UNIVERSITI PUTRA MALAYSIA

PITCH ACCURACY IN THE SINGING OF SECONDARY SCHOOL STUDENTS

SU LIH HUEY

FEM 2008 11

PITCH ACCURACY IN THE SINGING OF SECONDARY SCHOOL STUDENTS

By

SU LIH HUEY

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Master of Science

OCTOBER 2008

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

PITCH ACCURACY IN THE SINGING OF SECONDARY SCHOOL STUDENTS

By

SU LIH HUEY

October 2008

Chairman: Chan Cheong Jan, D. Lit.

Faculty: Faculty of Human Ecology

The objective of the study was to determine the pitch accuracy in the singing of secondary students, in various tonal pattern setting via quantitative approach. In order to determine whether certain tonal patterns predict greater pitch accuracy in contrasting song material, this study analyses the sung pitch fundamental frequencies of the secondary school students. The tonal patterns covered in this study are phrases form national anthem Negaraku, Rasa Sayang, and Auld Lang Syne; put in the progression of ascending, and descending; and are derived from music materials that are familiar to the respondents.

The subjects for the study (N = 92) were secondary students of Chong Hwa Independent High School, where 45 (aged 16-18) were upper form students and another 47 (aged 13-15) were lower form students. A pitch model in PowerPoint instructions was prepared. Respondents were asked to sing four test patterns guided by the PowerPoint instructions.

Test patterns consist of combination of the four variables of diatonic major, pentatonic, ascending, and descending, constructed into 19 pitches in total. Therefore, 1748 sung pitches would be subjected to quantitative evaluation.

Recording of singing was edited using *Adobe Audition* audio editing software, and pitches was analysed according to the Target Pitch Frequency, based on equal temperament. For measurement analysis, the *Praat* software was used to determine the fundamental frequencies from the waveforms of the recorded data.

Research result reveals that upper form students sang with lesser pitch accuracy compared to lower form students. The junior high male and female, and senior high male students sang average accurately on all the test patterns except senior high female was unable to sing the pitches in tune. Besides, students sang with greater pitch accuracy when they sang an ascending pattern in diatonic scale. Result also revealed that the descending patterns in diatonic scale were less accurate than in pentatonic scale. 63% of the respondents were found with an average pitch deviation of 25 cents and below, categorized as accurate singers while 17% of the respondents were with an average pitch deviation of 100 cents (one semitone) and above and were categorized as inaccurate singers. Future studies may look into the relationship of vocal parameters and pitch accuracy through quantitative evaluation.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

KETEPATAN PIC BAGI NYANYIAN PELAJAR-PELAJAR SEKOLAH MENENGAH

Oleh

Su Lih Huey

Oktober 2008

Pengerusi: Chan Cheong Jan, D. Lit

Fakulti: Fakulti Ekologi Manusia

Objektif kajian ini adalah untuk mengkaji ketepatan pic bagi nyanyian pelajar-pelajar sekolah menengah dengan pelbagai corak lagu tertentu melalui cara kuantitatif. Oleh itu, sesuatu bahan uji dapat meramalkan ketepatan pic yang lebih jitu dalam ragam pic lagu, maka satu kajian tentang penilaian sumbang nyanyian pelajar-pelajar sekolah menengah dijalankan dengan menganalisis frekunsi pic nyanyian. Ragam bunyi ujian dalam pengukuran nada sumbang ini terpilih daripada lagu-lagu yang dikenali oleh pelajar, dinamakan Negaraku, Rasa Sayang dan Auld Lang Syne.

Subjek kajian ini terdiri daripada 92 orang pelajar sekolah menengah, dengan 45 orang pelajar dari tingkatan atas (umur 16-18) manakala 45 orang yang lain terdiri daripada pelajar tingkatan bawah berumur 13-15. Arahan ujian dipersembahkan dalam bentuk PowerPoint dan model pic disediakan terlebih dahulu. Semua bahan uji lagu disembunyikan dalam model pic ini. Bahan uji kajian merupakan gabungan empat

pembolehubah iaitu major diatonik, pentatonik, menaik, dan menurun, terdiri daripada 19 pic nyanyian. Sejumlah 1748 pic dianalisis dengan penilaian kuantitatif.

Responden diminta menyanyi dan nyanyian mereka dirakam. Semua rakaman disunting dengan perisi Adobe Audition penyunting audio sebelum analisis ketepatan pic dijalankan. Dalam mengukur ketepatan pic, perisian Praat digunakan untuk mencatat *frekunsi fundamental* gelombang dalam data yang dirakamkan.

Kesimpulannya, terdapat pelajar tingkatan atas mempunyayi ketepatan pic kurang tepat daripada pelajar tingkatan bawah. Pelajar lelaki dan perempuan tingkatan bawah dan pelajar lelaki tingkatan atas menyanyi ragam bunyi ujian dengan pic yang tepat, kecuali pelajar perempuan tingkatan atas, tidak reti menyanyi ketepatan pic yang tepat. Malah, ketepatan pic didapati lebih jitu jika muzik terdiri daripada muzik bermajor diatonik dengan ragam menaik. Keputusan juga menunjukkan ragam muzik yang menurun dalam major diatonik adalah kurang tepat daripada skel pentatonik. Terdapat 63% pelajar dapat mencapai pic yang tepat dalam min purata 25 cents perbezaan manakala 17% pelajar dikenali nyanyian sumbang, min purata adalah melebihi 100 cents (satu semitone). Penyelidikan yang akan datang boleh mengkaji hubungan parameter vokal dan ketepatan pic melalui penilaian kuantitatif.

ACKNOWLEDGEMENT

First and foremost, I would like to express my sincere thanks and deepest appreciation to my honorable supervisor, Dr. Chan Cheong Jan, for his untiring support, invaluable guidance, advice and assistance throughout the entire duration of the project. I am honored to become one of his postgraduate students, as I believe that he is the best music lecturer that I had ever known.

Besides that, I am also very grateful to my wonderful friends Crystal Lim and Lee Pang Seng who rendered help towards the completion of this project. Furthermore, I would like to take this opportunity to thank all the juniors of UPM for their utmost support, suggestions and comment.

Last but not least, I wish to thanks again my beloved mum, dad, sisters and brother for being the pillar of strength throughout the process of the project.

I certify that a Thesis Examination Committee has met on 17 October 2008 to conduct the final examination of Su Lih Huey on her thesis entitled "Pitch Accuracy In the Singing Of Secondary School Students" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Siti Nor Yaacob, PhD
Department of Human Development and Family Studies,
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Chairman)

Zahid Emby, PhD
Department of Social and Development Science,
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Internal Examiner)

Loo Fung Chiat, PhD
Department of Music,
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Internal Examiner)

Mohd Hassan Abdullah
Lecturer,
Faculty of Art and Music,
Univertiti Pendidikan Sultan Idris.
(External Examiner)

BUJANG KIM HUAT, Ph.D.
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 19 February 2009

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of Master of Science. The members of the Supervisory Committee were as follows:

CHAN CHEONG JAN, D. Lit
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Chairman)

INDRA SELVARAJAH
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Member)

LAM MING HUEY
Faculty of Human Ecology,
Universiti Putra Malaysia.
(Member)

_____

HASANAH MOHD. GHAZALI, Ph.D.
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 9 APRIL 2009

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

_____

SU LIH HUEY

Date: 16 January 2009

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CSL	Computerised Speech Lab
ESL	English as a Second Language
F_o	fundamental frequency
KR	knowledge of results
MDVP	Multi-Dimensional Voice Profile
MPFR	maximum phonational frequency range
SINGAD	Singing Assessment and Development
SPL	sound pressure level
SVDM	Singing Voice Development Measure
UPM	Universiti Putra Malaysia
VPA	vocal pitch accuracy
VFB	visual feedback
VFT	visual feedback technology

CHAPTER 1

INTRODUCTION

Audiation and technical acquaintance are two major factors that affect good singing performance (Weikart, 1987; Bertaux, 1989). In view of this, singing intonation that is based on the construction of audiation plays an important role in determining good vocal pitch accuracy. If singing is developed properly during early childhood, the ability to perform music vocally will coincide with the ability to think tonally. Therefore, it is clear that the education environment of today, the accuracy of singing intonation as one of the important agendas in the education system should be emphasised, particularly school students through their singing lessons. This is because successful singing education includes a sufficient accuracy of intonation (Murbe, Pabst, Hofmann & Sundberg, 2002).

Intonation is one of the first criteria to achieve good quality singing. Due to the continued advancement of visual technology in the teaching of intonation, singing pitch analysis can be done by connecting technology while understanding the fact of intonation as well as description of pitch. Pitch is the perceptual correlation of frequency (Smith & Sataloff, 1999). Under the current music education syllabus, the terminology of each musical sound is named as "pitch" in terms of intonation in singing. In the computational analysis, the *average fundamental frequency* (f_o) is displayed in waveforms, and each musical sound can be represented scientifically as "fundamental frequency". However, there is a significant difference between *frequency* and *pitch.* Frequency in this context refers to physics but pitch is normally meant for psychology.

Overview of Singing in Malaysian Music Education

Most of our modern education system in Malaysia was established during the British governance. This includes our formal music education which was greatly influenced by British governance. These influences include popularisation of piano instruction and grade exam, development of marching band as by the Ghurkha regime and choir singing in church and school. The three musical activities mentioned above are the main activities in present education scene. For example, there are students taking examination of ABRSM; involve themselves in the organisation of brass band competition as well as taking part in choir competition yearly.

In addition to this, western music system dominates the musical activities in education scene as well as in the public. It is most seen and heard in the raising of patriotic song, "Negaraku" on television and radio as evidence. Besides, the traditional music practice like in the harvesting celebration in East Malaysia can be observed according each ethnic group and region.

With regard to singing competition in Malaysia, most of these events are meant for the purpose to gain popularity on the television stage besides being regarded as an effective ways to win prizes, whether in monetary or a contract form to release personal album. On other hand, the singings of folk songs are scarcely practiced, other than "Dikir Barat" of the Malays community, Canartic songs of the Indian community. Besides, folk traditions are practiced for tourism or research purposes. This includes Ulu Tembeling's Malay folk songs, song of the Kenyah and many more.

Choir singing is common in the secondary school co-curriculum activities. Besides choir, house singing competition and “Chuang Zuo” or song composition in Chinese area, are also popular among the youth nowadays. In all of these singing activities, music is based on Western music system which applies diatonic scales, chords and cadence, though the song text may be in other language.

Measurement for Accuracy in Singing

For evaluation purpose, measurement in music education essentially involves quantification of test data. This means the conducted test must involve a systematic method to assess singing. Similarly, procedures used for quantifying singing responses must also be systematic. Under music education guideline, it is the teachers’ responsibility to help students in understanding the matter of intonation correctly, with hope that the measured attempt in singing intonation accuracy can be used to improve precision and thus function in observation objectivity.

As a matter of fact to understand the level of singing intonation, the singing pitch measurement could be proven in laboratory. For example, speech laboratories provide a basis for subsequent objective and statistical treatment of test data (Howard, 2002). By considering the importance of singing as a core of the primary program it would be beneficial for educators to develop tools to evaluate intonation achievement accurately so that inaccurate students could be identified to receive remedial training.

Statement of Problem

Most of the cited studies used elementary school students as subjects in past research, resulted a lack of documentation in contemporary studies about pitch accuracy in the field of music education research in adult. Nevertheless, the pitch accuracy of students has never been investigated in Malaysia. In the Malaysian music education, research about singing intonation conducted in Malaysia is scarce.

In reality, some teachers cannot sing in pitch. It could be well observed from the yearly recruitment of the trainee teachers in Malaysia Teacher Training College who majoring music. Some of them cannot get the accurate pitch singing before they finish their study in music course (Kam, 2008). In view of this, if the teachers demonstrate with inaccurate pitch accuracy to the students, there is a possibility the students would follow the faulty pitch singing.

Over the last few decades the question of children or adults singing 'out of tune' has been studied in many different ways. Observations in the classroom and in students' choir practice or rehearsals revealed that many students have difficulties in acquiring correct intonation in singing. Most of the kindergartens and elementary school students were found could not sing correct pitch, this is confirmed when Aaron (1991) reported that 69% of the 4th, 5th, and 6th grader students in his study were inaccurate singers.

Buckton (cited in Welch, 1997) found that 30-40% of children aged 6-7 in various Western countries are unable to sing in tune. It is estimated that up to 40% of children in Western societies sing out of tune at the age of 5-6 years on entry of

compulsory state education (Welch, 1986, 1997; Welch & Murao, 1994; Rutkowski, 1996; Howard & Welch, 2005). In Italy the percentage of 'inability' in singing is higher (Tafuri, 2002). The pitch accuracy of boys declined from ages 5-7 in a study from England (Welch, Sergeant, & White, 1997).

The students' poor skill in using their singing voices when performing familiar songs provoked problems, a reflection of a broader educational problem for an individual student in most of the primary and secondary school students in Malaysia. For instance, with regards to the effect of singing familiar and unfamiliar music, intonation and pitch pattern inaccuracy is common among the students who sing the national anthem during weekly assemblies. This phenomenon has been statistically proven in the USA early seventies. The National Assessment of Educational Progress indicated that 50% of the 9-year-olds, 45% of the 13-year-olds, 35% of the 17-year-olds, and 30% of the adults were unable to sing the song *America* with acceptable pitch. This is one of the reasons in formulating the research rationale to find out the extent of students to singing inaccurately.

Learning to sing requires plenty of practice. It focuses on strategies that develop students' ability to read music notation accurately and sing it with correct pitches. Any inappropriate assessment of children voice during their growing year may lead to high incidence of singing inaccuracy. As a result, many of these children will continue to have similar singing difficulties when they grow up as adults (Bannan, 2000). Furthermore, due to a lack of standard parameters to be evaluated, the perceptual judgments are sometimes vague and aggravate the situation. For example, descriptive criteria such as "too high" or "too low" are often adopted in the Likert

scale ranking. This variability in accuracy of perceptual rating has heightened interest and development in electronic acoustic voice assessment. By using latest instrument, it is found more consistent than the perceptual methods and can reveal the information that is not picked up by the ear (Liu & Channell, 1995).

At present, most of the researches are conducted mostly in Western country. Malaysia is unique where students not only sing songs with Western based musical system but also sing songs that related to other countries' and religion. However, the relationship of pitch accuracy in singing and the nature of selected singing task is not clear. As such, in order to create a more systematic and reliable way of evaluating singing inaccuracy, a more quantitative way has been carried out to measure student singing pitch accuracy. This will hopefully result in a more convenient, efficient, reliable, lesser error and eventually able to match pitch with minimal prompting.

This study addresses the following questions:

Is pitch inaccuracy a problem in the singing in school in Malaysia? If so, what are the characteristic of tonal patterns that contributing pitch accuracy among the Malaysia student?

Research Objectives

The objective of research is to determine accuracy of singing of selected patterns, applying different scales and contours by secondary school students.

Specific objectives are as follow:

1. To determine the pitch accuracy of singing patterns according to form level.
2. To determine the pitch accuracy of singing patterns according to gender.
3. To determine the pitch accuracy of singing patterns according to scale type, using diatonic major and pentatonic scale.
4. To determine the pitch accuracy of singing patterns according to pitch contour, using ascending and descending patterns.

Research Hypotheses

1. There is no significant difference in pitch accuracy of singing patterns according to form levels.
2. There is no significant difference in pitch accuracy of singing patterns according to gender difference.
3. (a) There is no significant difference in pitch accuracy in singing ascending patterns using diatonic major and pentatonic scale.

   (b) There is no significant difference in pitch accuracy in singing descending patterns using diatonic major and pentatonic scale.
4. (a) There is no significant difference in pitch accuracy in singing diatonic patterns using ascending and descending contour.

   (b) There is no significant difference in pitch accuracy in singing pentatonic patterns using ascending and descending contour.

Significance of Study

In response to the concern over the measurement of pitch accuracy among Malaysian students, this research is carried out to address the matter. By using computer software in intonation measurement, the evaluation would reveal the ability of students in matching the research-designed pitch patterns. The study explores the effects of two different song elements (scale type and pitch contour) on singing skills, pitch accuracy.

The measurement of pitch accuracy allows music teachers and researchers to examine different types of musical materials. It can be considered an evaluation in singing assessment at schools, specifically in teaching singing and choir rehearsals. To improve the in-tune singing among the secondary school students, the results obtained from this study are expected to reveal and help in understanding whether certain tonal patterns which are sung inaccurately should be emphasised in the singing syllabus.

It is hoped that this research would contribute to acquiring knowledge of pitch accuracy measurements because it provides a concrete feedback for evaluating singing intonation in a scientific manner and enables the quantifiable information to be shared with students. This forms the premise of investigating the use of technology in singing lessons of the future.