CHAPTER EIGHT: THE FINALE

8.1. Introduction

In this final chapter, a summary of this study, major findings, formulated theories, limitations and the recommendations for future research and follow-up tasks of AP are described.

8.2. Summary

This study was designed to examine the effectiveness of LCK MusET in training students to develop AP and to identify relative factors influencing the development of AP. Three AT, 103 MS and 38 SEN students at MusH were recruited as subjects. Their ages ranged from two to 25. It was a case study in which there was one-group and pretest-post-test and descriptive methods were used. An AP assessment, a questionnaire completed under an interview, and forms for recording, observation and collecting feedback were devised. Descriptive statistics, chi-square, the Spearman's 's correlation, the independent and paired samples t-tests, the two and three ways analyses of variance, the Tukey HSD test, the multiple linear regression and content analysis were used as analytical tools. The findings from this study are summarized as follows.

8.2.1. The trait to indicate an absolute judgment of tones should be called "AP". "Perfect pitch" cannot be another name for AP. AP can be defined as an innate ability to identify or produce tones with octave designations accurately, with certainty, spontaneously and effortlessly without reference of at least for one timbre.

8.2.2. An absolute solfège system is designed for naming and singing tones. The solfège d-di-r-ri-m-f-fi-s-si-l-li-t-d^1 represent C-C#-D-D#-E-F-F#-G-G#-A-A#-B-C^1 with the black keys of a sharp nature and d^1-t-te-l-le-s-se-f-m-me-re-d represent C^1-B-Bb-A-Ab-G-Gb-F-E-Eb-D-Db-C with the black keys of a flat nature. If the black keys are without sharps or flats in relation to their white keys, the solfège, d-di-r-me-m-f-fi-s-le-l-te-t-d^1, l represent the letter names of neutral relationships C-C#-D-Eb-E-F-F#-G-Ab-A-Bb-B-C^1. Doh is always fixed to C. Moreover, octaves are assigned numbers at the upper or lower right

hand corners of the sol-fah or letter names to indicate high or low registers respectively. For example, the middle C is C_0. The C one, two, three or four octaves higher than the middle C is either C^1, C^2, C^3 or C^4. The C one, two, three or four octaves below the middle C is C_1, C_2, C_3 or C_4.

8.2.3. The AP assessment test in this study can be employed as a blue print for setting up an AP standardized test. The test should be conducted in a quiet room. Test tones can be generated from the piano, the synthesizer, tuning forks or the examinee's major musical instrument even though only the piano was used in this study. All possible tones of the chosen instrument are used. They must be set to A440. Each test tone lasts for one second. Test tones are randomly ordered. The intervals between two adjacent test tones are at least a major tenth apart. 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 their back against the instruments. Examinees respond to one tone after another within three seconds. Complete answers must include note and octave names. They can name or notate answers on the manuscript paper. The inter-stimulus interval is at least 30 seconds. A dialogue between examiners and examinees serves as the inter-stimulus distraction. The next item should not be presented if the previous one has not been completed. Examiners can use stop-watches or timers to count the time if needed. The answer with the right note and wrong octave names gets one mark, and that with both right gets two marks. The total score is presented in percentage terms.

AP achievement is divided into eleven grades, from AP0 to AP10. Examinees who score 9.99% or under are considered AP0. The other rankings are as follows: 10%-19.99% = AP1, 20%-29.99% = AP2, 30%-39.99% = AP3, 40%-49.99% = AP4, 50%-59.99% = AP5, 60%-69.99% = AP6, 70%-79.99% = AP7, 80%-89.99% = AP8, 90%-99.99% = AP9 and 100% = AP10. Scores 49.99% or under are considered fail and 50% or higher pass. AP0 signifies no AP and 10% indicates AP starting to develop. 10%-49.99% represent initial AP, 50%-99.99% satisfactory and 100% perfect. AP0 implies no AP, AP by chance or AP

with few notes. AP1-2 show AP starting to develop, AP3-4 AP in progress, AP5-6 fair AP, AP7-8 AP with merit, AP9 AP with distinction and AP10 perfect AP. AP can be assessed at least with one musical instrument. The name of the timbre needs to be attached before the AP grading. For example, an attainment grade may be called "Violin -AP9" if one can get scores of 90% to 99.99% in the AP test with 46 violin tones.

8.2.4. LCK MusET is an effective instructional method enabling students to develop AP. In this investigation, the 144 subjects obtained a zero mark in the pretest. In the post-test, 22 attained AP0, 58 AP1-4 and 64 AP5-10, including four with zero and one with full marks. All AP1-10 subjects reported using AP in the AP test, except one who reported using both AP and RP. All subjects were observed by examiners to use AP in the AP test. All responses written down on answer sheets were made within three seconds. All AP1-10 subjects were considered AP possessors since they all used AP in the assessment.

Two (1.4%) subjects mentioned that they might develop AP through tuning instruments. It seems that the AP developed at MusH helped them to tune and play instruments instead of vice versa. Others (N=142,98.6%) stated that the music activities outside MusH did not help them to develop AP. No subject reported that there was institution or activity outside MusH teaching them AP or employing AP as a medium of instruction. No subject commented that learning music outside MusH was one of the five factors in developing AP.

All subjects indicated that the music activities at MusH helped them to develop AP. These activities in order of importance were singing solfège in practising the piano, practising the piano without singing solfège, listening to music, playing the piano from memory, sight-singing, singing, sight-playing, practising the tone identification, learning music theory, composing and conducting.

8.2.5. The successful association of tones and absolute solfège through singing and thinking of tones in their absolute sense is a factor in developing AP. Nearly all (N=136, 94.4%) subjects sang or thought of tones in practising the piano. They got significantly

higher AP post-test scores than those who did not. Subjects who spent more time in practising the piano obtained significantly higher scores than those who spent less. Subjects sang or thought of tones in 85.64% of the activities attended (63.99%). They used AP on 99.11% of the occasions. The more they sang and thought of tones in music activities, the higher would be their AP achievement.

8.2.6. Accurate piano tuning to A440 is another factor in developing AP. All pianos in this study were tuned to A440. All the tones, including the highest and the lowest compasses in the piano scale, have to be in tune. A qualified and competent piano tuner was employed to tune all the pianos at MusH and at the students' homes. Parents were encouraged to tune their pianos with this contracted piano tuner. The 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. Nearly all (N=111, 79.3%) subjects felt that playing the in-tuned piano was one of the five factors in developing AP.

8.2.7. Becoming familiar with musical tones is another factor in developing AP. In this study, the mean post-test scores of the subjects playing the piano for 1-2 months to eight years were found to be significantly different. The mean score of the subjects learning the piano for less than a year was significantly lower than those learning from five to eight years. AP achievement was found to be positively and highly correlated to the duration of playing the piano. The subjects who spent more time in practising the piano got significantly higher post-test 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.

A high exposure to piano music is another influence. There are 12 books or 12 sets of books in each grade. As students progressed, they acquired and rehearsed more different tones. Through playing, singing and thinking of tones, they became more familiar with tones and their association to the absolute solfège. Under sufficient tonal-absolute solfège labeling perceptual input, AP grows.

Another influence is the familiarity of timbre. Four (2.8%) subjects practised with the

electronic piano in learning to play the piano. Subjects practising the piano (N=140, 97.2%) obtained a significantly higher mean post-test score than those practising with the electronic piano. The longer the time they used the piano to practise, the higher would be their post-test scores. Since there were two AP2s practising with the electronic piano, the timbral familiarity appears to be an auxiliary rather than a determining factor.

8.2.8. Interest in playing the piano is another factor in developing AP. Twelve (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 post-test scores were significant among the groups of different levels of interest. Those with little interest had significantly lower scores than other groups. The more interest subjects had in playing the piano, the higher would be their AP achievement.

8.2.9. Attention is another factor in developing AP. Twenty-four (16.7%) subjects out of 144 subjects were reported to have an attention problem and one (0.7%) had a stress problem. Three were MS and 22 were SEN. They got a significantly lower mean post-test score than those without such behaviour.

8.2.10. Sex difference is not a factor in developing AP. The number of boys (N=34, 53.1%) who successfully attained to AP5-10 was not significantly more than that of girls (N=30, 46.9%). The mean post-test score of girls was not significantly higher than that of boys. Either gender can develop AP equally well.

8.2.11. The aptitude difference is not a factor in developing AP. Out of the 144 subjects, 28.6% to 100% of the AT, MS, autistic, EBD, LD, SID, moderate and severe HI, and asthma subjects attained AP5-10. In the SEN group, only one mild MR and three SD subjects failed to develop to AP5 because they were new. In the AP1-10 group, 66.7% to 100% of the AT, MS, autistic, EBD, SD, LD, SID, moderate HI, severe HI and asthma subjects were able to develop AP. In the SEN, only the one mild MR subject failed to do so since he was new. SEN subjects did not get significantly lower mean post-test scores than the MS. Three AT, 41.7% (N=43) of MS and 47.4% (N=18) of SEN were able to attain

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. Students with different aptitudes can develop AP.

8.2.12. The age of commencing piano playing is not a factor in developing AP. The 144 subjects started to learn to play the piano from the age of two to 23. Their differences in the mean post-test scores were non-significant. Of 64 AP5-10s, the AP achievement was non-significantly correlated to the age of onset. The AP5-10 subjects were regrouped into two to six years of age and seven to 23. Their mean post-test scores were non-significantly different. AP can be acquired at any age of onset, at least before 23 years of age.

8.2.13. The tonal language background is not a factor in developing AP. Four (2.8%) subjects spoke English and 140 (97.2%) spoke Cantonese. Their mean post-test scores were non-significantly different. Persons with or without a tonal language background can acquire AP.

8.2.14. Inborn acute memory for pitch is not a factor in developing AP. There were 122 (84.7%) students achieving AP1-10. Eighteen (12.5%) obtained scores of 1.14% to 9.09%. Only four (2.8%) subjects did not get any marks. The proposition that AP is developed from the acute memory can be ruled out.

8.2.15. Auditory hypersensitivity is not a factor in developing AP. The autistic is said to have an auditory hypersensitivity to sound. The prevalence rates of auditory hypersensitive (autistic) subjects were 0.2% and 15.8% lower than that of normal hearing (AT and MS) subjects in AP1-10 and AP5-10 respectively. Despite hearing loss, the prevalence rates of HI subjects were 30.6% and 46.4% in AP5-10, and 14.1% and 14.3% in AP1-10 higher than those of normal hearing and auditory hypersensitive subjects respectively. The mean post-test scores of auditory hypersensitive, normal hearing and HI subjects were non-significantly different. All students with different levels of auditory sensitivity can develop AP.

8.2.16. Pitch identification practice is not a factor in developing AP. Sixteen (11.1%)

subjects practised pitch identification and 128 (88.9%) did not. Subjects practising pitch identification did not get a significantly higher mean post-test score than those without. Even though more AP5-10 subjects (N=10, 6.9%) practised pitch identification than the AP0-4 group (N=6, 4.2%), the AP5-10 subjects practising pitch identification did not obtain significantly higher mean post-test score than those without either. Students who do not practise 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 that students develop AP.

8.2.17. Inheritance is not a factor in developing AP. Nearly all subjects possessed AP or started to possess AP. 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 as possessing AP. All the brothers or sisters with AP were students or ex-students of MusH. No subject claimed that inheritance from parents or grandparents was one of the five factors in developing AP. The possibility that AP has a genetic factor seems unlikely..

8.2.18. Tinnitus is not a factor in developing AP. No subject reported to be suffering from tinnitus. No one claimed comparing tones to the ear ringing sound as one of the five factors in developing AP. In this study no case was found of AP developing from tinnitus.

8.2.19. Chromesthesia is not a factor in developing AP. No subject reported having chromesthesia. No one claimed that chromesthesia was one of the five factors in developing AP. In this study no case was found in which AP was thought to develop as a result of chromesthesia.

8.2.20. 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 the predictor variables of AP achievement. The ANOVA table showed that these six variables were significant predictors too. The regression coefficient table showed that their

latest piano grades, frequency of using AP in music activities, time for practising the piano, duration of playing the piano and age were all positively correlated to AP achievement except for age. The age of commencing piano playing was not correlated. This implied 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.

8.2.21. AP takes as little as one to two months to develop. From the 17 subjects playing the piano for one to two months, nine (52.9%) subjects attained AP1-7. All other subjects playing the piano longer than this period obtained mean post-test scores higher than this. The longer they played the piano, the higher AP scores they would get. From the 122 AP1-10 subjects' feedback, 8.2% (N=10) of the AP1-4s and 10.65% (N=13) of the AP5-10s reported that their AP began to develop within one to two months of their piano tuitions. The shorter the time AP began to develop, the higher would be their post-test scores. Subjects playing the piano for two years got a mean of AP5. Those playing the piano longer than two years could attain even better AP grades.

8.2.22. Students can develop AP at the preparatory grade. From the 60 preparatory grade subjects, 33 (55%) were AP1-4 and six (10%) were AP5-7, with a mean of AP2. The subjects higher than this grade got a mean of AP4 or higher. As their piano standards moved up, their AP achievement would improve. Subjects could get AP5 or higher (maximum AP8) at grade three (with a mean of AP6). The subjects higher than this grade obtained even better AP scores.

8.2.23. The main AP processing strategy of the AP5-10 subjects was to associate tones to sol-fah names (55.5%). Others were to identify tones naturally without noticing how (25.5%), associate tones to letter names (10%) and recognize tonal qualities (5.4%). To associate tones to the image of the keyboard (1.8%) and the stave (1.8%) were rare. Referring tones to an or many internal standards, ear ringing sounds, compositions, colours, scales, throat positions or words were not used. Since all subjects responded by calling out

sol-fah names, to identify tones naturally without noticing how, recognizing tonal qualities and comparing tones to internal standards appeared to be the verbal strategy of associating tones to sol-fah names. Actually, 96.4% were the verbal codes of associating tones to sol-fah and/or letter names, and 3.6% were the pictorial codes of relating tones to the images of the keyboard and/or stave. All AP1-4 used the single strategy of the verbal code. All (N=58, 100%) AP1-4s and nearly all (N=61, 95.3%) AP5-10s used the single strategy of the verbal code and very few (N=3, 4.7%) AP5-10s used the multiple strategies of verbal and pictorial codes.

8.2.24. The AP5-10 subjects used both skills of identifying tone and octave names simultaneously (50.81%) and identifying note names and then octave designations (49.19%). The AP1-4 subjects demonstrated a similar process too (53.55% in 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. Very few (N=3, 4.7%) used one technique of identifying note and octave names simultaneously. Most (N=45, 77.6%) AP1-4 subjects used both strategies. Few (N=9, 15.6%) identified note and octave names simultaneously.

The AP1-10 subjects of two to six years of age identifying note and octave designations simultaneously obtained significantly higher mean post-test scores than those of the seven to 25 group. As young children perceive tones with octave designations as a whole, they are inclined to name tones and octaves at the same time. The approach of identifying tones and octave names simultaneously helps students recognize tones more correctly.

8.2.25. The AP5-10 subjects identified tones with different accuracy. The easiest 12 sets of tones to identify with right octave designations in order were: 1) Co; 2) Fo; 3) Eo, C^1 and G_o; 4) Do; 5) G_1; 6) D_1; 7) C^2; 8) E^1, C_1 and C_2; 9) A_2, E^2, G_2, D_2, D^1, D^3 and F#o; 10) A^1, E_1 and E^3; 11) A_1, G^1 and C^4; and 12) F^1, Bo, F_1 and B_2. These are mainly the white key tones within two octaves below or above the middle register. The most difficult 12 sets of tones in order were: 1) $C\#_3$; 2) Eb_3; 3) Bb_4 and B_4; 4) Ab_3; 5) $F\#_3$; 6) Ab^3; 7) $F\#^3$ and E_3; 8)

C#^{2}; 9) Ab_2 and Bb_3; 10) B_3; 11) Bb^2, C#$_2$, F^3 and D^3; and 12) F#^{2}, Bb_2, and Eb^3. They are mainly the black key tones of the lowest or highest two octaves.

With regard to tonal judgment ignoring octave errors, the easiest seven sets of tones in order were: 1) Co, C^1 and Eo; 2) Go, G_1, D_1, C_1, E^1, A_1 and C^3; 3) Fo, C^2, C_2, A_2, A^1 and G^1; 4) Do, E^2, D_2, G_2, F^1, Bo, D^2, Ao and F^2; 5) D^1, F_1 and F#$_1$; 6) F_2, and B^1; and 7) D^3, G^2 and C^4. These are mainly the white key tones within two octaves below or above the middle compass. The most difficult 12 sets of tones in order were: 1) C#$_3$; 2) B_4; 3) Eb_3; 4) Bb_4; 5) F#$_3$ and Ab_3; 6) E_3 and Ab^3; 7) F#^{3}; 8) D_3; 9) Bb_3; 10) C#^{2}; 11) Eb^3 and Ab_2; and 12) C#$_1$, C_3, Bb^3 and F_3. These are mainly the black key tones of the lowest and highest octaves in the piano scale.

As regards tonal judgment of the 12 notes without octave designations, the tones from the most familiar to the least in order were: C, G, A, D, B, F, E, Bb, F#, Eb, Ab, and C#. Subjects identified the seven white key tones better than the five black key tones. C was the easiest tone to identify and C# the hardest, regardless of whether octave designations were considered or not.

Comparing the accuracy of judging white and black key tones, the AP5-10 subjects had mean accurate tonal responses of 87.65% for white key tones and 65.28% for black key tones. The mean post-test score for white key notes was significantly higher than that of black key tones. They identified white key tones significantly better than the black key tones.

8.2.26. Comparing the accuracy of judging tones in different octaves, for the AP5-10, the order of accuracy was 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 was the best identified region. The lowest and highest extreme regions were the hardest to identify. Concerning the accuracy of the lowest and highest regions (A_4-A_3 and C^3-C^4), and the rest of the regions (Bb_3-B^3), their mean post-test score in the lowest and highest regions was significantly lower than that of the other registers. The tones in these two extremes were the most difficult to identify.

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. They found it more difficult to identify tones in the lowest region than in the highest.

8.2.27. Fifty-nine (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 the answers with octave errors and 61% without. The percentage of octave errors was regarded small with a difference of 43.51%. For the AP1-4 group, 14.36% of answers were with octave errors and 21.42% without with a difference 7.06%. The AP1-4 subjects had 36.45% more octave errors than the AP5-10 group. Octave errors can be improved if AP improves. Students were taught to judge tones with sol-fah and octave names simultaneously. Even though students with AP make octave errors, the situation is believed having been.

8.2.28. Twenty-two subjects failed to develop AP to AP1 or higher. Twenty-one (95.5%) represented a combination of factors, including: playing the piano at the beginning level (N=21, 95.5%), having attention deficit or short attention span due to their age, learning difficulties or unstable emotions (10 two- to three-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 tune pianos (N=2, 9.1%) and practising with the electronic piano (N=2, 9.1%). One autistic subject, playing the piano for two years and attaining grade two, failed to achieve to AP1 or higher because he had emotional and attention problems during the post-test. In fact, 18 AP0s got 1.14% to 9.09% marks in the post-test. They made one to six right judgements. Compared to the zero mark in the pretest, their AP was improving. Out of these, 17 (11.7%) subjects reported employing AP in the post-test, while 12 (8.3%) were observed by examiners to use AP. They (N=18, 12.5%) were starting to develop AP; however, they needed a longer period of time to attain AP1 or higher.

8.2.29. From the 122 AP1-10 subjects, 121 (99.2%) thought that AP was useful in learning music. Of participants in the related activities, all reflected that AP helped them to identify notes, play the piano, play 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 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 examination. The 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. The 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 examination. The 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 examination, ready for the DipABRSM or ATCL. They (N=26, 21.3%) started to play the piano at a mean of the preparatory grade. The diploma students accumulated 1300 to 1560 hours in practising the piano. They spent 3440 and 8440 hours less than those low and high achievers respectively to attain to the diploma level (Ericsson et al, 1993). Their progress was three to six times faster than that mentioned in the literature. They possessed AP with a mean score of 85.47%. It appears that they may have been helped to do this as a result of having AP as AP is a medium in perceiving and memorizing music.

Over half of the subjects (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 were those in the piano syllabus, the examination syllabus or competition repertoire. For those who could not play the music from memory in 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. The grade five subjects 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 as long as 14 pages in the first or three to ten attempts after they had practised the music well within 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. The higher the subjects' piano grades, the longer the music they could memorize and the more times they needed to memorize the music, the higher would be their AP achievement.

8.2.30. AP which can elicit other musical talents is an essential musical talent itself. It exerts help to students in playing instruments, memorizing music, sight-reading, singing, sight-singing, music listening, conducting, composing and learning music theory, not to mention identifying tones. All (N=144) subjects agreed that the AP acquisition should be continued at MusH. Their opinions support the value of developing AP.

8.3. Theory Formulation

The findings lend support to the contention that LCK MusET enables one to develop AP. The following theories concerning AP are thus proposed:

8.3.1. 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).

8.3.2. 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.

8.3.3. 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 successfully 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.

8.3.4. 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).

8.3.5. 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.

8.3.6. 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).

8.3.7. 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 o f 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.

8.3.8. 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.

8.4. 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.

8.5. 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 (200 3) 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.

8.6. 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.