability to perform a repertoire of rehearsed music, such as tone quality, intonation, musical style and interpretation, phrasing and ability to keep in time with a piano accompaniment. Thus, the *WFPS* was used to assess ability to perform from notation music that had not been previously rehearsed, while the *AMEB* result was used as an indication of overall proficiency to perform a repertoire of music that had been rehearsed during the preceding six to twelve months.

As a guide to the level of ability reached by *AMEB* candidates, Grade 3 subjects on clarinet and trumpet are expected to play from memory the stipulated scales and arpeggios for the grade (i.e., C, F and G major; A, D and E harmonic and melodic minor), and be able to perform a repertoire of short orchestral works in an original key or transposed up one tone. During the examination they also perform from the works stipulated for the grade, a repertoire consisting of two short studies or one long étude, plus two pieces with piano accompaniment. After performing each of these works the examiner will choose one additional work from a repertoire of at least three pieces submitted by the student. By Grade 6 *AMEB* candidates on these instruments are expected to be able to perform from memory all major and minor scales and arpeggios, all dominant and diminished arpeggios, and chromatic scales starting on any note. In addition, they are asked to perform a range of orchestral excerpts in various transpositions. Grade 6 candidates also perform a demanding étude and two contrasting pieces with piano accompaniment and the examiner will choose one fur-

ther work from a repertoire of at least three additional works submitted by the candidate.

5. Design of the study

The study involved subjects learning clarinet and trumpet as a means of restricting playing experience, since consultation with teachers (both studio and school), examination of school instrumental programs, and analysis of applications for *AMEB* instrumental examinations shows that the most common age for beginning instrumental instruction on these two instruments is in School Years 4 or 5. This differs from students of other instruments such as strings and piano, in which there is often a greater range of starting points.

5.1 Subjects

For the initial study a random sample was chosen from subjects who were all undertaking a performance examinations in *AMEB* Grades 3, 4, 5, or 6. These grades were chosen as computer analysis of *AMEB* applications showed them to be the most common grades completed by high school wind instrumentalists. The investigation also aimed to contrast the ability of students in School Years 7 to 9 (ages 12 to 15) undertaking the *AMEB* Grades 3 and 4 (**Group 1**), with those in School Years 10 to 12 (ages 15 to 18) undertaking *AMEB* Grades 5 and 6 (**Group 2**). The initial sample consisted of 52 females and 49 males of whom 54 were clarinetists and 47 were trumpeters.

Within **Group 1** and **Group 2** there was a relatively even distribution of gender, age, instrument and level of achievement as assessed in the *AMEB* examination.

5.2 Procedure

Before the initial study, appointments were made to work with individual subjects in a familiar setting, such as their home or teacher's studio. During these sessions, held around the time of the *AMEB* examination, subjects completed measures aimed to assess their ability to sightread, play from memory, play by ear and improvise, plus a researcher designed questionnaire which was used to obtain information on a range of variables believed to influence the development of these skills. Information obtained during the interviews was checked with a parent and/or teacher at the conclusion of each research session to ensure the accuracy of the data.

Three years after the initial study, Group 1 subjects were administered the same measures and interviewed by the researcher using the same procedure as the original study (McPherson, 1995a, 1997b).

During both studies subjects were also asked at the completion of the final item of the *TAPE*, *TAPFM* and *TAI*, to describe exactly what they were doing in their mind immediately before commencing their performance as they studied the notation (when preparing to play from memory), listened to the tape (when preparing to play by ear), or began to improvise. Similarly, for the final item on the *WFPS*, the notation was covered immediately after the performance and subjects were asked to describe what they could remember for that item and exactly what they could remember doing in their mind in the brief period immediately before they commenced to sightread each item on the measure.

The design of this longitudinal study enabled the researcher to collect data on two distinct groups of instrumentalists (i.e., Group 1 and Group 2) who were stratified according to two levels of age and instrumental proficiency. Three years after the initial study, subjects in Group 2 had completed High School (information on these subjects is currently being analyzed). For Group 1, 10 of the original 53 subjects had ceased learning, and of those continuing to play, 21 were clarinetists (9 male and 12 female) and 22 trumpeters (12 male and 10 female). Three years after the initial study Group 1 subjects were again tested using exactly the same procedures, in order to determine how, and in what ways their skills had developed, and also in order to compare the results of these students (now in High School years 10–12) with Group 2 from the initial study (who were in High School years 10–12 at the time of the original study).

5.3 Results of the initial study

Consistent with the design of the study, ANOVA procedures show that the more experienced subjects in Group 2 scored significantly higher on the *WFPS* ($F_{1,99} = 86.74, p < .00005$), *TAPFM* ($F_{1,99} = 50.40, p < .00005$), *TAPE* ($F_{1,99} = 47.07, p < .00005$) and *TAI* ($F_{1,99} = 76.01, p < .00005$) than subjects in Group 1.

Table 1 provides information about the first research question by detailing the strength of correlation between each of the five musical skills. For the Total Sample, all correlations are significant and substantial. The highest correlation is a healthy .77 between an ability to play by ear and improvise. The second highest correlations occur between an ability to sightread and perform rehearsed music (.75), and an ability to sightread and improvise (.75).

As part of the study subjects completed a researcher administered questionnaire aimed at obtaining information on variables which were thought to influence the development of the five performance skills. Explanations of these variables, together with the scoring methods used for data analysis has been reported extensively elsewhere (McPherson, 1993a, 1995a). Pearson product-moment correlations were used to explore the relationship between each of these questionnaire scales with skill as evaluated on each

Table 1:
Pearson Product-Moment Correlation Matrix: The Five Musical Skills

	Sightread	Play by Ear	Play from Memory	Perform Rehearsed Music
Total Sample N = 101				
Play by Ear	.67**			
Play from Memory	.69**	.64**		
Perform Rehearsed Music	.75**	.64**	.67**	
Improvise	.75**	.77**	.68**	.70**
Group 1 N = 53				
Play by Ear	.40**			
Play from Memory	.38**	.23		
Perform Rehearsed Music	.31*	.30*	.32*	
Improvise	.42**	.51**	.22	.18
Group 2 N = 48				
Play by Ear	.55**			
Play from Memory	.58**	.64**		
Perform Rehearsed Music	.54**	.43**	.51**	
Improvise	.68**	.77**	.68**	.47**

Group 1 = *AMEB* Grades 3 & 4, School Years 7 to 9;

Group 2 = *AMEB* Grades 5 & 6, School Years 10 to 12.

* = Significance level > .05 ** = Significance level > .01 (2-tailed)

of the five measures (see Table 2 and 3). In the analysis for Group 1 and Group 2, differences can be observed between the significant correlations for each of the skills involving performing rehearsed music, sightreading, and playing from memory, but there is a pattern of overlap in the correlations for the abilities of playing by ear and improvising.

Tables 2 and 3 reveal that the skills of playing by ear and improvising were most closely associated with variables which require an ability to 'think in sound'. Report of frequency of playing from memory, playing by ear, improvising, singing, composing and mental rehearsal were all significantly correlated with these abilities for one or both groups. In sharp contrast were the results for performing rehearsed music, which was significantly correlated with variables associated with length of study, including how long the student had been learning music, studying their instrument, and taking private lessons for Group 1, and studying their instrument and average daily practice for Group 2. Only report of singing was significantly correlated with this ability for Group 2.

Extending these results are the reflective comments by students as they performed on each of the measures which show a wide range of strategies used by instrumentalists to represent on their instrument what they hear in their mind (McPherson, 1993a, 1996). Older, more experienced subjects

Table 2:
Group 1: Correlation Matrix; Questionnaire Information With Five Skills

Group 1 N = 53	Perform Rehearsed Music	Sightread	Play from Memory	Play by Ear	Improvise
Early exposure to music ^b	.31*	.19	.10	.33*	.32*
Starting method on instrument ^a	.18	-.04	.07	.29*	.15
Total period of training	.28*	.13	.04	.26	.30*
Period studied Clarinet/Trumpet	.28*	.21	.03	.00	.04
Period of private lessons on Cl/Tr	.44**	-.11	.16	-.05	.12
Learning <i>AMEB</i> theory ^a	.28*	.09	-.05	.10	-.04
Learning other instrument(s) ^b	.21	.24	.38**	.40**	.26
Average daily practice in minutes	.20	.31*	.20	.43**	.14
Electing school classroom music ^a	-.12	-.04	.09	.09	.24
Participation in ensembles	.26	.25	.06	.14	.09
Report of playing from memory	.19	.03	.10	.43**	.31*
Report of playing by ear	.18	.20	.18	.45**	.39**
Report of improvising	.11	.01	.25	.36**	.37**
Report of composing	.00	.07	.11	.26	.28*
Report of singing	.25	.43**	.18	.37**	.29*
Report of mentally rehearsing music	.21	.12	.22	.49**	.35**

^a = dichotomous variable coded 0, 1 ^b = ordinal measurement coded 0, 1, 2

* = Significance level > .05 ** = Significance level > .01 (2-tailed)

Table 3:
Group 2: Correlation Matrix; Questionnaire Information With Five Skills

Group 2 N = 48	Perform Rehearsed Music	Sightread	Play from Memory	Play by Ear	Improvise
Early exposure to music ^b	.20	.04	.41**	.33*	.29*
Starting method on instrument ^a	.06	.05	.31*	.17	.08
Total period of training	.19	.02	.33*	.33*	.25
Period studied Clarinet/Trumpet	.41**	.25	.19	.29*	.20
Period of private lessons on Cl/Tr	.25	.24	.20	.16	.08
Learning <i>AMEB</i> theory ^a	.32*	.20	.36*	.41**	.38**
Learning other instrument(s) ^b	.23	.32*	.52**	.38**	.47**
Average daily practice in minutes	.30*	.36*	.08	.07	.13
Electing school classroom music ^a	.09	.45**	.23	.32*	.55**
Participation in ensembles	.09	.25	.06	.22	.27
Report of playing from memory	-.02	.12	.20	.32*	.31*
Report of playing by ear	.09	.14	.34*	.56**	.34*
Report of improvising	.13	-.02	.12	.19	.20
Report of composing	.27	.35*	.24	.40**	.35*
Report of singing	.29*	.12	.21	.36*	.41**
Report of mentally rehearsing music	.16	.36*	.42**	.43**	.35*

^a = dichotomous variable coded 0, 1 ^b = ordinal measurement coded 0, 1, 2

* = Significance level > .05 ** = Significance level > .01 (2-tailed)

were more likely to mentally rehearse (i.e., silently sing and finger) music when preparing to perform from memory or by ear, in comparison with their younger, less experienced colleagues who often fail to connect what they hear in their mind with the instrumental fingerings needed to execute these thoughts. The best students demonstrated a refined ability to link ear and hand, or, when sightreading, eye, ear and hand (McPherson, 1994a, 1996).

6. Results of group 1 three years later

6.1 *Development of the musical skills*

As expected, repeated measures analysis of variance shows a significant improvement ($p < .01$) for each of the skills for Group 1 subjects across the three years (see Table 4).

Information obtained from the structured interviews show a number of important changes. In comparison with the initial study, at the end of the three years subjects were reporting higher levels of activities which require the capacity to 'think in sound', such as performing by ear, from memory and by improvising during their instrumental practice and related musical activities, and mentally rehearsing music away from their instrument (Table 4).

Reports of the frequency with which subjects play by ear, play from memory and improvise were all significantly correlated ($p < .01$) with actual skill at playing by ear (.48), playing from memory (.62) and improvising (.43).

In the initial study, no Group 1 respondent reported being taught by their instrumental tutor to play by ear, only three (6%) to play from memory, and only one (2%) to improvise. Three years later, no respondent reported being taught to play by ear, one (2%) reported being taught to memorize music, and only three subjects (7%) reported being taught by their tutor to improvise. Analysis of ensemble participation shows that 15 (35%) of the sample played in either a stage band or small jazz ensemble in which improvisation was encouraged.

6.2 *Cognitive Strategies and Performance Skill*

A content analysis of taped responses by students to describe what they were doing in their mind to perform by sight, by ear, from memory and by improvising resulted in the identification of distinct categories which were used to code comments on each of the four measures (see Table 5).

Spearman's rank order correlation coefficients between the hierarchy of strategies identified in Figure 1 and skill as assessed on each of the four measures were .76 ($p < .001$) for the TAPE, .51 ($p < .001$) for the TAPFM, .70 ($p < .001$) for the WFPS, and .67 ($p < .001$) for the 'Freely Conceived' item of the TAI.

Table 4:
Summary Statistics for Group 1, Three Years Later

Performance Skills (N = 43)	Mean	SD	ANOVAS Group 1 3 Years Apart F
Sightread (WFPS) (Scored between 1 and 147)			
Group 1 (Initial Study)	48.51 (33 %)	11.29	101.55**
Group 1 (3 Years Later)	59.52 (41 %)	13.51	
Play by Ear (TAPE) (Scored between 1 and 732)			
Group 1 (Initial Study)	310.27 (42 %)	140.99	77.52**
Group 1 (3 Years Later)	462.35 (63 %)	142.76	
Play From Memory (TAPFM) (Scored between 1 and 132)			
Group 1 (Initial Study)	42.63 (32 %)	17.73	51.15**
Group 1 (3 Years Later)	69.04 (52 %)	20.07	
Improvise (TAI) (Scored between 84 and 420)			
Group 1 (Initial Study)	199.35 (34 %)	43.70	53.69**
Group 1 (3 Years Later)	241.47 (47 %)	39.37	

* = Significance level > .05 ** = Significance level > .01

Mean Scores: percentages are shown in brackets

Note: all calculations are based on the 43 students of Group 1 who had continued learning an instrument

Interview Questionnaire	% Never	% Rarely	% Sometimes	% Often
Initial Study				
<i>Report of frequency of:</i>				
Playing by Ear	35	44	16	5
Playing from Memory	51	31	16	2
Improvising	58	28	9	5
Mentally Rehearsing Music	21	58	19	2
Three Years Later				
<i>Report of frequency of:</i>				
Playing by Ear	0	37	35	28
Playing from Memory	28	47	7	19
Improvising	26	30	23	21
Mentally Rehearsing Music	18	26	35	21

The significant improvement in the level of performance across the three years shows the extent to which these skills develop during the intermediate stages of learning an instrument. Extending this finding are results which highlight important differences between what students are asked to practice by their instrumental teacher and the way they structure their own

Table 5:
Cognitive Strategies

Type of Strategy	Example of Subject Response
<p>Playing by Ear Independent of the instrument or sound of item <i>Coded as '1'; N = 10</i></p> <p>Independent of the instrument but involving singing inwardly <i>Coded as '2'; N = 12</i></p> <p>Involving kinaesthetic recall on an instrument linked with sound <i>Coded as '3'; N = 21</i></p>	<p>While listening to the tape "I tried to listen to how it moved and I was thinking does it go up or down" "I tried to think in terms of the letters names of the notes" "I'm trying to think of the intervals. Seeing it in my mind, thinking of the spaces in between the notes. Thinking how many notes – down 4 and up by step. I visualize the notation and staff" "I just sing it in my head" "I sing the melody and think about how it would look on paper" "As I was listening I was trying to work out whether the ending sounded like a D or not. When the tape stopped I was singing it back in my mind and trying to match the notes to my instrument" "I just sing it in my head and finger it through on my instrument"</p>
<p>Playing from Memory Independent of the instrument and sound of the notation <i>Coded as '1'; N = 13</i></p> <p>Independent of the instrument but involving singing inwardly <i>Coded as '2'; N = 13</i></p> <p>Involving kinaesthetic recall on an instrument linked with sound <i>Coded as '3'; N = 17</i></p>	<p>While studying the notation "I was just going over the letters. First off, I picked out the key and accidentals and time signature and then just kept saying the notes over to myself" "I think how I could write it down" "I studied the rhythm and then tried to sing it to myself" "I was singing it to myself while I was fingering it on my clarinet" "I used fingerings, because I know how the notes sound"</p>
<p>Sightreading Allocated 1 mark each if they: Could remember key signature Could remember time-signature Analyzed first part of the music</p>	<p>Notation covered after completing exercise "I look for the key and time-signatures" "I looked at the time-signature and thought about how fast it was going to be" "I checked out the time with the metronome and tried to work out how the first part goes" "I focussed my attention on the first bar"</p>

Table 5 (cont.):

Type of Strategy	Example of Subject Response
Scanned the music to identify possible obstacles Scores: '1' (N = 7); '2' (N = 7); '3' (N = 11); '4' (N = 18)	"I looked for the really hard bits. I was trying to figure out how I could cut them into sections that I could play" "I looked through it to see if there was anything that might prove difficult"
<p>Improvising</p> <p>No plan; the first note or pattern often dictated the final shape and course of the improvisation <i>Coded as '1'; N = 10</i></p> <p>Vague conception of what might be done, but often failing to adopt an idea once the improvisation had commenced <i>Coded as '2'; N = 17</i></p> <p>Some idea for shaping the improvisation, such as thinking about the range and style which could be used <i>Coded as '3'; N = 10</i></p> <p>Distinct plan for shaping the response and moving fluently between ideas <i>Coded as '4'; N = 6</i></p>	<p>'Freely Conceived': Extended improvisation in a style or mood of the subjects own choice</p> <p>"I couldn't really think of anything" "I just made it up on the spot with no idea where to start"</p> <p>"I thought of a rhythm to use, but I didn't really use it once I started improvising" "I thought of a rhythm for the first bar"</p> <p>"I chose a blues scale to use because its what I'm familiar with, and then worked out a pattern to use in the beginning section"</p> <p>"I was singing ideas in my head before I began and worked out a couple that I could use. I also thought about ways I could use sequences and variations on them so that I could keep going"</p>

individual practice. Teaching instructions from tutors were almost entirely restricted to the refinement of performance repertoire and technical exercises, and rarely included any guidance or encouragement in the aural and creative forms of performance described here. This is in stark contrast to the range of activities, which include mentally rehearsing music, and practising music from memory, by ear, and by improvising, that subjects report engaging in during their instrumental practice and related musical activities.

The best musicians on each of the measures possessed a rich repertoire of strategies which they used when preparing to perform. For example, comments by the clarinettist who received the highest score on the *TAPFM* display a mature level of metacognitive ability. First, he chanted the rhythm of the melody to himself to establish an appropriate tempo

and feel. He then sang the melody through once before mentally rehearsing (singing and fingering) the melody a few times from beginning to end. To check that he had memorized the melody correctly, he then looked away from the notation for a brief period in order to rehearse the melody in his mind. This was followed by a brief period where he isolated and practised a problem section before returning to mentally rehearse the melody in its entirety. For this musician, the link between fingers and singing was automatic, and seemed to occur without any conscious effort.

In contrast, the weakest subjects displayed a naive understanding of how to transfer information obtained from the notation or aurally into an appropriate musical response. Their comments show how lacking they were in their ability to internalize and coordinate musical skills, as evidenced in an orientation to think in symbols rather than in sound. In general, these subjects lacked sufficient understanding of how to monitor and control their performance and were unable to coordinate the types of musical relations needed to successfully overcome the problems encountered when performing on each of the measures.

7. Conclusion & implications of the study

Directions for further research are many and varied. However, one important implication is the extent to which lack of exposure or training in any one skill will impact on the development of other styles of performance. In this regard a theoretical model proposed by the author (McPherson, Bailey & Sinclair, 1997a) contrasts the traditional visually oriented style of learning characteristic of much instrumental teaching, with a broader approach to training in which aural and creative skills are fostered and developed, not always through planned instruction, but by exposure to other forms of performance such as playing by ear and improvising. Discussions with subjects as they completed the questionnaire show that even though many are rarely encouraged by their instrumental teachers to play by ear and improvise, many do practice in these ways during their daily practice (McPherson, 1995a, see also McPherson, 1994b, 1995b). This result is consistent with research reported by Sloboda (1993) who cites evidence showing that during the initial stages of training, better students spend less time during their practice than their less able peers on formal task-oriented practice. In these studies many of the best students spent time freely exploring the musical medium, such as improvising and 'messing-about', activities which Sloboda describes as important to the development of the 'expressive' dimensions of musical ability.

The findings of the study also show that employing a suitable strategy when performing is of vital importance, as is knowing how to connect what is in the mind with the instrumental fingerings necessary to execute one's thoughts. In particular, the finding of significant correlations between the hierarchy of strategies used when performing, and skill, as evaluated on

the measures deserves further attention. Studies should attempt to understand the types of cognitive strategies and metacognitive functioning that enable musicians to monitor and control their performance, and seek to determine how these assist students as they learn to perform.

Above all, the results of this study support an increasing body of knowledge suggesting that learning to perform music should involve the types of visual, aural and creative forms of performance examined here, and that these forms of performance are a fundamental means by which a musician learns to coordinate ear, eye and hand and to perform on their instrument what they see in notation and hear or imagine in their mind. Training programs which do not recognize the importance of aural and creative forms of musical performance may be neglecting an important facet of training which enhance overall musical growth and which provide for more enjoyable and meaningful experiences. At a fundamental level this study (see also, McPherson, Bailey & Sinclair, 1997a) questions the long-term benefits which would accrue if aural and creative skills were introduced and encouraged during earlier stages of development, and a re-evaluation of the emphasis that has traditionally been placed on reproducing music to the exclusion of other styles of performance. Aural and creative activities, such as mentally rehearsing music away from an instrument, and playing music by ear, from memory and by improvising, may well be more important to musical development than has commonly been assumed.

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