The Acquisition of Absolute Pitch for the Mainstreamed, Special Educational Needs and Academically Talented under Lau Chiu Kay Music Educatherapy (Simplified Version)

Hong Kong Music Home for Handicapped Normal Talented Children Ltd

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CHAPTER ONE: THE PRELUDE

1.1. Background

Hong Kong Music Home for Handicapped Normal Talented Children Limited (Subsidiary with Youth and Adults Sections) (MusH) was founded by the researcher on 4th April, 1992. The Lau Chiu Kay Music Educatherapy for the Special Educational Needs, Mainstreamed and Talented (LCK MusET) was formulated and practised there. At that time, there were about 30 students, including special educational needs (SEN), mainstreamed (MS) and academically talented (AT) children. The age range was from two to 16. One of the purposes of their enrolment was to learn to play the piano. The researcher was the only piano instructor. In order to develop AP for students and help them to learn the piano faster, an absolute solfège system was designed. The pianos at MusH and the students' homes were tuned to A440. As the teaching moved on, the researcher noticed that students identified piano keys from pitches rather than positions. They always played back music from memory. They could identify single tones. It seemed that they were developing AP. Their progress in playing the piano was rapid too. From 1st to 14th July 1992, the researcher conducted a simple AP test with all students except new ones. When he struck piano keys randomly, students could name the sol-fah and octave names without referential tones immediately and with certainty. This test suggested to the researcher that everyone can develop AP and AP may be an innate potential to all.

1.2. Definition of AP

AP, according to the researcher, is an innate ability to identify or produce tones with octave designations accurately, with certainty, spontaneously and effortlessly without reference and at least for one timbre.

1.3. Aims and Objectives

Even though nearly all students appear to possess AP under LCK MusET, the researcher was aware that AP is rare in the population as well as in musicians (Gregersen, 1998; Heaton et al, 1999). The occurrence of AP on such a large scale at MusH is uncommon and this prevalence has even lasted for all these years. It was felt that this phenomenon should be investigated in greater depth.

The fundamental aim was to find out whether subjects under LCK MusET can gain AP. If they can, to investigate to what extent they gain AP. How do they get it? What are the influencing factors? How is AP processed? What are its characteristics? How is AP useful to them? If some students cannot achieve it, why can they not?

The main objectives were to investigate: a) what activities of LCK MusET enable subjects to develop AP;

b) at what level and after how long of the piano learning subjects can possess AP ; c) what factors may influence them to develop AP, such as age, sex, language background, aptitude, age of onset, tonal memory, attention, auditory sensitivity, the exposure to music, singing and thinking of absolute solfège in music activities, piano standards, the interest in the piano learning, the duration of practising the piano, piano tuning, the practice of the tonal identification, inheritance, tinnitus, and/or chromesthesia; d) how age, age of commencing piano playing, piano standards, the duration of learning and practising the piano, and the frequency of singing and using absolute solfege in music activities are related to their AP development; e) what the important characteristics of AP are (these may include encoding strategies, identification processes of note and octave designations, tonal accuracy, the white key superiority, octave errors and regional accuracy); f) what the reasons why some subjects cannot develop AP are; g) to what extent subjects find AP useful in identifying notes, playing the piano, playing the piano from memory, sight-playing, singing, sight-singing, music listening, composing, conducting and learning music theory; h) subjects' attitude to AP is positive or not; and lastly, i) why some subjects have not yet developed AP.

CHAPTER TWO: REVIEW OF LITERATURE

2.1. Occurance

It was commonly accepted that AP is a rare ability. The estimation is from less than 1:100 (Moore, 1997) to 1:10000 (Bachem, 1955) in the general population. AP occurs more in musicians than in the general population. The estimation is around 3.4% (Révész, 1913, cited in Miyazaki, 1988) to 24.6% (Gregersen et al, 1999) in western countries, 32.1% in Asian countries (Gregersen et al, 1999) and 50% in Japan (Miyazaki, 1988). AP is more commonly found in musical savants (Miller, 1989; Heaton et al, 1998), autistic (Young & Nettbeleck, 1995; Heaton et al, 1998), blind (Bachem, 1940) and Williams syndrome persons (Lenhoff et al, 2001) than in the general population. Rimland and Fein (1988) approximated the prevalence of AP in autistic persons is higher than that in the general population, around 5%. From blind samples, Révész (1953) quoted that 14% had AP, while only 5% of seeing persons had. Neal (1983) found 40% to 60%, Welch (1988) found 76% boys and 46.2% girls, and J.T. (2000) found 58% had AP.

2.2. Theories of AP

AP can be theorized with two major trends, i.e. the heredity and the innate approach. Both approaches emphasize that music training is inevitable to reveal the trait, no matter whether there is a critical period for training or not. In the heredity approach, the heredity plays a prime role in the development of AP. AP is limited to very few people (Bachem, 1940, 1955) and there is familial segregation (Gregersen et al, 1999; Baharloo et al, 2000). In the innate approach, AP is a potential to everyone. This approach includes Learning theory, Unlearning Theory and Early Learning theory. The learning theorists postulated that AP can be acquired at any age through training (Brady, 1973; Eaton & Siegel, 1976). The unlearning theorists assumed that there is no appropriate experience for AP to develop. AP is trained out of most children because of the moveable solfège system (Deutsch, 1999; Saffran & Griepentrog, 2001). The early learning theorists believed that AP should be acquired at the age before six (Takeuchi & Hulse, 1993; Kirchubbel, 2000). Another viewpoint is from the inter-behavioral theorists who view AP neither as

innate potential nor heredity trait, but a learnt skill from the interaction with tones (Neu 1947; Levitin 1998).

2.3. Processing of AP

How AP is processed in the brain is still controversial. The assumptions include that AP persons may: a) possess an acute memory for pitch. They do not display a large P300 in identifying pitches (Hantz et al, 1992; Crummer et al, 1994); b) possess an auditory hyper-sensitivity (Profita & Bidder, 1988; Wayman et al, 1992); c) perceive individual tonal qualities (Balzano, 1984; Semal & Demany, 1990); d) use chromesthesia and tinnitus as anchors for tones (Costall, 1985); e) develop an internal reference standard to compare tones (Levitin, 1994); f) formulate a fix scale to place tones (Brady, 1970; Corliss, 1973); g) use verbal encoding strategy (Takeuchi & Hulse, 1993; Ohnishi & Matsuda, 2001); and h) use multiple encoding strategies, including the formation of the image of the keyboard or hand positions on strings, larynx positions, hand movements, or relating tones to compositions, keyboards and staves (Miyazaki, 1990; Zatorre et al, 1998).

2.4. Training Attempts

The training methods for children and adults are basically similar. They are: a) listening to tones and overtones (Boggs, 1907); b) relating tones to colours (Rush, 1989), compositions (Chang, 2003), symbols or syllabus (de Vetten, 2002) , numbers (Ward, 1999), moveable solfege (Slonimsky, 1988), fixed solfege (Cohen & Baird, 1990) or letter names (cuddy, 1971); c) developing anchors on middle C (Mull, 1925), A440 (Crozier, 1997), white key tones (Mull, 1925), chromatic scale tones (Lundin & Allen, 1962), tones within singing voices (Chang, 2003), the lowest singing tones (Farnsworth, 1958), the highest singing tones (Chang, 2003), head tones (Cogan, 1999), any one tone (Seashore, 1919), any several tones (Pollack, 1953), C (Chang, 2003) or F major chords (Cuddy, 1971), or the C major scale (Brady, 1970); d) listening to tones of pianos (Deutsch, 1986), violins (Farnsworth, 1958), tuning forks (Backus, 1969), tonometers (Mull,1925) or pitch pipes (Crozier, 1997); and e) tuning music instruments (Riemann, 1908, cited in Neu, 1947). There were a few successful attempts in young children (Oura & Eguchi, 1981) and one in adult (Brady, 1970). Successful cases were rare. AP training in children were not more successful than in adults (Takeuchi and Hulse, 1993).

2.5. Tone Identification Training

The training on the tone identification appears to be a crucial factor in acquiring AP. Nevertheless, through the subjects' music history, Boggs (1907) did not find his 13 AP subjects having such training. Levitin (1998) argued that AP possessors must have systematic training in the pitch identification with labels at the young age.

2.6. Unclear Phenomena

Even after Stumpf has raised AP as a scientific issue a century ago, AP still remains as a scientific mystery (Brown, 1999; Stary, 2002). The first issue concerns the aetiology. Whether AP comes from nature or nurture (Neu, 1948; Sundberg, 1991; Ward, 1999)? Why does AP develop in some people not in others (Halpern, 1989; Heaton et al, 1998; Zatorre et al, 1998)? Why do so few people have AP (Ward,

1999; Brown et al, 2001)? Why is the occurrence so rare even in musicians (Halpern, 1989; Levitin, 1994)? Why do some people possess AP without much training and why do some people not have it even after strenuous effort (Mull, 1925; Ward, 1999)?

The second controversy is the criteria for deciding AP ability (Stanaway et al, 1970). The standard of an objective measure for AP has not been determined (Brady, 1970). Thirdly, its characteristics are rarely revealed (Macpherson, 2000; Brown et al, 2001), such as the brain processing mechanism (Ward, 1999; Macpherson, 2000), the way labels anchored with tones (Brown et al, 2001; Saffran & Griepentrog, 2001) and the influence of one's aptitude for music (Shuter-Dyson & Gabriel, 1981). Fourthly, the value of AP is debatable (Vernon, 1977). Its utility in music is subject to testify (Burns, 1999).

2.7. Coda

Up to now, most of the issues of AP are still debatable, such as its definition, etiology, characteristics, processing, measurement, training methods and value. As Levitin and Zatorre (2003) stated, AP comes from "some yet unknown substrate ….. in interaction with right input at the right time" (p.109). Eighty years ago, Mull (1925) suggested a solution to the query of AP. The convincing proof comes from the "success in training average individuals in AP" (p.475). Seventy years later, Ward (1999) suggested a similar method. The nature of AP can only be resolved if "some technique for teaching AP is developed that would succeed with everyone, or at least with all children" (p.270). Otherwise, most features of AP can hardly be revealed truly.

CHAPTER THREE: THE ACQUISITION OF AP UNDER LCK MusET

3.1. Introduction
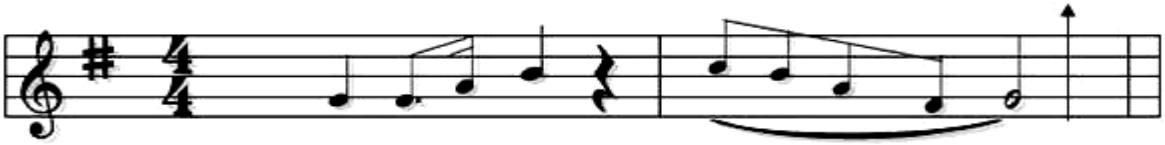
Under LCK MusET, students develop AP mainly through singing and thinking of the absolute solfège in practising the piano, sight-playing, singing, sight-singing, music listening, composition, conducting, learning music theory and preparing for piano practical examinations. As a support, parents receive music guidance and attend all students' learning sessions.

3.2. Basic Method of Singing Absolute Solfège

Under LCK MusET, there is a naming system in singing solfège, in which one note is associated with one tone with the fixed solfège. For example, the note G would be sung "sol" and D would be sung "ray" in any keys. Even though sol-fah names are common, the naming system is not universal. So, the researcher, based on the existing system, has designed a solfège naming system. This was doh-di-ray-ri-mi-fah-fi-sol-si-lah-li-ti-doh^1 (d-di-r-ri-mi-f-fi-s-si-l-li-t-d^1) corresponding to the letter names of C-C#-D-D#-E-F-F#-G- G#-A-A#-B-C^1 with the black key notes in the sharp relationship to white keys and doh^1-ti- te-lah-le-sol-se-fah-mi-me-ray-re-doh (d^1-t-te-l-le-s-se-f-m-me-r-re-d) corresponding to C^1-B-Bb-Ab-G-Gb-F-E-Eb-D-Db-C with the black key notes of a flat nature . If the notes are without sharp or flat relationships, d-di-r-me-m-f-fi-s-le-l-te-t-d^1 are used to represent the letter names of neutral relationships C-C#-D-Db-F-F#-G-Ab-A-Bb-B-C^1. The doh is fixed to C. There are octave indications following the letter names or solfège. Take C and doh as examples. The middle C is C_o

or d_o. The C an octave higher than the middle C is C^1 or d^1, two octaves higher is C^2 or d^2 and so on. Take Bb as an example. An octave lower than the middle Bb is Bb_1 or te_1, two octaves lower is Bb_2 or te_2 and so forth. Students are taught to identify tones with octave placements whether the tones are in the middle register, one, two, three or four octaves above or below the middle register. It was designed in this way after examining how students approximated octaves when LCK MusET was first devised. When students sing the solfège, the notes can be too high or too low. They must lower high notes and raise low notes to their singing ranges and sing with natural voices. The basic absolute solfège singing technique in the musical content is illustrated as follows:

Example 3.2.1: To sing a musical phrase with absolute solfège



Solfège Singing: s s. l t d t l fi s

In the above example, when students practise the piano, they sing the solfège simultaneously, following the pitches and the rhythm of the notes, i.e. they sing sol when they play the first note and they sing sol again when they play the second note and so forth. This kind of solfège singing lasts for the whole music learning. They sing solfège in every piece except in some music with fast running passages.

3.3. Pitch Identification in Piano Playing

3.3.1. The piano is the only instrument formally learnt at MusH. Students acquire AP mainly through playing the piano. The piano can be comfortably sat at and played even by very young children. Students can play and sing solfège at the same time. The piano can be well in tune if a competent piano tuner is employed. The piano range is the widest among all musical instruments.

3.3.2. Piano books are accompanied with CDs or cassettes if available. Otherwise, piano instructors would play the music in class with singing solfège and record it for students, especially in the first few grades. In practising the piano, students listen to the recording of the piece and point at the score for several times. When they are familiar with the notes, they point at the score and sing solfège after the recording. If they know how to sing, they sing on their own. If they can sing the notes correctly, they start to practise the piano. When they are practising, they sing the notes simultaneously. When they feel fatigue, they may sing the notes silently or think of the notes in the way as they sing. In their next piano lessons, they play the music back with singing solfège simultaneously. When communicating pitches to each other, students and instructors sing or name solfège instead of using letter names, preferably with right pitches. In most piano method books, there are CDs or cassette tapes attached. For the books of classical music by great composers, CDs are paired by the researcher. In this case, students sing solfège on their own. The solfège singing is taught in class, group sessions and in the parent guidance.

3.3.3. The piano instruction begins with black keys. As all the black keys have their own solfège, students have no difficulty to learn them before acquiring white keys. Since the black keys stand out from the white keys in the keyboard, it is easy for new learners to recognize their positions. It is intended that students can develop AP for black key tones as good as white key tones.

In learning the black keys, the beginning lessons of the piano books in the preparatory grade by Palmer et al, Bastien, Kreader et al and Agay contain few exercises in playing all the black keys across the whole piano keyboard. When students play these pages, they sing sol-fah names for the first time and letter names for the second time. They keep singing within their voice ranges even though some pitches go beyond them. This way of singing tones enables them to get use to these two naming systems. Refer to *The Piano Keyboard, Hal Leonard Student Piano Library Book I*, p. 7 as an example.

After the identification of the black keys, students proceed to play and sing piano pieces with black keys and with black keys mixed with white keys. Students are required not only to play and sing the piano pieces, but to play and sing the "Finger Position" as well. They play it twice, singing sol-fah names for the first time and letter names for the second time. Refer to *Balloon Ride, Hal Leonard Piano Library Book I*, p. 24 as an example. All finger positions are played in this way.

The piano books in the syllabus starting with black key pieces are: a) Palmer et al: *Alfred Basic Piano Library—Lesson Book A, Prep Course,* pp.8-15; b) Bastien: *Bastien Piano Basics—Piano (Chinese Edition), Primer Level*, pp.8-12; c) Kreader et al: *Hal Leonard Student Piano Library—Piano Lessons, Book 1*, pp.8-9, 12-20, 24-25, 28-29; and d) Agay: *Learning To Play Piano, Book 1: Primer Level*, pp.5&7.

3.3.4. Most method books for beginners start with white keys. At the beginning of learning white keys, students play and sing notes from the lowest range to the highest range in the entire piano keyboard. Refer to *The Music Alphabet, Bastien Piano Basics, Piano-Primer*, p.14 as an example. Students sing solfège for the first time and sing letter names for the second time. This is to help them memorize pitches as well as the location of notes in the entire piano keyboard.

After the identification of the white keys in the entire piano range, students proceed to play and sing piano pieces with white key notes. After the piano pieces specifically designed for black keys, the pieces consist mainly of white key notes. Students have more chance to acquire white keys than black keys except in the pieces with three or more sharps and flats in the latter stage of the piano learning. But the proportion of playing white key notes is far more than playing black keys.

3.3.5. AP can be learnt through playing scales. Students need to sing all notes. Scales sometimes appeared in the contrary motion. Take the second line of *A Hard Trick, A Dozen A Day, Book I*, p. 28 as an example. On the first occasion, students play the right hand part and sing the right hand notes. At the second time, they play the left hand part and sing the left hand notes. The third time, they play both parts and sing the right hand notes. In the last session, they repeat both parts and sing the left hand part. They would notice the lower part notes more. In addition, they have to play and sing the key signature of each scale before playing and singing the scale. For example, in B major, students play the key signature notes both hands, following the exact tonal order on the stave, i.e. F#-C#-G#-D#-A#. Students sing fi-di-si-ri-li simultaneously. This is another chance to practise the tone identification of black keys.

3.3.6. In contrapuntal music, students play and sing one voice after another before playing with both hands. Take *Bourrèe, The Russian School of Piano Playing I Part II*, No. 146, p. 39 as an example. Students practise the first section (bars 1-4) in the following ways: a) play and sing the notes of the right hand part; b) play and sing the notes of the left hand part; c) play with both hands, singing the notes of the upper part; and d) play with both hands, singing the notes of the lower part. They then play the second section like the first one. The aim here is that they can identify notes in different voices.

3.3.7. When students play music built on melodies with chordal accompaniments, they sing all the chord notes and the melody with solfège if time allows. For example, in *Love Somebody, Bastien Piano Basics, Piano-Primer*, p.43, they practise the left hand part first, singing dms234-s234 and so on. Then, they practise the whole song, singing $d_1m_1s_1$d-m-s-s-s_1r-m-f and so forth. When they sing chords, they must sing as fast as possible without dragging the music. If the music is fast, students may not have enough time to sing all the chord notes and melodies. They sing the melody only when they practise both hands.

3.4. Acquisition of AP through Other Music Activities

The classes related to the AP acquisition include the AP training course, music listening, sight-reading, singing, sight-singing, composition, conducting, preparation for piano examinations and music theory.

3.4.1. In the AP Training Course, the AP identification (see Appendix I.7, pp.?????), the piano purchase, the piano tuning and maintenance, and the purchase of audio equipment and CDs are instructed. The course aims at developing students' AP of all 88 piano tones before grade three. The method involves listening attentively to piano tones, singing solfège, looking at notes and identifying tonal qualities. The preparatory grade involves the tonal identification from C_0 to C^1, grade one from C_1 to C^1, grade two from C_2 to C^2, and grade three from A_4 to C^4, i.e. all the 88 piano tones.

3.4.2. There are three types of music for listening, comprising recordings from piano instructors, cassette tapes or CDs of the piano textbooks, and extracurricular music. For the music of the piano books recorded by instructors, students are advised to listen attentively, look at scores and sing solfège after the music, preferably memorizing the pitch. This process enables students to associate tones to the absolute solfège, their positions in the keyboard and stave. For the music from the CDs and cassette tapes accompanied with the piano books, students have to listen attentively, look at scores and sing solfège on their own after the music. The extracurricular music is assigned as background music when students are studying, reading, sleeping, waking up, playing games, taking meals or in leisure. Most of the music is instrumental or orchestral. It is designed to enhance students' AP through the frequent exposure to music of different instruments.

3.4.3. Sight-reading is another means to train students' AP. In practising sight-reading, they play and sing the key signature, the right hand part, the left hand part, and then both parts. Finally, they do all the singing in the brain, and just play.

3.4.4. In singing classes, the instructor demonstrates singing the melody in absolute solfège when s/he is playing the melody at the piano. Students listen and memorize the tune, looking at the score simultaneously. When students feel confident about the tune, they sing solfège with the instructor with the help of the piano. Then they sing solfège by themselves and the instructor play the tune. After they feel confident about the tune, they sing the solfège without the piano. They practise in the same way at home. In the next session, they are expected to sing the solfège in tune without the piano. Then the instructor plays the accompaniment and they sing the solfège. The last stage will be singing words.

3.4.5. In sight-singing, students try to develop the technique of singing tunes in tune without the help from any instruments. To achieve this, after the instructor has played the tune on the piano, students, looking at the score, sing the tune with solfège and try to memorize the pitches. Then, the instructor plays the first note and any notes that they sing out of tune in order to assist them to sing. If they fail to sing the melody in tune, they keep practising in these two stages until they can sing the whole tune without any

references.

3.4.6. The method of composition related to AP is to sing the music out with in-tuned solfège before playing it out on the piano. Students explore the motive of the melody or accompaniment through singing solfège before writing it down on the manuscript paper. They compose the whole piece of music through singing solfège alone. After finishing a section or the whole piece, they try it on the piano and did some revision. The aim here is that they can compose with exact tones even though they are without references or the help from music instruments.

3.4.7. The method of conducting related to AP is to sing all the music in absolute solfège before students sing songs, and before or at the time when they are playing musical instruments. The instructor or student conductor conducts players and singers to sing their parts in solfège until they understand their parts well. Then, they play and/or sing the music. The conductor, players and singers communicate pitches to each other with singing solfège. The conductor would sing the music out as players are playing the music at the beginning of the practice in order to help young and SEN players to follow the music.

3.4.8. Piano students would take grades three, five, eight and DipABRSM piano practical examinations held by ABRSM, or grade eight and ATCL held by TCL. The same AP approach described above is used in preparing scales, arpeggios and broken chords, technical works, examination/recital pieces, sight-reading and the quick study. They are all started with singing absolute solfège. Students are prepared for aural tests in AP even though only RP is required.

3.4.9. In teaching music theory, before any written work, students sing notes, scales, intervals, chords or music excerpts in absolute solfège. If students cannot catch the exact pitches, the piano is used as the reference. In the piano method books, music theories are given wherever these are needed to explain theories in the piano pieces. Students are not only required to understand them on paper, but to play and sing them. When teachers play back the materials, they have to identify them from hearing alone.

3.4.10. In the meetings of parent guidance, the AP identification (see Appendix I.7, pp.?????), the piano purchase, the piano tuning and maintenance, and the purchase and operation of audio equipment and CDs are covered. In the students' courses on similar topics, the instructor gives greater emphasis to the process and the method of training. But in the parent guidance, the instructor gives greater attention to the rationale. Parents would support their children's learning more if they have a greater understanding on these areas.

3.5. AP Grading Scheme

Under LCK MusET, there is a system to grade the AP achievement. Octave errors are so common that they are always ignored (Miller & Clausen, 1997; Marvin & Brinkman, 2000). When octave errors were ignored, the accuracies were from 30% (Rush, 1989) to 100% (Hantz et al, 1997; Mottron et al, 1999 etc.). In many cases, the lowest accuracies were 30% and 60% (Rush, 1989), 40% (Miyazaki, 1993), 50% (Boggs, 1907), 58% (Lockhead & Byrd, 1981), 60.63% (Klein, 1984), 60% and 65% (Meyer, 1899), 62.5% (Hantz et al, 1997), 64% (Whipple, 1903) and 66.75% (Wayman et al, 1992). Under LCK MusET, 60% is the passing mark.

However, the octave placement should be part of the tone. One should identify note names together with octave designations. Only answers with right note and octave names are counted as all right. Answers with right note names and wrong octave placements are counted half right. If note names are wrong, even

if octave names are right, answers are regarded as wrong. The revelation mark of 10% indicates AP starting to develop. It is based on the chance level. One getting 9.99% or less is likely to have been achieved by guessing. Students have a 1/12 chance of guessing the right tone names, i.e. 8.33%. The chance of guessing right octave names after right note names is 8.3x1/8, i.e. 1.04%. The chance level of getting both note and octave names right one after another is thus 9.37% (100%x1/12+100%x1/12x1/8x). In an assessment with the octave errors counted, the accuracy was 10% for non-AP and 42.87% for AP subjects (Klein et al, 1984). In this scheme, 9.99% or under signify no AP, 10% indicates AP starting to develop, 10%-40% represent initial AP, 50% is a passing score and 100% is perfect. See Table 3.5.1.

Table 3.5.1: AP Grading Scheme with Octave Errors Counted

Pass or Fail		Specification	Description	AP Grading	Score (%)
Fail	Fail	No AP	No AP AP by chance AP with one to few notes	AP0	0-9
	Initial	Starting AP	Start to possess AP	AP1	10-19
				AP2	20-29
		Progressive AP	Possess AP with Progress	AP3	30-39
				AP4	40-49
Pass	Satisfactory	Fair AP	Possess AP with Fairness	AP5	50-59
				AP6	60-69
		Meritorious AP	Possess AP with Merit	AP7	70-79
				AP8	80-89
		Distinctive AP	Possess AP with Distinction	AP9	90-99
		Perfect AP	Possess Perfect AP	AP10	100

CHAPTER FOUR: PREPARATION OF INSTRUMENTS, SUPPORTIVE DOCUMENTS, PIANOS AND ROOM SETTING FOR THE STUDY

4.1. Introduction

This was a case study. Both qualitative and quantity data had to be collected, including an AP achievement test, a questionnaire and forms to gather subjects' background information and opinions on AP, instructors' observations, and feedback from instructors, administrators, parents and students. The piano room had to be designed and the piano had to be tuned and checked. A pilot study was conducted. After the pilot study, the documents and the procedures were finalized.

4.2. The Notice of "AP Acquisition Project" was distributed to inform students, parents and other members of MusH about the "AP Acquisition Project".

4.3. The "Invitation Letter to Participants in AP Acquisition Project" was sent to all piano students to

ask for their parents' consent to join the project.

4.4. The "AP Practice Guidelines of MusH" was distributed to subjects. In the guideline, the AP training method was described. This guideline had been used for some years at MusH. Subjects were taught to follow the method to acquire AP. See Appendix I.7, pp.?????.

4.5. The "Guidelines on Piano Tuning and Maintenance of MusH" was distributed to subjects to call their attention again to the fact that pianos had to be tuned to A440.

4.6. The "Guidelines on the Purchase and Operation of Audio Equipment of Compact Discs of MusH" was distributed to subjects to draw their attention again to listen to music CDs and tapes frequently with proper hi-fi equipment.

4.7. The "Student Background Information Sheet before Entering MusH" was designed to collect information on subjects' musical background and health condition before studying at MusH.

4.8. The AP Assessments for New Students had been taken by all students when they came to MusH. The testing method was similar to that of the AP test. It comprised ten randomly selected items from the middle register (e.g. Heller & Auerbach, 1972; Siegel, 1974) which was the easiest to identify among all (Rakowski & Morawska-Bungeler, 1987). No octave designation was needed. One right answer carried ten marks, with 60 the passing and 100 the full mark.

4.9. An AP Assessment was conducted to test subjects' AP in this study. Piano tones were used as stimuli (e.g. Miller & Clausen, 1997; Pantev et al, 1998; Lenhoff et al, 2001). All 88 piano tones were employed (Bachem, 1937; van Krevelen, 1951). Consecutive tones were at least a major tenth (i.e. an octave and a major third) apart to avoid RP (Miyazaki, 1990; Takeuchi & Hulse, 1993; Levitin, 1998). Test tones lasted for one second each (e.g. Marvin & Brinkman, 2000; UCGAPS, 2003). Test tones were allowed to vary from mezzo-forte to forte especially when subjects were inattentive or moving around. If subjects were out of control, the test would cease. The inter-stimulus interval was at least 30 seconds. If a longer time was needed to write down answers, the interval could be prolonged (van Krevelen, 1951). This was long enough to avoid RP (Bachem, 1954). Examiners were given stop-watches to count the time. Distractions of naming, pointing or writing answers (van Krevelen, 1951) and conversations (Petran, 1932) among subjects, parents and examiners were introduced.

Subjects were assessed individually. They took the test before their individual tuitions. They had no chance to listen to tones in class before they took the assessment. Even though they might practise piano before the class, there was a time gap in between. When subjects came into the classroom, they would say hello to instructors, put down their belongings, place seats themselves properly, look at distributed papers, write down names and so forth. These procedures were long enough for non-AP subjects to forget referential tones (Hall, 1982; Takeuchi & Hulse, 1993). They sat or stood with the back at the piano (e.g. Brady, 1970; Lockhead & Byrd, 1981). Their standing or sitting postures would not allow them to see the keyboard or examiners' movements.

Subjects responded to one test tone after another. No feedback was given. Judgements had to be immediate. No answers were accepted after test tones were completed more than three seconds (Marvin & Brinkman, 2000). Subjects responded by naming note and octave designations (e.g. Miller, 1989; Miller & Clausen, 1997), pointing at keys of the keyboard chart on the answer sheet (Petran, 1932; Wedell, 1934), or writing note and octave names on answer sheets (e.g. Tervaniemi et al, 1993; Crummer et al, 1994). If subjects' abilities were too low to write down answers, parents or instructors would do it for them. In the answer sheet, there was the "Name Chart of Letter Names and Sol-fah Names" to remind new, young and SEN subjects on identifying letter or sol-fah names. Whenever they wrote answers, examiners would check whether the answers were in right blanks or boxes. Examiners would call out item numbers clearly too. After each written answer, subjects had to say something like: "It is done. I am ready for the next one, please!" The instructor might respond by saying something like: "Fine! The next one is….." and so on.

Since subjects took the assessments at different time, there was always a chance that they would share answers with each other. Three groups of items were arranged to eliminate this possibility. The items of the second group were No. 11 to No. 50 and No.1 to 10 of group one. The third group started at No.31 to No.50 and then from No.1 to No.30. Subjects were told that there were several groups of questions. Only one group would be selected randomly. They were told that they should not discuss answers with others. In fact, most subjects were not acquainted with each other. They came for individual classes at different time. They did not even know who had joined the project.

AP achievement may be influenced by attention, fatigue, illness, depression or stress (Sergeant, 1969; Wynn, 1971, 1972). To control for this, subjects were not permitted to take the test if they were inattentive, hungry, emotionally disturbing, fatigue, anxious or ill. On the other hand, they could take it in several sessions instead one if they had a short attention span.

Two methods of scoring were utilised. One counted octave errors as mistakes (Klein et al, 1984; Tervaniemi et al, 1993) and the other did not do this (e.g. Wayman et al, 1992; Crummer et al, 1994). The first score was to count answers with right note names and right octave designations for two marks each and with right note names and wrong octave designations for one mark each. The second score was to count answers with right note names regardless of octave errors for two marks each. The passing mark was 60% if octave errors were ignored (e.g. Klein et al, 1984; Miyazaki, 1993) or 50% if the octave errors were counted (Klein et al, 1984). The scores with octave errors counted were mainly used in the statistics.

4.10. The "Comment of Student's Response on AP Assessment" was designed to record subjects' AP judgment. After subjects had completed the AP test, instructors evaluated whether they judged tones certainly, immediately or with AP. If subjects were inattentive, moving around, playing games, emotionally unstable and so forth, instructors had to mark it down.

4.11. The "Questionnaire of Student's Background on Developing AP" was designed to get information from subjects to analyze the phenomena of AP. Most of them related to possible background factors on the development of AP. It was completed by examiners under interviews. The questionnaire was concerned with: a) personal data of name, age, sex, category of educational needs, language background, tinnitus, chromesthesia, age of onset and piano standard; b) the tuning of pianos; c) pitch

identifications; d) music participation at and outside MusH; e) information on the time and solfège singing in the piano practice, pitch identification, music listening, sight-playing, playing the piano from memory, singing, sight-singing, composing, conducting and learning music theory; and f) how AP helped subjects learn to play the piano, identify tones, listen to music, sight-play, play the piano from memory, sing, sight-sing, compose, conduct and learn music theory.

4.12. The Grand Piano Room was a quiet room without interruption. A quiet room is good enough for the AP tests (e.g. Marvin & Brinkman, 2000; Lenhoff et al, 2001). It was 19 feet by 22 feet. The grand piano was fixed at the left corner of the room. Opposite to the grand piano was another upright piano. They were facing to each other with seven feet apart. In front of the upright piano were placed a table and two chairs. Subjects sat at the table with their backs against the grand piano. Parents sat at either side of the table.

4.13. The Yamaha C2 Grand Piano was good for the AP test since the piano was commonly used to produce test tones in AP tests (e.g. Pantev et al, 1998; Lenhoff et al, 2001). It was brought in brand-new form six years before the study. It was tuned and inspected once to ensure that it was in tune and in a proper condition.

4.14. The "Comment of AP Acquisition Project was designed to gather opinions about the whole study from instructors, administrators, parents and subjects.

4.15. Coda

The main experiment was conducted from 26th December 2001 to 4th February 2002.

CHAPTER FIVE: THE RESEARCH METHOD

5.1. Introduction

This study was a single case study design which incorporated a one-group-pretest-post-test quasi-experiment.

5.2. Sample

There were 173 students at MusH at the time of the experiment. Out of these there were 154 piano students. All piano students were invited to join the project except for four MS because they could recognize one to three tones in the AP test at admittance. Only subjects without AP were recruited (e.g. Cuddy, 1968, 1970, 1971; Heller & Auerbach, 1972). Out of the 150 piano students, 144 (96%) joined in the research, including three (2%) AT, 103 (68.7%) MS and 38 (25.3%) SEN. Of the SEN, there were one (0.7%) mild MR, 14 (9.7%) autistic, five (3.5%) EBD, three (2.1%) SD, seven LD (4.8%), three (2.8%) moderate HI, one (0.7%) severe HI and one (0.7%) asthma subjects. The AT subjects were those who had an I.Q. of 130 or over in the Hong Kong Wechsler Intelligence Scale for Children-Cantonese Version (Hong Kong Government, 1981). Subjects from the MS were those who were studying in MS schools and

had no reports from doctors, psychologists, psychiatrists or therapists certifying either the SEN or AT. SEN subjects included the MR, autistic, EBD, LD, SD, SID and HI who had certified medical reports.

5.3. Administrators

There were two administrators assisting the researcher to follow up the administration. They were administrative staff at MusH.

5.4. Piano Instructors

There were seven piano instructors responsible for assessing and interviewing other instructors' students. They were initially the piano instructors employed at MusH. They were qualified piano teachers in Hong Kong. They were trained to use LCK MusET to teach the piano at the time when they were employed. Before this study, they were trained in the methods of conducting the AP training, assessment, interview and observing subjects' feedback. They were examiners and interviewers too in the study.

5.5. Piano Tuner

Subjects were advised to have their pianos tuned by the contracted piano tuner of MusH. He was responsible for tuning the pianos at MusH too. He was a qualified piano tuner and had 35 years of experience in tuning pianos. He could tune all the piano tones in tune.

CHAPTER SIX: THE RESULTS AND DISCUSSION

6.1. The Introduction

As Mull (1925) and Ward (1999) have suggested, most of the mystery surrounding AP can be revealed if a method is discovered to train average individuals to develop AP successfully. From the findings of this research, LCK MusET appears to be the one.

6.2. LCK MusET Helps to Develop AP

None of the 144 subjects could identify a tone in the pretest. In the post-test, 122 subjects (84.7%) achieved AP1-10. Out of them, 64 attained AP5-10. All except one reported using AP solely in the post-test. One 23-year-old student, learning the piano for three months, reported using both AP and RP. All subjects' responses were made within three seconds after one-second test tones. All examiners reported that subjects gave accurate answers immediately and certainly, and used AP. Therefore, all AP1-10 subjects were AP possessors, including the 23-year-old student.

Subjects might develop AP through music activities outside MusH. From 144 subjects, only one AP 10 and one AP7 reported that playing the violin, flute and in the orchestra helped them to develop AP because they had to tune instruments. Tuning instruments may help one to develop an internal reference tone, but not AP as an overall ability (Bachem, 1937, 1955; Costall, 1985). From the researcher's observation, it seems that the AP developed at MusH helped them to tune and play instruments instead of vice versa. In the pretest, only four (2.6%) out 154 piano students possessed small degrees of AP. The prevalence rate and the accuracy were low. Furthermore, no subject reported that there was any institution

or activity teaching them AP or employing AP as a medium of instruction or tone acquisition. In kindergartens, primary and secondary schools of Hong Kong, RP is widely exercised. AP would only be suppressed under the RP environment (Crozier, 1997). In naming five factors to develop AP, no subject indicated that their AP was being learnt somewhere outside MusH. The data support the idea that the music environment in Hong Kong does not favour AP growth. Subjects can hardly develop AP outside MusH.

Concerning the effect of music activities at MusH in developing AP, five (0.7%) responses from 757 responses of 144 subjects indicated “No”. Three (0.4%) replied “Not Sure”. Others (98.9%) reported “Yes”. In fact, those saying no or unsure in one activity said yes in other activities. All subjects agreed to that the music activities at MusH helped them to develop AP. In naming five factors to develop AP, 122 AP1-10 stated, in order of importance, singing solfège in practising the piano (N=119, 97.5%), practising the piano without singing solfège (N=94, 77.1%), listening to music (N=51, 41.8%), playing the piano from memory (N=49, 40.2%), sight-singing (N=43, 35.3%), singing (N=34, 27.9%), sight-playing (N=29, 23.8%), practising the tone identification (N=14, 11.5%), learning music theory (N=6, 4.9%), composing (N=3, 2.5%) and conducting (N=2, 1.6%) as influencing factors. The activities of LCK MusET are reported to be the media that enable subjects to develop AP.

There were 22 (15.3%) AP0s, including seven SEN (49%) and 15 (10.4%) MS children. Except for four (2.8%) students, all (N=18, 12.5%) got 1.14% to 9.09% marks in the post-test. They made one to six right judgements. They were advised not to guess in the test. They were not good at guessing due to their young ages and /or disabilities. Their answers might not be by chance. Comparing to the zero score in the pretest, these results indicate that their AP was improving. They were in fact starting to acquire AP. Out of them, 17 (11.8%) subjects reported employing AP in the post-test, while 12 (8.3%) were observed by examiners to use AP. Even though they failed to attain AP1, they (N=18) had started to develop AP. They were new and/or did not follow LCK MusET to learn music. They needed a longer time to attain AP1 or higher.

6.2.1. Factors Affecting AP Development under LCK MusET

6.2.1.1. Tone and Absolute Solfège with Octave Designations Association

AP development depends on how successfully one anchors labels to tones (Miyazaki, 1988; Levitin, 1998). A fixed solfège system is crucial (Ward, 1999). Under the note naming system of LCK MusET, each note is associated to an independent sol-fah name and octave designation. Absolute tones can be reinforced with the AP naming. It is even more effective when students still centre on parts rather than on the relativity of music (Takeuchi and Hulse, 1993).

Another criterion is the exposure to tones. The more one exposes oneself to music, the better one can develop AP (Miyazaki, 1989, 1990; Simpson & Huron, 1994). The absolute solfège singing was employed in all music activities. Out of 144 subjects, 136 (94.4%) sang or thought of tones in practising the piano. They got significantly higher post-test scores than those who did not ($F=11.12$, $df=1, 141$, $p=.001$, 2-tailed). Logically, subjects who spent more time practising the piano got significantly higher mean post-test score than those who spent less ($rho=.571$, $df=138$, $p=.000$, 2-tailed). Eight (5.6%) AP0-2 did not sing or think of tones in the piano playing. Some (one AP1 and three AP2) might start to develop

AP because they would hear the demonstration in class and the recording of the demonstration with solfège singing from their instructors. They would sing and think of tones in other music occasions. They could still learn the tone naming and develop AP even though their AP achievement was significantly lower.

Students sang or thought of tones in 85.64% of the activities attended (63.99%), including playing the piano, playing the piano from memory, sight-playing, singing, sight-singing, music listening, composition, conducting and learning music theory. They used AP in 99.11% of the occasions. It was found that the more they sang and thought of absolute solfège in music activities, the higher would be their AP achievement (rho=.744, df=142, p=.000, 2-tailed).

LCK MusET makes AP dominant over RP. Even though under the use of RP in schools and music functions in the society widely, students keep using AP as the main tonal recognition and communicative strategy. The method is successful to make students develop AP ultimately. Therefore, the approach of associating tones to absolute solfège and developing the association through singing and thinking of tones in their absolute sense is one of the factors in developing AP.

6.2.1.2. Accurate Tuning

Tuning affects the AP identification (Vernon, 1942a, b). Musicians getting used to different tunings may identify tones tuned to A440 one semitone higher or lower (Petran, 1932; Bachem, 1937; Ward, 1963). In this study, from 140 subjects who practised the piano in the piano learning, five (3.6%) subjects reported their pianos being out of tune. Two were AP0, one was AP1, one was AP2 and one was AP6. After examining their pianos, the piano tuner found that the tones of the pianos of the AP0-2 were out of tune due to the lack of tuning for a long time. Some tones of the AP6's piano were only slightly lower. Her AP was so keen that she could discriminate minute tonal differences. Anyway, subjects claming to have the inaccurate piano tuning got a significantly lower mean score in the post-test than those claiming to have in-tuned pianos (F=4.08, df=2, 141, p=.019). Accurate piano tuning therefore seems to be a significant factor in developing AP. In naming five factors to develop AP, 79.3% (N=111) of the subjects were of the view that in-tuned pianos were helpful. That the accurate tuning is crucial in developing AP was supported further by their feedback.

6.2.1.3. Familiarity of Musical Tones

AP depends on familiarity (Baharloo et al, 1998, 2000; Stary, 2002). The first related criterion is the duration of playing the piano. In this study, it was found that there were significant differences among the mean AP scores of subjects playing the piano for different durations (F=10.51, df=13, 130, p=.000). The mean score of the subjects learning the piano less than a year was the lowest and it was significantly lower than those learning one to eight years (p=.000). Moreover, the AP achievement was found to be positively and highly correlated to the years of playing the piano (rho=.068, df=142, p=.000, 2-tailed). The subjects playing the piano for one to two months got the lowest mean score of 16.21%, whereas the subjects playing the piano for seven to eight years got the highest mean score of 87.27%. The longer the time students play the piano, the better are their AP achievement. As mentioned above, the subjects who spent more time practising the piano got significantly higher scores than those who spent less. The more they used AP to sing and think of tones in music activities, the higher would be their AP achievement

(rho=.74, df=142, p=.000, 2-tailed). The findings proved that AP depends on familiarity of tones.

Another influence is the familiarity of timbre (Hantz et al, 1997; Marvin & Brinkman, 2000). However, Bachem (1937) and Sergeant (1969) found no timbre influence. Miyazaki (1989) found the timbral familiarity an auxiliary rather than a determining factor. In the present study, only four (2.8%) subjects practised the electronic piano in learning the piano. The subjects practising the piano (N=140, 97.2%) got a significantly higher mean post-test score than those practising the electronic piano (t=2.04, df=142, p=.043, 2-tailed). Undoubtedly, the longer the time they used the piano to practise, the higher would be their AP scores (rho=.57, df=138, p=.000, 2-tailed). Moreover, one AP5 trumpet player commented that the trumpet tones hindered him from identifying piano tones. These findings are consistent with the notion that the timbre familiarity exists in the AP judgment. Since there were two AP2s practising the electronic piano, the timbral familiarity appears to be an auxiliary rather than a determining factor.

Even though piano tones are believed to be the easiest tones to recognize among all instrumental tones (Miyazaki, 1989; Marvin & Brinkman, 2000), AP is not more prevalent among piano students. Under LCK MusET, nearly all students possess AP except new students and those fail to follow LCK MusET to learn music. A high exposure to piano music is another factor. There are 12 books or 12 sets of books in each grade of the piano syllabus. As they proceed, students encounter more different tones. Through playing and singing tones, they get more familiar with tones and their associations to absolute solfège. Under sufficient tone-label perceptual input, AP grows. The tonal familiarity is thus another crucial factor in developing AP.

6.2.1.4. Interest for Piano Playing

Some AP musicians and musical savants liked music or liked to play instruments (Charness, Clifton, & MacDonald, 1988; Mottron et al, 1999). The interest in music may be associated with AP development. In this study, 12 (8.3%) subjects had no or little interest in playing the piano. Others (N=132, 91.7%) had moderate to very great interest. The differences of mean AP scores were significant among groups of different levels of interest (F=4.03, df=4, 139, p=.004). Those with little interest (N=10, 6.9%) had significantly lower scores than other groups. And subjects' interest in playing the piano was positively correlated to their AP achievement (rho=.25, df=142, p=.003). The more interest students have in playing the piano, the higher will be their AP achievement.

Promoting students' interest for music and the piano performance is one of the tasks in LCK MusET. The basic strategy is to promote students' sense of achievement in playing the piano. They are more likely to develop interest if they can play the piano well. They should have enough studies, exercises and repertoire to build up piano technique gradually. Pieces with beautiful melodies are selected, so as to make them enjoy music when they practise the piano. Public concerts are organized each year for students to enhance their sense of achievement. Children are accompanied with parents or maids in learning the piano. They can help their children to solve elementary problems at home and read music stories to them. CDs of favourite classical music and songs for children were played for enjoyment or as background music at home. They are free to join activities such as ensemble playing, sight-playing, singing, sight-singing, composing, conducting, music listening, tone identification and music theory. Piano instructors are always trained to give encouragement to students.

6.2.1.5. Influence of Attention on Accuracy

AP achievement is influenced by attention (Boggs, 1907; Bachem, 1940), illness, fatigue (Sergeant, 1969), anxiety and stress (Wynn, 1971, 1972). In taking the AP test, children may not possess sufficient attention. They treated the test as games. They would play, run, chat, jump, swing, stand here and there, laugh or cry during the test. Twenty-four (16.7%) and one (0.7%) subjects were reported to have severe attention and stress problems respectively. Three were MS and 22 were SEN. They got a significantly lower mean post-test score than those without such behaviour (t=-2.10, df=142, p=.038, 2-tailed). Attention influences the AP achievement.

6.2.2. Factors Not Affecting AP Development

6.2.2.1. Sex Difference

Stumpf (1883, 1890, cited in Petran, 1932), Valentiner (1913, cited in Révész, 1953) and Welch (1988) found more men than women having AP. Profita and Bidder (1988) found that more women than men had. But Petran (1932), Sergeant (1969) and Baharloo et al (1998) found no sex difference. The present study supports no gender difference. There were 34 (53.1%) boys and 30 (46.9%) girls attaining to AP5-10. The number of boys who successfully acquired AP was not significantly more than that for girls (X^2=.25, df=1, p>.05). The mean post-test score of girls was not significantly higher than that of boys (t=.55, df=62, p>.05, 2-tailed). It seems that either sex can develop AP equally well under LCK MusET.

6.2.2.2. Aptitude Difference

Even hereditary theorists (Gregersen et al, 2001; Stary, 2002) believed that AP depends on music ability. AP is rare in musicians (Burns & Campbell, 1994; Dowling, 1999). It is rarer in the ordinary population (Gregersen, 1998; Heaton et al, 1999). It is even rarer in the SEN (Hill, 1977) except in the autistic (e.g. Young & Nettbeleck, 1995; Heaton et al, 1998), blind (e.g. Welch, 1988; J.T., 2000), Williams syndrome (Lenhoff et al, 2001) or musical savants (Miller, 1989; Heaton et al, 1998). However, AP seems independent of intelligence to Heaton et al (1998). Shuter-Dyson and Gabriel (1981) queried whether the music aptitude influences the AP development.

In the present study, 28.6% to 100% of those attaining to AP5-10 were either AT, MS, autistic, EBD, LD, SID, moderate HI, severe HI or asthma subjects. In the SEN, only one mild MR and three SD subjects failed to develop to AP5 because they were new. They came to MusH for one to six months and were still in the preparatory grade. For the AP1-10, 66.7% to 100% were either AT, MS, autistic, EBD, SD, LD, SID, moderate HI, severe HI or asthma subjects. In the SEN, only the one mild MR subject failed to do so since he was a new student in the preparatory grade. Different SEN students possess different types and levels of attention, learning, behavioural and perceptual difficulties. They could develop AP and did not get a significantly lower mean post-test score than the MS (F=2.34, df=2, 141, p>.05, 2-tailed). All the three AT, 41.7% (N=43) of MS and 47.4% (N=18) of SEN were able to attain to AP5-10. The percentages of MS and SEN were similar. The differences of the mean post-test scores of these three groups were non-significant (F=.97, df=2, 61, p>.05). Therefore, AP is independent from aptitude. The findings are consistent with those proposed by Heaton et al (1998).

6.2.2.3. Age of Onset

AP musicians usually started music training at six years old or younger (Gregersen et al, 1999, Brown et al, 2003). Some started from seven to nine (Benguerel & Westdal, 1991; Gregersen et al, 1999). Few started between 10 and 16 (Takeuchi & Hulse, 1991). The older the mean age, the lesser would be the number of AP possessors (Sergeant, 1969). After childhood, it was difficult to learn (Cuddy, 1968). AP would disappear after 12 years of age (Sergeant and Roche, 1973).

The 144 subjects in this study started to learn to play the piano from the age of two to 23. Their differences in the mean post-test scores were found non-significant ($F=.68$, $df==10, 133$, $p>.05$). Of 122 Ap1-10 subjects, their age of commencing piano playing was negatively correlated to their AP achievement ($r=-.18$, $df=120$, $p=.000$). Of 64 AP5-10, The AP achievement was negatively associated with the age of onset with a low and non-significant correlation too ($rho=-.102$, $df=62$, $p>.05$). The AP5-10 subjects were regrouped to two groups, i.e. one at two to six years of age and another seven to 23. It was found that students commencing piano playing at the age of two to six did not attain a significantly higher mean score than those commencing at seven to 23 ($t=1.35$, $df=62$, $p>.05$, 2-tailed). The findings did not support the early music training in the AP development. The age of onset is not a determining factor. The findings support the Learning Theory that AP can be acquired at any age through proper training (Brady, 1970; Corliss, 1973; Eaton & Eaton, 1976). Persons of any age can possess AP under LCK MusET, at least before the onset age of 23.

6.2.2.4. Language Background

Meyer (1970, cited in Petran, 1932) insisted that AP could be developed better in primitive people, but his viewpoint was objected to by Stumpf (1911, cited in Petran, 1932). Gregersen, et al (1999) speculated a higher prevalence of AP genes in Asian populations. Deutsch (1999) proposed that speakers of tonal languages were more likely to develop AP than those of phonetic languages. However, this has been contested by Ladd (1999), Lawton (1999), Hall (1999) and Zatorre (2003). In this study, four (2.8%) subjects spoke English while others ($N=140$, 97.2%) spoke Cantonese which is a tonal language. Results showed that the English speaking subjects achieved a higher mean post-test score than that of the Cantonese speaking subjects though the difference was non-significant ($t=-.49$, $df=142$, $p>.05$, 2-tailed). The language background is not an influencing factor in the AP development. Persons with or without the tonal language background can acquire AP under LCK MusET.

6.2.2.5. Acute Memory for AP

There has been a supposition that AP is developed from an acute memory for pitch (Pollack, 1952; Oakes, 1955). In this study, 122 (84.7%) students achieved AP1-10. Eighteen (12.5%) got scores of 1.14% to 9.09%. Only four (2.8%) new subjects did not get any marks. The proposition that AP is developed from the acute memory for pitch can be ruled out. Ordinary individuals with different levels of memory ability can develop AP under LCK MusET. AP is a successful transfer of tones from the short-term to long-term memory (Tervaniemi et al, 1993; Crummer, et al, 1994). It can be done by every student under LCK MusET. The widespread use of AP in all music activities, the habitual singing and thinking of tones in practising the piano, and the frequent listening to recordings of piano music with solfège singing and to CDs of classical music are the media. Through the frequent active rehearsal and exposure to tones,

ordinary individuals can store AP in the long-term memory successfully, as the frequent rehearsal process suggested by Atkinson & Shiffrin (1977) and the active rehearsal process proposed by Bekerian and Baddeley (1980) in transferring information from the short-term to the long-term memory.

6.2.2.6. Auditory Hypersensitivity

There has been a belief that AP can be developed if people have a super auditory sensitivity to sound. Boggs (1907) and Watt (1917) believed that AP possessors have an exceptionally refined hearing for tones. Bachem (1940) found musicians having AP declining with deafness. Profita and Bidder (1988) suggested a hypothesis of the auditory hypersensitivity to explain AP development. Anastasi et al (1960) and Mottron et al (1999) used this theory to explain the trait in autistic persons. Wayman et al (1992) found that AP persons have an extraordinary auditory sensitivity at the cortex. However, Sergeant (1969) did not find his AP subjects had greater hearing acuity than the non-AP in the audiometric measurement. On the contrary, the average hearing loss of AP subjects was even higher than that of the non-AP. Fujisaki and Kashino (2002) did not find AP persons possess particularly sensitive or "good ears" (p.83) for frequency, temporal and spatial resolutions either.

In this study, the prevalence rates of the auditory hypersensitive (autistic) subjects were 0.2% and 15.8% lower than that of the normal hearing (AT and MS) subjects in AP1-10 and AP5-10 groups respectively. Despite the hearing loss from 25dBHL to 75dBHL, one HI was AP1-4 and three were AP5-10. The prevalence rate was 30.6% and 46.4% in AP5-10, and 14.1% and 14.3% in AP1-10 higher than those of the normal hearing and auditory hypersensitive subjects respectively. The mean score of the HI was the highest (M=50.85, SD=28.57). The second highest was that of the normal hearing (M=43.86, SD=27.93). The lowest belonged to that of the auditory hypersensitive group (M=32.55, SD=20.72). But those differences were non-significant ($F=1.25$, $df=2, 121$, $p>.05$). Auditory hypersensitivity is not a factor in developing AP. The present findings showed that auditory hypersensitive, HI and normal hearing persons can develop AP equally well. Under LCK MusET, all students are directed to develop auditory awareness to music through singing solfège and listening to music frequently in the everyday piano practice and music listening. The inborn auditory hypersensitivity is not a factor of developing AP. All students with different levels of auditory sensitivity can develop AP under LCK MusET.

6.2.2.7. Pitch Identification Practice

There is a belief that AP development and pitch accuracy depend on how much one practises the pitch identification (Eaton & Siegel, 1976; Crozier, 1997). Miyazaki (1992) suggested that ear training is sufficient to develop AP. However, Levitin (1998) and Levitin and Zatorre (2003) argued that the ear training emphasizes RP instead of AP. AP can only be developed from the systematic training in pitch and labeling tasks. In the present study, out of 144 subjects, 16 (11.1%) practised pitch identification and 128 (88.9%) did not. Subjects practising the pitch identification did not get a significantly higher mean post-test score than those without ($t=.96$, $df=142$, $p>.05$, 2-tailed). Even though more AP5-10 subjects (N=10, 6.9%) practised pitch identification than the AP0-4 (N=6, 4.2%), AP5-10 subjects practising the pitch identification did not get a significantly higher mean AP score than those without either ($t=.73$, $df=62$, $p=>.05$, 2-tailed). Surprisingly, it was found that the pitch identification practice exerts no determining influence on AP development. Students may make improvement in the AP achievement

through the pitch identification training. Students without practising the pitch identification can develop AP too. It is through singing and thinking of absolute solfège in general music activities instead of the deliberate training in tonal and labeling tasks, students develop AP.

6.2.2.8. Inheritance

The etiology of AP has been an argument among researchers for more than a century (Wedell, 1934; Ward, 1999). The main query lies on whether AP is genetically inherent to a few or a universal potential to ordinary individuals. In this study, nearly all subjects possessed AP or started to possess AP, except new students and those not following LCK MusET to learn music. Nobody reported that their family members were professional musicians or had a music level up to a professional standard. None of their parents or grandparents was reported to possess AP. All their 17 brothers and sisters with AP were students or ex-students of MusH. Further, in naming five factors to develop AP, no subject claimed that their AP was from inheritance. The possibility that AP has a genetic factor may be ruled out. AP should be an innate potential to all. The finding is consistent with Takeuchi's and Hulse's (1993) postulation that "everyone initially has the potential to acquire AP" (p.357), Levitin's (1994) proposition that "everybody does have AP to some extent" (p.414) and AP is "widespread in general population" (p.415), and Saffran's and Griepentrog's (2001) proposition that infants may be born with AP.

6.2.2.9. Tinnitus

Stanaway et al (1970) found no correlation between the AP judgment and tinnitus. But Costall (1985) reported musicians' feedback that tinnitus was used as anchors. In this study, there was no evidence that any of the subjects suffered from tinnitus. In naming five factors to develop AP, no one claimed comparing tones to the ear ringing sound as one of the factors. This study therefore is unable to shed any light on this possible association.

6.2.2.10. Chromesthesia

Some AP possessors had chromesthesia before AP (Vernon, 1977). Some AP persons related tones to colours (Petran, 1932; Costall, 1985). There is a query whether AP can be developed from chromesthesia. In this study, no subject reported having chromesthesia. No one claimed that AP was developed from chromesthesia. This study has been unable to show any evidence supporting the claim that AP may be correlated with chromesthesia.

6.2.3. Correlation of Age, Age of Commencing Piano Playing, Duration of Playing Piano, Piano Standard, Time for Practising Piano and Frequencies of Using AP to AP Achievement under LCK MusET

Concerning the 122 AP1-10 subjects, the multiple correlation coefficient (R=.630) showed that the subjects' age, age of commencing piano playing, duration of playing the piano, latest piano grades, time for practising the piano and frequency of using AP were predictor variables of the AP achievement. The effect size, R=.6, was great (Cohen, 1988). The ANOVA table showed the similar result that these six variables were significant predictors (F=32.69, df=6, 115, p=.000).

The regression coefficient table showed that the AP1-10 subjects' latest piano grades (t=3.88, p=.000),

frequency of using AP in music activities (t=2.85, p=.005), time for practising the piano (t=2.86, p=.005), duration of playing the piano (t=2.23, p=.027) and age (t=-2.11, p=.037) were significant predictor variables of AP attainment. All were positively correlated to AP attainment except age. Age of commencing piano playing was not correlated (t=1.37, p>.05). This implies that the higher their piano grades, the more time they spend on practising the piano, the more frequently they use AP in music activities, the more time they play the piano, the younger their age, the higher will be their AP scores.

6.2.4. Codetta

Conclusively, the activities in LCK MusET, such as associating tones to absolute solfège, the accurate piano tuning, using AP in playing the piano, playing the piano from memory, sight-playing, singing, sight-singing, music listening, composing, conducting and learning music theory are determining factors of AP. Other influencing factors are the duration, piano standard, interest of playing the piano and attention. Other criteria, such as the gender, aptitude, age of onset, tonal language background, acute memory for pitch, auditory sensitivity, pitch identification training, inheritance, tinnitus and chromesthesia are not shown to be important factors. Thus, LCK MusET is an effective instructional method enabling students to develop AP.

6.3. Time and Grades Needed to Develop AP under LCK MusET

6.3.1. Time Needed to Develop AP

AP persons usually recognize the trait at their early music experiences (Profita & Bidder, 1988; Tervaniemi et al, 1993). AP reveals when they learn the musical scale and naming (Bachem, 1940, 1955; Hall, 2002; Shiel, 2002). In this study, from the 17 (11.8%) subjects having played the piano for one to two months, nine (52.9%) subjects attained to AP1 or higher, with a mean AP score of 16.21%. One could get as high as AP7. All other subjects playing the piano longer than this period got mean scores even higher than this, ranging from 18.32% (SD=12.47) at 9-10 months to 92.61% at seven years. The longer they played the piano, the higher AP scores they would get (rho=.68, df=142, p=.000, 2-tailed). So, students can start to develop AP in as little as one to two months of learning the piano.

From the 122 AP1-10 subjects' feedback, 8.2% (N=10) of AP1-4 and 10.65% (N=13) of AP5-10 reported that their AP revealed within one to two months of their piano tuitions. The shorter the time AP revealed, the higher would be their post-test scores (rho=-.17, df=120, p=.30, 1-tailed). Their reports supported the experimental finding. A short development time signifies that AP starts to develop within a short period of time. If the tone-absolute solfège input is strong, the development time will be short. If the AP input is kept up, AP grows to a higher level of attainment, like the acquisition of a skill (Annett, 1989).

The students who played the piano for two years got AP5 (with a mean AP score of 55.03% and a maximum of 92.61%). The students playing the piano for longer than two years were able to get better AP attainments. They reached AP8 or AP9 (maximum AP9 or AP10 respectively) when they played the piano for seven to eight years.

The findings support the research from Bachem (1940, 1955), Profita and Bidder (1988) and Tervaniemi et al (1993) that some AP persons notice their AP in their early experiences of learning tones and naming. But this study supplies more concrete data. Students may notice their AP through identifying one or few tones

successfully. This signifies that AP starts to grow. That AP can be developed in a short time implies that AP is an innate potential. It starts to flourish under the circumstances that the tonal-labeling input is strong enough. The LCK MusET is an appropriate method to facilitate the development.

6.3.2. Piano Standard Needed to Develop AP

AP can be developed during AP musicians' early musical experiences (Profita & Bidder 1988; Tervaniemi et al, 1993). Students in this study were able to develop AP at the preparatory grade. From 60 (41.7%) preparatory grade students, 33 (55%) were AP1-4 and six (10%) were AP5-7, with a mean of AP2. Students higher than this grade got a mean of AP4 or higher. As their piano standards move up, their AP achievement would improve (rho=.79, df=142, p=.000). Students got AP5 or higher (maximum AP8) at grade three (with a mean AP score of 67.57%). The students higher than this grade were able to obtain an even better AP achievement, a mean of AP8 (maximum AP9 or AP10) at grade seven and higher. Conclusively, students' AP starts to develop in the beginning of their piano learning under a saturated music environment with the tonal-label association. Once the trait is developed, it starts to grow. Students can attain to AP5 or higher in grade three. When their piano standards move up, they can attain even higher levels of AP.

6.4. Processing of AP under LCK MusET

6.4.1. Encoding Strategies of AP

There has been some disagreement on how AP persons perceive and process AP (Ward, 1999; Macpherson, 2000). From the 110 responses of 64 AP5-10s, it was known that the main strategy (55.5%) is to associate tones to sol-fah names. It is the only approach taught in LCK MusET. The next one is to identify tones naturally without noticing how (25.5%). Most students are young. They may be unaware of how they identify tones. The third strategy is to associate tones to letter names (10%). Letter names are taught as a secondary medium to label tones. To recognize tonal qualities is uncommon (5.4%). Tones have unique qualities. Students must have recognized them; otherwise they could not label them. They are too young to tell. To associate tones to the image of the keyboard (1.8%) and the stave (1.8%) are rare. Other methods, such as referring tones to an or many internal standards, ear ringing sounds, compositions, colours, scales, throat positions or words are not used. They are indirect and RP techniques. All subjects responded in the AP test by calling out sol-fah names. In the researcher's understanding, recognizing tonal qualities and comparing tones to internal standards are the verbal strategies of associating tones to sol-fah names. Concerning the AP5-10 group, 96.4% of the responses were verbal codes of associating tones to sol-fah and/or letter names, and only 3.6% were the pictorial codes of relating tones to the images of the keyboard and/or the stave. All of the AP1-4 subjects used the single strategy of the verbal code.

Almost all AP individuals (N=58, 100% in AP1-4 and N=61, 95.3% in AP5-10) used the single strategy of the verbal code and only three (4.7%) AP5-10 used the multiple strategies of verbal and pictorial codes. The finding is consistent with the supposition of Siegel (1972, 1974, 1977a, b), Siegel & Siegel (1972), Zakaay et al (1984), Takeuchi and Hulse (1993), Zatorre and Beckett (1989), Schlaug et al (1995), Nowak (1995), Marin and Perry (1999), and Ohnishi and Matsuda (2001) that AP possessors use mainly the single strategy of the verbal code. Only very few AP students (4.7%) use multiple strategies. Even though

the verbal encoding strategy was the main processing strategy, SD subjects did not get a significantly lower mean AP score than that of normal speech subjects (t=1.629, df=107, p>.05, 2-tailed). This is contrast to what Miller (1989) has suggested that musical savants with language problems are unlikely to make tonal-verbal association in the AP development.

One AP2 indicated that she compared tones to internal standards. She was an adult and had learnt to play the piano for only three to four months. She could not get rid of RP in such a short time. She used both AP and RP before developing true AP. No RP strategy was found in other students, even in new comers of primary or secondary students. All new students are trained to develop AP through the absoluteness of tones. No intervals or tonal relationship are taught in beginning levels. Absoluteness in tonal recognition can override relativity in the music study in schools and in the music learning outside MusH, so that every student can develop AP.

6.4.2. Identification Process of Note and Octave Designations

AP possessors usually identify tone names and then octave designations in a two-way process (Miyazaki, 1989; Takeuchi & Hulse, 1993). Half of the AP5-10 students, (50.81%) identified tone and octave names simultaneously. In another half (49.19%), they identified note names and then octave designations. The AP1-4 students demonstrated a similar process too with 53.55% identifying note and octave names simultaneously, and 44.76% in identifying note names before octave placements. Nearly all (N=61, 95.3%) AP5-10 subjects used both strategies of either identifying note names before octave designations or identifying note and octave designations simultaneously. Three (4.7%) used one technique of identifying note and octave names simultaneously. Most (N=45, 77.6%) AP1-4 subjects used both strategies. Nine (15.6%) identified note and octave names simultaneously.

The findings are different from what Miyazaki (1989) and Takeuchi and Hulse (1993) have found. The subjects in this study identified both note and octave names simultaneously and one after another for half of the cases respectively. It was observed that students recognize tone and octave names simultaneously in their familiar regions, i.e. the middle registers. It is beyond the middle registers that they recognize tone names and then octave designations. They are taught to recognize tone and octave designations as a whole tonal individuality. They manage both solfège and octave signs well.

It was further found that the AP1-10 subjects of two to six years of age identifying note and octave designations simultaneously got significantly higher mean AP scores than that of the seven to 25 (F=.45, df=1, 118, p=.037). As young children perceive tones with octave designations as a whole, they are inclined to name tones and octaves at the same time. As children get older, they develop a separate concept of tones and octaves. They learn to name tones and octaves in two separate stages. To identify familiar tones, they are inclined to recognize tones with octave designations in one process. These results showed that the approach of identifying tones and octave names simultaneously helps them to recognize tones more correctly.

6.5. Accuracy in Tonal Judgment

6.5.1. Accuracy of Tones with or without Octave Designations

Miyazaki (1990) found that G is the most correctly recognized tone, followed by C, A, D, E, F and other

black key notes. Miller and Clausen (1997) found the accuracy order for children is C, A, A#, E, D, C#, F, B, G#, D#, G and F#, and for adults is G, B, C, D, E, F, G#, F#, A, A, A#, D#, and C#. These lists ignore octave designations.

In this study concerning AP5-10 students, the middle C is the easiest note to judge among the 88 piano tones with right octave designations. The order of the first 13th notes is C_o, F_o, E_o, C^1, G_o, D_o, G_1, D_1, C^2, E^1, C_1 and C_2. The list includes mainly the white key notes in the middle region except C_2 and C^2. The first easiest 14th to 43rd notes are mainly white key tones of other registers. The $C\#_3$ is the most difficult tone to identify. The order of the 13th hardest tones to judge is $C\#_3$, Eb_3, B_4, Bb_4, Ab_3, $F\#_3$, Ab^3, E_3, $F\#^3$, $C\#^2$, Bb_3, Ab_2, and B_3. They are mainly the black key tones in the lowest register. The hardest 14th to 45th tones are mainly black key tones of other registers and some white key tones of the two extreme octaves.

Concerning the tonal judgment ignoring octave errors, the middle C is still the easiest to identify. The first 33rd easiest tones to identify are all white key tones within two octaves below and above middle C except $F\#_1$, and all Cs except C_3, the lowest C. The hardest tone to recognize is $C\#_3$, which still ranks the lowest in identifying tones with right octave designations. The most difficult eleven tones to judge are mainly the black key tones in the lowest register. The hardest 19th to 55th tones to identify are mainly black key tones of other registers and some white key tones in the two extreme regions.

Concerning the judgment of the 12 notes without octave designations, the order of tones from the most to the least familiar is C, G, A, D, B, F, E, Bb, F#, Eb, Ab, and C#. C and C#, like the tonal judgment with octave errors counted or ignored, are still the easiest and the hardest tones to identify respectively. The white key tones are apparently better judged than the black key tones. C is the easiest tone to judge, like the list for children by Miller and Clausen (1997). C# was found the hardest to judge in this and in Miller's and Clausen's (1997) list for adults. The white keys tones are apparently better judged than the black key tones in Miyazaki's (1990), Miller's and Clausen's (1997) and this studies.

In LCK MusET, middle C is the first tone to learn after a brief introduction of black key tones. C is logically the easiest tone to memorize. After the C, the order of accuracy is different in tonal judgments with or without octave placements. This is because 12 sets of piano books are employed. Each book has a different approach in the introduction of tones, even though all the books focus mainly on white key tones. Concerning the black key tones, the order from the most familiar to the least appears as F#, Bb, Eb, Ab and C# generally. This reflects the occurrence of these tones in the piano syllabus.

6.5.2. Accuracy of White and black Key Tones

It was commonly found that AP persons identify white key better than black key tones (Miyazaki, 1990; Takeuchi & Hulse, 1991; Miller & Clausen, 1997; Mottron et al, 1999; Ward, 1999). Miyazaki (1990) found the mean correct response to white key tones was 96.1% and to black key tones 89.2%. Takeuchi and Hulse (1991) found 90% and 75% correct for white and black key tones respectively. However, Marvin and Brinkman (2000) found no significant difference. Comparing the accuracy of judging the white and black key tones, subjects in this study had mean accurate tonal responses of 87.65% for white key tones and 65.28% for black key tones. The mean score for the white key notes was significantly higher than that of the black key tones ($t=10.78$, $df=63$, $p=.000$, 2-tailed). The findings are consistent with those stating the white key superiority mentioned above.

Under LCK MusET, piano instruction starts with learning black keys. It was thought that students could

identify the black key tones equally well as the white key tones. These results have shown differently. This may be because that the learning of black key tones in the early stages was insufficient as the white key tones appear far more than the black key tones in the western classical music (Takeuchi & Hulse, 1991; Simpson & Huron, 1994; Miller & Clausen, 1997). These findings further support the idea that students acquire AP through exposing themselves to music with the awareness to the tonal-verbal association rather than through the pitch identification training. Miyazaki (1988) and Takeuchi and Hulse (1991) employed the Early Learning Theory to explain the white key superiority. The researcher did not find support for this in this study.

6.5.3. Accuracy of Tones in Different Registers

It was commonly accepted that the tones in the middle region are the easiest to identify among all tones (Rakowski & Morawska-Bungeler, 1987; Miyazaki, 1989). It is the most familiar register to musicians. The highest and lowest extremes are the hardest to judge. Accuracy is particularly poor in the lowest rather than in the highest region (Corliss, 1973; Ohgushi & Hatoh, 1992). Comparing the accuracy of judging tones in different octaves of the AP5-10 subjects, the order of accuracy is C_o-B_o, C_1-B_1, C^1-B^1, C_2-B_2, C^2-B^2, C^3-B^3 and C_3-B_3. The middle register is the best identified region. The lowest and highest extreme regions are the hardest to identify. Concerning the accuracy of the lowest and the highest regions (A_4-A_3 and C^3-C^4), and the rest of the regions (Bb_3-B^3), their mean AP score in the lowest and highest regions was significantly lower than that of the other registers (t=12.90, df=63, p=.000, 2-tailed). These two extremes are the most difficult to identify. In these regions, the “tone chroma” disappears while only the “tone height” exists and it is difficult for one to recognize tones with the vague “tone chroma” (Bachem, 1955). The finding is consistent with those by Corliss (1973) and Ohgushi and Hatoh (1992).

Comparing only the accuracy of the lowest (A_4-A_3) and the highest (C^3-C^4) octaves, the AP5-10 subjects’ mean AP score of the lowest register was significantly lower than that of the highest one (t=-10.88, df=63, p=.000, 2-tailed). Students find it more difficult to identify tones in the lowest region than in the highest. The finding is consistent with the findings of Corliss (1973) and Ohgushi and Hatoh (1992).

Under LCK MusET, the piano books are arranged to contain music with tones spread over the entire piano range, at least not always consisting of tones in the middle region. In fact, not many piano method books fulfill this requirement. In the pitch identification training, the tones in all regions are practised, even though the training starts in the middle region. The piano tuner is asked to tune all the piano tones in tune. All students are encouraged to tune their pianos by this contracted piano tuner. Results showed that even though students can identify tones of all regions, the accuracy of the outer regions is still worse than that of the middle region. It is under the influence of the piano textbooks and western classical music that most music is composed in the middle region (Miyazaki, 1989).

6.5.4. Octave Errors

Octave errors are common in AP possessors (Demany & Armand, 1984; Miyazaki, 1989). In this study, the 59 (92.2%) AP5-10 subjects made one to 47 octave errors out of the 88 judgments. Five (7.8%) made no octave errors. There were 17.49% of answers with octave errors and 61% without. The percentage of octave errors is considered small (with a difference of 43.51%). Octave errors are unavoidable because the tones of the nearest octaves share common overtones (Bachem, 1955; Ward & Burns, 1982). With the

AP1-4 group, 14.36% of answers were with octave errors and 21.42% without, with a difference of 7.06%. The AP1-4 subjects had 36.45% more octave errors than the AP5-10. This showed that octave errors can be improved if AP improves.

Another cause for octave errors is the misapprehension or ignorance of octave designations. Most music students discriminate tones within an octave. Tones of other regions are identified like the ones in the same octave. Octave designations are neglected. There is no standardized system for musicians to assign octaves (Ward & Burns, 1982; Takeuchi & Hulse, 1993). In LCK MusET, note and octave names are taught simultaneously. Students are taught to judge tones with sol-fah and octave names simultaneously. Tones carrying the same sol-fah name in different octaves possess different tonal qualities actually. AP is the successful attempt of the tonal-solfège with the octave designation association. Even though AP students make octave errors, the situation is believed having been improved.

6.6. Investigation on Non-AP

There is still the question of why some people can develop AP while others cannot (Heaton et al, 1998; Zatorre et al, 1998). In this study, 22 subjects failed to develop to AP1 or higher at the time of the assessment. Twenty-one (95.5%) were associated with a combination of factors including: playing the piano at the beginning level (N=21, 95.5%), having attention deficit or short attention spans due to their age, learning difficulties or unstable emotions (including ten 2-3 year old children, 45.5%; seven SEN, 31.8%; and one MS, 4.6%), practising less than three hours a week (N=17, 77.3%), being new (N=15, 68.1%), having no or little interest in playing the piano (N=15, 68.2%), not singing solfège in practising the piano (N=4, 18.2%), playing out-of tuned pianos (N=2, 9.1%) and practising the electronic piano (N=2, 9.1%). One autistic subject, playing the piano for two years and attaining to grade two, failed to achieve to AP1 or higher because he had emotional and attention problems during the AP test. In fact, 18 AP0 got 1.14% to 9.09% marks in the AP test. They had made one to six right judgements. Compared g to the zero mark in the pretest, they actually started to develop AP. They might need longer time to achieve AP1 or higher.

6.7. Value of AP

It is universally accepted that AP helps to identify tones, intervals, chords and keys, to produce tones and tune instruments without a reference tones (Siegel & Siegel, 1977; Marvin & Brickman, 2000). Other values are arbitrary. Some considered it a disadvantage (Sundberg, 1991; Krieger, 1997) and some viewed it a valuable endowment (Brown, 1999; Ward, 1999).

6.7.1. Value in General Music Activities

From 122 AP1-10 subjects, 121 (99.2%) thought that AP was useful in learning music. Of participants in related activities, all commented that AP helped them to identify notes, play the piano, playing the piano from memory, sight-play, sing, listen to music and conduct. Nearly all participants reported that AP helped them to sight-sing (98.7%), learn music theory (98.6%) and compose music (90%). Fifty-three (43.4%) subjects had experiences in playing back music after hearing. A total of 79.2% (N=42) of them reported that they could do it if the music was within their piano standard. The advantages of AP are identifying tones, chords, keys and notes of different parts. They are consistent with the findings of

Révész (1953), Bachem (1954), Ward (1963), Miller (1989), Eppstein (1997), Siegel and Siegel (1977), Levitin (1998), Dowling (1999) and Marvin and Brickman (2000). That AP helps piano playing has been indicated by Collier (1983) and Slonimsky (1988). AP also helps one to memorize music. Music heard can be memorized and played back. This is consistent with the findings of Bachem (1955), Brown (1999) and Chang (2003). AP helps in sight-reading and score reading which is supported by Eaton and Siegel (1976), Miyazaki (1992, 1993) and Chang (2003). AP helps singing in tune and sight-singing according to Révész (1953), Eaton and Siegel (1976), Miyazaki (1995), Dowling (1999), Burns (1999) and Dickson (1999). Miyazaki (1992, 1993) and Brown (1999) have suggested that AP helps a person to notate and compose music. AP may even help a person to conduct music in tune. This is consistent with Révész's (1953) and Miyazaki's (1993) viewpoints. Furthermore, students pointed out that AP helps them to learn music theory too. From the researcher's experience, AP can help in the above-mentioned ways.

6.7.2. Fast Progress in Piano Performance

Grade three piano students (N=13, 10.7%), who practised the piano for a mean of five to six hours a week, took a mean of two years to achieve to this grade and passed the ABRSM grade three piano practical examination. Grade five students (N=4, 3.3%), who practised the piano for a mean of five to six hours a week, took a mean of three years to attain to this grade and passed the ABRSM grade five piano practical examination. Grade eight students (N=2, 1.6%), who practised the piano for a mean of three to four hours a week, took a mean of five years to advance to this grade and passed the ABRSM (N=1) or TCL (N=1) grade eight piano practical examination. Diploma students (N=7, 5.7%) who practised the piano for a mean of five to six hours a week, took a mean of five years to attain to this grade and passed either the DipABRSM (N=2), ATCL (N=1), or the ABRSM (N=3) or TCL (N=1) grade eight piano practical examination, ready for the DipABRSM or ATCL. They (N=26, 21.3%) started to play the piano at a mean of the preparatory grade.

Ericsson et al (1993) found that the best violin students of performance majors in the music conservatory spent a total of 10,000 hours in practising the instrument. The lower achieving students accumulated about half of that amount. In the present study, diploma students took five years to get the DipABRSM or ATCL or to be ready for them. These examinations are equivalent to the completion of year one of music majors at the university level. The students accumulated 1300 to 1560 hours practising the piano. They spent 3440 and 8440 hours less than those low and high achievers respectively to attain to the diploma level. Their progress was three to six times faster than that of other music students. They possessed AP with a mean score of 85.47%.

From the researcher's point of view, it appears that they benefited from AP. Under LCK MusET, AP is a medium in perceiving and memorizing piano music. From singing or thinking of absolute solfège, students get a fuller understanding of music expressions, tempo and rhythmic sense, not to mention the tonal and key relationships. They sing loudly and play loudly. They sing fast and play fast. They sing expressively and naturally play expressively. Through singing and playing, they develop a better awareness to tones and a better involvement with music. If they can identify tones at the early stage of learning, they will develop more interest and achievement in music. Their parents would be more eager to involve and invest their children into this field (Gregersen et al, 1999; Baharloo et al, 2000). Under LCK MusET, AP is not an independent ability, but an indispensable component in the music learning. With it

students seem to progress fast in learning to play the piano (Collier 1983, Hall 2002) and have high achievement in the piano performance (Slonimsky, 1988; Willet, 2001; Hamer, 2001).

6.7.3. Good Memory Ability in Piano Performance

Out of 107 subjects who had experiences in playing the piano from memory, over half of the students (N=71, 66.4%) reported that they could play the music from memory immediately after they had practised the music well with sight. These pieces of music are those in the piano syllabus, examination syllabus or competition repertoire. For those who could not play the music from memory at the first attempt, 55.6% (N=20) practised less than six times to memorize it. Most of them (N=83, 68%) could play one to three pages from memory in the first or first few attempts. Grade five students could memorize pieces of 10 to 12 pages. The long pieces were the piano sonatinas by Mozart, Beethoven, Clementi, Diabelli, Gurlitt, Kuhlau or Dussek. The grade eight or diploma students could play from memory pieces as long as 14 pages after they had practised the music well for two to three weeks. These pieces were from the repertoire of examinations, open competitions or the piano syllabus. They were sonatas or difficult long pieces by Handel, Haydn, Mozart, Beethoven, Schubert or Chopin. These processes were under the witness of the researcher and their parents. It was further found that the higher the students' piano grades, the longer the music they could memorize (X^2=137.55, df=36, p=.000, 2-sided), the more times they needed to memorize the music (X^2=70.53, df=45, p=.009, 2-sided) and the higher would be their AP achievement (r=.70, df=120, p=.000).

The memory that students develop is called the "video-camera-type-of-memory", the memory model named by the researcher. When they practise the piano, the notes are shot into the memory system like images through vision, and at the same time, the tones are recorded into the memory system like tape-recorders through singing and perceiving absolute solfège. They develop this kind of memory during the daily piano practice. In the whole process, AP is an inevitable agent.

Forty-two subjects had experiences in playing back music after hearing. A total of 79.2% of them reported that they could do this if the music was within their piano standard. Some of them played back in front of the researcher. This suggests that AP can help them to memorize and play back the music (Brown, 1999). This supports claims that AP can help musicians to develop excellent memory for music (Slonimsky, 1988; Krieger, 1997).

6.7.4. Defence for AP

Some investigators viewed AP as a disadvantage rather than a help (Krieger, 1997). Some claim that it is disturbing (Weinent, 1929, cited in Petran, 1932). It is a nuisance (Sundberg, 1991). AP possessors are weak in RP tasks (Burns & Ward, 1978; Burns & Campbell, 1994), find difficulty with unconventional scales (Cuddy, 1977) and feel confused in playing a piano with a different tuning (Planck, 1893). AP possessors may find it hard to transpose (Wallaschek, 1892, cited in Petran, 1932), may not be good in improvisation (Weinent, 1929 cited in Petran, 1932) and may sing out of tune (Abrams, 2001). AP composers may not compose better than the non-APs (Parncutt & Levitin, 1999). It does not help in aesthetics (Halpern, 1989; Miyazaki, 1992, 1995). It has no musical advantages (Davis, 1978). It is not essential to music (Dowling, 1999). It is not a condition for musical talent (Dickinson, 1999; Weinberger, 1999). Tonal relationship is what music is composed of. RP is essential in music instead of AP (Takeuchi

& Hulse, 1991; Miyazaki, 1995). So AP is not important as a musical ability except in identifying isolated tones, chords and keys.

Nevertheless, there is no doubt that AP helps in identifying tones (Ward, 1963; Macpherson, 2000), melodies (Petran, 1932), intervals (Miller, 1989; Levitin, 1998), tones of different voices (Eppstein, 1997), chords (Slonimsky, 1988; Marvin & Brickman, 2000), harmonic progressions, tonal relationship (Hantz et al, 1997; Siegel & Siegel, 1977) and key relationship (Révész, 1953; Dowling, 1999). The identification itself is a musical ability. Music listening, appreciation and analysis do not always have scores in hand or have referential tones. In extended pieces of music, skillful musicians may fail to trace out tones and lose tonal relationships. AP musicians may be weak in RP tasks, sing out of tune, not good at improvisation, transposing or composing and so forth. All these weakness may occur in RP musicians. RP musicians may not find these things easy to manage either. These are musical techniques which need extensive training. It is a matter of training rather than the obstacle from AP.

AP possessors feel upset in hearing music out of tuned or in different tunings. Out of tuned music should not exist. It is the responsibility of performers to play music in tune. APs should not be the ones to blame. If everyone had AP, all the music played would be in tune. If AP musicians feel difficulty in unconventional scales, the similar difficulty would be experienced by RP musicians. Concerning the music tuned differently from A440, there is not much music set in other tunings nowadays (Chang, 2003). The situation has been improved since the concert pitch of A440 has been set up.

Moreover, AP persons can manage both AP and RP properly (Miyazaki, 1993). There are numerous researchers reporting that AP musicians or AP possessors who possess exceptional music abilities. They can learn to play instruments at an early age (Slonimsky, 1988; Hall, 2002) and progress fast (Willet, 2001; Hamer, 2001; Hall 2002). They have excellent memory for tones, chords, melodies and music (Krieger, 1997; Willet, 2001). They can play back music just heard (Révész, 1925, 1953; Rutz, 1996), transcribe music (Krieger, 1997; Hamer, 2001) and analyze complicated chords from hearing (Révész, 1925, 1953). They can transpose and compose music at young age (Révész, 1953). They have high achievement in performance (Willet, 2001; Hamer, 2001), composition (Willet, 2001; Hamer, 2001) and improvisation (Collier, 1983; Slonimsky, 1988). Music savants with AP are able to do all the things mentioned above (Minogue, 1923; Rife & Synder, 1931; Owens & Grimm, 1941; Scheerer et al, 1945; Anastasi & Levee, 1960; Paulson et al, 1967; Viscott, 1970; Charness et al, 1988). Therefore, AP is not a hindrance to develop musical skills, including RP, which are emphasized in western music. On the contrary, AP, which can elicit other musical talents, is an essential musical talent itself (Brown, 1999). It has musical advantages and is an important component of musicality (Slonimsky, 1988; Baharloo et al, 1998). Whether AP is the isolated ability of identifying and producing tones without reference or an important component in musicality solely depends on how it is used. Under LCK MusET, AP is a musical talent itself, and is a crucial agent in developing other musical talents too. It exerts help to students in playing instruments, memorizing music, sight-reading, singing, sight-singing, music listening, conducting, composing, learning music theory, not to mention identifying tones.

The subject who thought that AP did not help her to learn music was a new student with moderate HI. She thought that she could not hear, play the piano and develop AP well. In fact, she started to develop AP and attained to AP1.

6.7.5. Vote for AP

All (N=144) subjects agreed that AP should be put forward continuously at MusH. The votes further support the value of AP from subjects' points of view.

6.8. Measurement of AP

The AP assessment, scoring and grading system used in this study can be developed into a standardized measure for AP. The test is conducted in a quiet room. A sound-proof room is unnecessary. Test tones can be generated from the piano, the synthesizer, tuning forks or the major instrument of the examinee since one should primarily identify tones from the major instrument one is playing. Instruments must be tuned to A440 Hz. All the tones of the chosen instruments should be used, for examples, 88 tones (A_4-C^4) from the piano, 46 tones (G_1-E^2) from the violin, 37 tones (C_o-C^3) from the flute, 32 tones ($F\#_1$-C^2) from the trumpet, 27 tones (Bb_1-C^2) from the glockenspiel and 22 tones (C_o-A^1) from the soprano voice. Each test tone lasts for one second. The distance between test tones is at least a major tenth apart and tones are randomly ordered to avoid RP. Test tones may be presented live, or recorded with high fidelity audio equipment and presented free field through loudspeakers or headphones. If test tones are presented live, examinees sit at desks with the back against the instruments. Examinees respond one tone after another within three seconds. Complete answers must include note names and octave placements. They can name or notate answers on the manuscript paper. The inter-stimulus interval is at least 30 seconds. The dialogue between examiners and examinees serves as the inter-stimulus distraction. Examiners use stop-watches or timers to count the time if needed. Each answer with the right note and wrong octave name gets one mark and that with both right note and octave designations gets two marks. The total score is calculated into a percentage.

Strictly speaking, if one identifies one tone without reference accurately and immediately, one is an AP possessor, but an AP for one tone. If one identifies many tones without reference, one can be called an AP for many tones. Similarly, if one identifies tones limited to one timbre, one can be considered an AP for one timbre. If one identifies tones of all timbres, one can be called AP for all timbres. For example, if one can get a score from 50% to 59% in piano tones, one can be called "Piano AP5". A "Flute AP8" gets 80% to 89% accurate answers for flute tones. This naming system has the advantage of being able to precisely label how many tones one can name and for what instrument. Refer to Section 3.5, p.116 for the AP scoring and grading scheme.

6.9. Theory Formulation

6.9.1. AP is an Innate Potential

Ward (1999) has suggested that a method has to design to rule out the genetic influence. Under LCK MusET, nearly all students at MusH were able to develop AP (except some new students and students who did not follow LCK MusET to learn music), regardless of their gender, aptitude, age of onset, language background, memory acuity and auditory hypersensitivity differences. It is neither developed from the inheritance from parents or grandparents, tinnitus, or chromesthesia. Its innate potential is revealed as one has an adequate input of the music with the tonal-absolute solfège and the octave designation labeling association. It can start to develop as soon as one starts to learn music with the

tonal-absolute solfège association (and the octave designation) at the beginning level of learning to play the piano. A saturated tonal-absolute solfège (with the octave designation) music environment is crucial in order for AP to develop, like speech that can only be developed in a saturated speech environment (Gross & McIlveen, 2002).

6.9.2. AP is a Musical Talent

AP is a valuable music endowment. It is correlated (r=.68) to music abilities (Révész, 1925). AP, like performing, sight-reading, singing, sight-singing, music appreciation, composing and conducting and so forth, is a musical talent itself. It is an ability to identify, memorize and produce tones, chords, keys and their relationships without references. It suggested further that it exerts an influence on developing talents of playing instruments, sight-playing, singing, sight-singing, music listening, composing, conducting and learning music theory in this study. This is what LCK MusET has been doing persistently. AP is not an isolated skill, but a medium of eliciting other musical abilities. It is an integral part of musicality.

6.9.3. AP is a Successful Outcome of the Tonal-Absolute Solfège with the Octave Designation Labeling Association

The present study supports the idea that whether one can develop AP depends on how successful one anchors tones to absolute labels. AP possessors in the literature have used colours (Kramer, 1916; Burge, 1986), letter names (e.g. Deutsch, 1986; Chang, 2003), visual symbols and flags (Oura & Eguchi, 1982, cited in Miyazaki, 1990; Cohen & Baird, 1990), sol-fah names (Slonimsky, 1988), numbers (Ward, 1999) and syllabus (De Vetten, 2002). AP persons were found to have an enlarged leftward asymmetry in the planum temporal of the brain. The left planum temporal is a region for the language processing. It is the result of the verbal-tonal association (Schlaug et al, 1995; Nowak, 1995; Marin & Perry, 1999; Keenan et al, 2001; Ohnishi & Matsuda, 2001). Verbal encoding is the main AP processing mechanism in AP musicians. Of the above-mentioned processing methods, the labels, colours and visual symbols are not verbal labels. The letter names and numbers can hardly signify pitches. The sol-fah names are based on the moveable solfège system.

Among all labels, the absolute sol-fah naming system of LCK MusET appears to be the best for AP to develop since nearly all students can develop AP. Each sol-fah name is attached to one white or black key tone. The sol-fah names are verbal labels suitable for singing and showing the highness of tones. The tonal quality involves the “tone chroma” and “tone height”. The naming system includes sol-fah names with octave designations. Through singing, naming and thinking sol-fah named tones in music activities frequently, one can anchor tones to sol-fah labels with octave designations. AP is developed in a saturated music environment of tonal-absolute solfège with octave designations. Therefore, AP development is a successful result of the association of tones to absolute solfège with octave placements.

6.9.4. AP is a Successful Attempt of Storing Absolute Tones in the Long-Term Memory

The present study supports the idea that AP is best developed with the most familiar tones (Takeuchi & Hulse, 1991, 1993; Miller & Clausen, 1997), regions (Miyazaki, 1989) and music instruments (Hantz et al, 1997; Marvin & Brinkman, 2000). The longer period of time one plays and practises the piano, and the more frequently one uses AP to sing and think of tones in music activities, the higher will be the AP

achievement. The situation is strengthened more with the comprehensive piano syllabus and the reinforcing use of singing absolute solfège in communicating tones in all music activities. The more time one plays musical instruments or listens to music, the more time one exposes oneself to tones with the tonal-absolute solfège association and the octave designation, the more familiar one is to tones. It is under this situation of frequently rehearsing tones from unfamiliarity to familiarity, the tonal-absolute solfège and octave designation associative information from the short-term memory is converted to the long-term memory (Atkinson & Shiffrin, 1977; Hantz, et al, 1992; Crummer et al, 1994), or from the auditory sensory memory is transferred to the long term-memory (Atkinson & Shiffrin, 1977). AP, an ability to "use a long-term memory of pitch" (Wayman et al, 1992, p.3527), starts to develop as the input is saturated. And the AP judgment becomes certain, immediate and effortless (Klein et al, 1982; Crummer et al, 1994).

6.9.5. AP Anchors on an Accurate and Constant Tuning

The students in this study listened to tones of in-tune pianos, music CDs and cassettes. This was one of the factors enabling them to develop AP. All the pianos at MusH and students' pianos were tuned to A440. All the tones in the entire piano range must be accurate. All the music in CDs and cassettes must be performed in this standard tuning. AP is the successful storage of a number of pitch levels along the pitch continuum in the long-term memory (Siegel, 1972; Siegel & Siegel, 1972). These pitch levels must be constant all the time in order for AP to develop.

6.9.6. AP is a Developmental Process

AP is not a none-or-all ability. It has a developmental process. The present study discovered that the new subjects at the beginning stage of learning to play the piano yield the lowest mean AP achievement among all. The longer the subjects played the piano and the higher the piano standards they achieved, the better would be their AP achievement. AP is a learning process that needs a saturated music environment with the tonal and absolute solfège labelling association together with the octave designation.

The development of AP can be explained by the "Flowering Model" which is proposed by the researcher. The model shows the life cycle of AP. The seed of AP potential is rooted in everyone's brain. Through the frequent exposure to music saturated with the tonal-absolute solfège labeling association and octave designation, AP starts to germinate from unnoticeable potential to seen behaviour. One starts to identify one to several independent tones. AP1-2 resembles the seedling stage of a plant. AP will keep growing to AP3, 4, 5, 6 and so forth if the music environment with the tonal-absolute solfège labeling association and octave designation remains saturated. As one plays and listens to more complicated music and music of wider tonal ranges with the tonal-absolute solfège and octave designation labeling association, AP flowers into AP7, 8, 9 or 10. How well AP flowers depends on how well the music environment with the tonal-absolute solfège and octave designation labeling association is established and practiced. AP may perish gradually after a long period of a lack of practice and music (Sergeant, 1969; Chang, 2002). AP achievement may also be weakened under adverse physical conditions of inattentiveness, illness, fatigue, depression, anxiety, stress (Wynn, 1971, 1972) or deafness (Bachem, 1940).

6.9.7. There may be a Sensitive Period for the AP Development

Even though, like language acquisition (Lenneberg, 1967), most researchers believe that there is a critical period in acquiring AP (e.g. Miyazaki, 1993; Crozier, 1997; Gregersen et al,1997, 1999; Baharloo et al, 1998, 2000), the present study found no critical period in AP development. Like language acquisition (Fromkin et al, 1974; Curtiss, 1977), there may be a "sensitive period" for the AP acquisition. The "sensitive period" occurs at and after the puberty stage of human growth like that of language development. The subjects commencing piano learning at 11 to 16 years of age (N=5, M=29.66, SD=30.88) and at 17 to 23 (N=4, M=39.06, SD=13.85) could still develop AP to a mean of AP2-3, with the maximum score of 77.27% and 56.25% respectively. Even though their mean scores were lower than those of most age groups, the differences were non-significant. The present findings showed that a "sensitive period" for AP acquisition may exist, at least up to 23 years of age of onset. The level of AP developed in the "sensitive period" appears to be lower than that developed in the "critical period" of six years of age or under, similar to the phenomenon found in language acquisition (Fromkin et al, 1974; Curtiss, 1977). Anyway, people after the critical period of six years of age can still develop AP.

6.9.8. AP Achievement can be Negatively Influenced by Particularly Low Aptitude, Low Memory, Severe Deafness, Low Interest in Music, Poor Attention or Brain Damage

Even though the present study found no aptitude, acute memory and deafness influences on the AP acquisition, the researcher believed that if one's aptitude, intelligence and tonal memory are particularly low, or the hearing loss is very severe, the AP acquisition will be hindered. The ability of the SEN and the hearing acuity of the HI in this study might not be low enough and to show significant differences. AP would possibly be affected in brain damage. The interest in playing the piano and attention were found to exert an influence on AP acquisition.

6.10. Limitations

Even though most other AP studies involved no control groups (e.g. Petran, 1932; Balzano, 1984; Profita & Bidder, 1988; Zatorre & Beckett, 1989; Miller & Clausen, 1997; Keenan et al, 2001; Lenhoff et al, 2001), this could be regarded as a limitation in research. This educational study was not a true experiment. Similarly, in the other studies there are no control groups. Casual relationships can hardly be drawn. And the findings cannot claim to have "true" experimental validity. Nevertheless, even without controls, subjects' characteristics, such as age, intellectual ability, age of onset in music learning, learning ability in music, piano standards and so forth were used as variables and analyses undertaken.

Most AP studies had only one to few AP subjects (e.g. Miyazaki, 1992, 1995; Tervaniemi et al, 1993; Burns & Campbell, 1994; Hantz et al, 1997; Pantev et al, 1998; Mottron et al, 1999; Lenhoff et al, 2001). Since AP persons were rare, it was difficult for researchers to recruit more. In this study, there were only three AT, one mild MR, five EBD, three SD, seven LD, three SID, three moderate HI, one severe HI, one asthma, four English speaking subjects, four electronic piano players, five out-of-tune piano players, two subjects of the age of two to six not identifying note and octave names simultaneously, and three subjects of the age seven to 25 not identifying note and octave names simultaneously. It was hard to draw convincing conclusions with these small sub-groupings. However, to group the different types and degrees of SEN together would mask the special characteristics of these sub-groups.

It sometimes happens in AP experiments that the researcher was the innovator of the method, the

experimenter or even the subject in the research (Meyer, 1899; Bachem, 1937; Brady, 1970; Vernon, 1977; Balzano, 1984). The researcher was the innovator of LCK MusET, the superintendent at MusH, the main instructor, as well as the researcher of this study. The validity and reliability were therefore under threat. In order to improve the validity and reliability, the researcher did not take part in carrying out the AP test, interviewing students and parents, and gathering information. The piano instructors did not conduct the AP test and interview, and did not complete the questionnaire of their own students. No pressure or directional guidance on responses was given to students, parents, instructors or administrators. The researcher just did the analysis after receiving all the information. The analysis was carried out as objectively as possible to avoid bias.

6.11. Recommendations

To remedy the limitation, future research should aim at comparing the existing pedagogy on music education in developing AP for ordinary individuals and replicate this research, using an experimental design with a control group. Other researchers are welcome to come to MusH to do research concerning AP. It is hoped that this research will stimulate music educators, psychologists and scholars to further investigate the influence of AP on music learning, brain functions and the behaviors outside music.

There are still some queries which cannot be answered. They are: a) whether AP, as Brady (1970) said, “is hard to forget” (p.887), or as Chang (2003) indicated, would disappear after lack of practice, or as Sergeant (1969) stated, would decline after a long period of time without music. It is logical to think that AP would decline after the absence of music for a long time like other skills (Loftus & Loftus, 1980). If it does, how long and how fast does it take? b) Vernon (1977) found AP fluctuation due to ageing, but Wynn (1992) found that it did not drift significantly with age. Does it really fluctuate with age? c) Aptitude should exert influence on the AP development even though no significant difference was found in this study. The aptitude of the SEN in this study might not be low enough to show a significant difference. How low the aptitude that hinders AP from developing remains unsettled; d) Deafness should hinder AP from developing since AP is an auditory perception of tones. In this research, the four mild and severe HI subjects achieved a significantly higher mean score than that of the MS. In the 19 years of teaching profoundly HI students music, the researcher did not find one with AP. How weak hearing acuity prevents AP from growing remains to be explored; e) Memory should influence AP development because AP is a long-term memory of absolute sense of pitch. Even though acute memory was not found to a factor for developing AP in this research, the researcher believed that the poor tonal memory and amnesia may hinder AP from developing. How poor the memory hinders AP from developing needs to be explored; f) LCK MusET is a successful method in training people to develop AP. Are there any other methods besides this one?

An extension of this study may: a) apply LCK MusET to people of different ages, aptitude, educational needs and countries in order to help them develop AP; b) examine the nature, development, characteristics and value of AP in a large cross-cultural study across continents; c) set up a standard test for measuring AP; d) establish a standardized absolute solfège naming system with octave designations to name and sing notes; and e) design a music programme for school children which includes the training of AP and makes absolute solfège a medium of communicating tones.

6.12. Coda

AP is the innate God-given potential in all of us. It is hoped that all people in the world might regain it after losing it for hundreds of years.

Appendix I.7.
Absolute Pitch Practice Guidelines of MusH

A. Practice Method

Absolute pitch is an endowment for musicians. Although musicians who possess absolute pitch are rare, all students at the Music Home should be able to acquire this ability. In order to develop AP, students and parents must follow the guidelines described below.

1. The piano should be tuned at least once every four months and maintained in a good condition. Refer to the "Guideline on Tuning and Maintenance" for details.
2. Parents should purchase good quality hi-fi equipment for listening and recording music. Refer to the "Guideline on the Purchase and Operation of Audio Equipment and CDs". Students should listen to the music of the piano text-books and the music for extracurricular listening frequently, preferably with singing absolute solfège.
3. Before practising the piano, the student should follow the music of the instructor's demonstration or CDs/cassettes to sing sol-fah names. In the instructor's demonstration, the music is accompanied by singing sol-fa names. If the music is from the CDs or cassettes accompanied with the piano books, the student must sing the absolute solfège on his/her own. After practising well with the CDs or cassettes, the student should sing plainly on his/her own. S/he must pay attention to the accuracy of tones. After the plain singing, s/he can practise the piano. In practising the piano, the student should sing sol-fah names simultaneously.
4. The steps for practising pitch identification are as follows.

(i) Go to the office to get an "A6 Note Album" and check whether the note-sheets are in order from high to low.

(ii) The first group of tones to be practised is from middle C to the C an octave higher, i.e. C_0-C^1.

(iii) The white key tones are practised first. Start with the highest note and practise downwards tone after tone. C^1 should be the first pitch to practise. Open the "C^1 note sheet" inside the "A6 Note Album".

(iv) The parent should press the piano key C^1 five times, that is C^1-C^1-C^1-C^1-C^1 with mf to f, in the tempo of a second a note (i.e. a beat equals to 60 in the metronome). At the same time, the student looks at the note-head (do not look at the stem), listens to the piano tone C^1, sings doh^1 five times after the piano tone, i.e. doh^1-doh^1-doh^1-doh^1-doh^1, points at the note-head (not the stem) with a pointer and memorizes the pitch.

(v) After singing C^1 five times, the student then sings downwards note after note, i.e. B_0 (sing ti), A_0 (sing lah), G_0 (sing sol), F_0 (sing fah), E_0 (sing mi), D_0 (sing ray) and C_0 (sing doh). The student repeats the middle C again, and then goes upward note by note, i.e. D_0, E_0, F_0, G_0, A_0, B_0 and C^1. The method of practising method is the same as practising C^1 as described in point iv.

(vi) If the student and parent want to practise more, repeat points iii to v. It is recommended that the

student spends 10 minutes a day to practise until the he/she acquires the ability.

(vii) After the student has practised for a period of time, the parent may test him/er by pressing the piano tone randomly within that range to see whether s/he can identify it. If the student can recognize the pitch, the parent responds “right” or “good”. The parent must not forget to smile and praise him/er. If s/he fails to give the right answer, the parent should give him/er the right answer immediately. Once again the parent should remember to smile and encourage him/er either. The proper answer from the student, for example, for G_0 should be “sol in the middle register”, not only “sol”. The student must identify which sol and in which octave. Alternatively, the student may point at the piano key or the note in the “Note Album”, but s/he has to name the note immediately afterwards. The parent sweeps the piano keys at least once, in order for the sound to hinder the student from comparing previous tones.

(viii) When the student can identify tones, the parents can point at a key silently or note on the stave randomly and ask him/er to sing back the pitch. After the child has sung, the parent presses the same key to check whether s/he sings the right pitch.

(ix) The practice in the later days involves checking, listening and singing tones frequently, until the child can acquire the pitches of this range.

(x) The parent may find some melodic excerpts from scores or CDs and ask the student to identify and sing them.

(xi) After the white keys, the parent should practise playing the black keys together with white keys with the child. C^1 is the note to start with too. The practice method is the same as points iii to iv. The notes are B_0 (sing ti), Bb_0 (sing te), A_0 (sing lah), Ab_0 (sing le), G_0 (sing sol), Gb_0 (sing se), F_0 (sing fah), E_0 (sing mi), Eb_0 (sing me), D_0 (sing ray), Db_0 (sing re) and C_0 (sing doh). The sharp notes and the enharmonic flat notes are written on the same stave paper. The student should point at the flat notes when singing the black keys.

(xii) The practice keeps on. When going down to C, the student repeats the middle C, and then goes up semitone by semitone to C^1, i.e. C_0 (sing doh), $C\#_0$ (sing di), D_0 (sing ray), $D\#_0$ (sing ri), E_0 (sing mi), F_0 (sing fah), $F\#_0$ (sing fi), G_0 (sing sol), $G\#_0$ (sing si), A_0 (sing lah), A_0 (sing li), B_0 (sing ti) and C^1 (sing doh^1). The practice method is as described in points iii to x. Be careful when singing sharp notes. The sharp note and the enharmonic flat note are written on the same stave paper. The student should point at the sharp notes when singing black keys this time. Practising from C^1 to middle C and back to C^1 makes a complete cycle.

(xiii) After practicing for a period of time with the child, the parent can test him/her by pressing any keys in that range randomly and see whether s/he can present the right answer. The way is the same as point vii. The child may give answers of sharp or flat notes for black keys. According to previous experiences, if C#/Db is sounded, the student would answer di, D#/Eb me, F#/Gb fi, G#/Ab le, and A#/Bb te. The parent should follow this naming system in naming isolated tones.

(xiv) The coming procedures are those described in points viii to x, until the student can establish AP for this region.

(xv) The next compass to practise is C_1-C_o. The practice method is like that of practising C_0-C^1. Please refer to points iii to xiv for details. If the student has difficulty in singing lower notes, s/he may sing them an octave higher. The proper answer for the notes of this register, for example, for F_1 is “fah, an

octave lower" or "an octave lower, fah".

(xvi) After finishing C_0-C^1 and C_1-C_0, the student may practise C_1-C^1. Start with C^1, practise downwards semitone by semitone to C_1 and go upwards semitone after semitone to C^1. Follow the practice method mentioned in points xi to xiii. Refer to points vii to x for follow-up procedures.

(xvii) The third octave is C^1-C^2. Up to this point, the student should be able to manage the skill in singing solfège. Whether to sing from C^1 upwards or from C^2 downwards is up to the student's choice. Any notes which are too high to sing should be sung an octave lower. The notes which the student can reach should be sung in their original levels. The practice method is similar to points iii to xiv.

xviii. After practising C_1-C^1 and C^1-C^2, the student should practise C_1-C^2. The student may sing a semitone upwards from C_1 or semitone downwards from C^2. The practice and follow-up procedures are like point xvi. The method is similar to practise C_1--C^1.

xix. The next compass is C_2-C_1. The practice method follows points xvii and xviii.

xx. The octave which follows C_2--C_1 is C^2--C^3. The practice method is like point xix.

xxi. The last register is A_4-C_2. The practice method is as point xx. Up to this stage, the student should develop AP for all piano tones.

xxii. The student, for the coming days of learning, should keep practising pitch identification, singing absolute solfège in all music activities, testing the ability on AP, and maintaining the piano in good condition and in tune.

B. Remarks

1. If the student practises tonal identification without any help from others, s/he may press the piano keys with one hand, point at the notes with another, and at the same time look at the notes, sing the tones and memorize the pitches. In testing, lift the head upward, press the key with one finger and listen to the pitch. After naming and/or singing the tone, look at the pressed key to check the answer.
2. Parents and students should stay calm in the whole course of practising tone identification. If anyone is not in a good mood, stop and practise at some other time. Different students will make different progress in developing AP.

~The End~