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A Study on Performance of Mandarin Speaking Test among Non-Native Speakers through Bio-Feedback

Yong Ying Mei, Sharifah Intan Safina Syed Zubir and Muhammad Nubli Abdul Wahab
Centre for Modern Languages and Human Sciences, Universiti Malaysia Pahang,
Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

Abstract: The advantages of mastering Mandarin as a Foreign language may increase competence among students in working fields in future, especially those who are able to communicate in Mandarin well. In Universiti Malaysia Pahang (UMP), the number of students enrolling in Mandarin course is increasing every year. However, some students demonstrate good performance in Mandarin speaking test while some students are weak. This study investigated the student's performance in Mandarin speaking test between good performers and weak performers through bio-feedback, specifically Heart Rate Variability (HRV). A total of 86 non-Chinese students from Mandarin for intermediate course took part as the respondents. A total of 30 out of the 86 students were chosen as focus group. The research instruments included Mandarin speaking script, bio-feedback instrument and Mandarin speaking test evaluation form. The frequency analysis by HRV aimed to investigate the level of stress and relax on Mandarin speaking test among focus group students. The finding shows the comparison of the performance of the Mandarin speaking test between good performers and weak performers through HRV. From this study, it can be concluded that positives stress will motivate students to perform well while too relax can cause student's performance weak in Mandarin speaking test. Therefore, the balance of stressful and relax by controlling emotion can influence to student's performance in Mandarin speaking test.

Key words: Speaking test, language performance, biofeedback, heart rate variability, Mandarin as a Foreign language, demonstrate

INTRODUCTION

Recently, the awareness among undergraduates about the roles of acquiring foreign languages is significantly surfaced. There are many advantages in acquiring a new language among undergraduates. Among the advantages of learning a foreign language is that undergraduates become more competent in handling situations at their workplace when they start working after graduation. This will be an added value to these students and therefore, increase their marketability. In line with the boom in China economy, the population of people who learn Mandarin as a foreign language in the world has increased. Until 2015, 500 Confucius institutes were established worldwide and 1000 Confucius classrooms were launched. It was recorded that 1,900,000 students registered for Mandarin courses offered.

Realising this situation, Universiti Malaysia Pahang (UMP) a public university in Malaysia has made the initiative in offering Foreign language courses to its students. Foreign languages offered are Mandarin, Japanese, German, Arabic, Spanish and Turkish. For Mandarin course specifically, UMP offers two levels of Mandarin as a Foreign language course where only 1 credit is allocated for each level with 2 contact hours per week for 14 weeks. Assessment methods that the students have to fulfil while enrolled in these courses include listening, speaking, reading and writing test.

Based on UMP graduation requirement, all undergraduates are required to learn two credit hours of Foreign language as their elective course. Since, each Foreign language course carries only one credit hour, students can choose two different Foreign language courses or one Foreign language course but for two levels: beginner and intermediate.

Among students who are enrolled in Mandarin courses offered by UMP are non-Chinese students. Non-Chinese students learn Mandarin language through hanyu pinyin, a Mandarin phonetic system which is in the form of alphabets with tones. As Mandarin language courses offered are one credit hour courses, students attend classes for 28 h per semester only or 2 h per week

Corresponding Author: Yong Ying Mei, Centre for Modern Languages and Human Sciences, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

for a duration of one semester (14 weeks). Therefore, learning Mandarin language through hanyu pinyin theoretically assists non-native students in mastering Mandarin language spoken skills quickly. Students who choose Mandarin as their elective courses take part in Mandarin for beginners course first before enrolling in Mandarin for intermediate course as the second credit hour for Foreign language course.

From the observation of the researchers in order for students to master a language, they must practise by speaking in the language. This is helped by speaking assessments administered towards them which include individual speaking test, group presentation, question and answer and also group discussion. As an example, to present during a public speaking a student has to prepare his or her script beforehand, memorise it and also practise. These processes carried out by the students enable the students to master the language.

Problem statement: The increasing number of students enrolling in Mandarin as a Foreign language classroom motivated the initiation of this study. It is observed that cognitive performance is different among non-native speakers in Mandarin speaking assessments, especially among non-Chinese students learning Mandarin as a Foreign language. Some students demonstrate good performance in Mandarin speaking test while some students are weak. Among factors that affect student's performance in public speaking factors are anxiety which causes stress among students, accuracy and environment. A number of studies have been conducted using questionnaire however, there are no studies conducted which measure student's stress/relax score scientifically.

Objective: Using coherence ratio score to measure stress or relax score of the learners, the study aimed to:

- Investigate average heart rate, coherence ratio score (low, medium, high) and accumulated coherence score among good performers between speaking test 1 and 2
- Investigate average heart rate, coherence ratio score (low, medium, high) and accumulated coherence score among weak performers between speaking test 1 and 2
- Investigate average heart rate, coherence ratio score (low, medium, high) and accumulated coherence score between good performers and weak performers on Mandarin speaking test

Literature review: Speaking assessment is an important element in learning Mandarin as a Foreign language. Students learn a Foreign language with the aim to communicate in the particular language. In order to understand the subject of learning a Foreign language, many studies were conducted on this particular subject, especially focusing on studying pronunciation and grammar of the language, elements which are assessed during speaking assessments. Currently, studies involving bio-feedback which investigate stress or relax level among learners of Mandarin as a Foreign language are absent. Overall, the study intended to use bio-feedback method in exploring stress or relax level of non-native speakers during Mandarin speaking assessments.

When addressing the issue of anxiety in learning in a Foreign language, Horwitz is one of the earliest figures doing research in this area. He also brought forward a general theory about Foreign language classroom anxiety (Horwitz, 1995, 2001; Horwitz *et al*., 1986; Horwitz and Young, 1991, 1989). Furthermore, Horwitz *et al.* (1986) presented three components of foreign language anxiety which are communication apprehension, test anxiety and fear of negative evaluation.

A number of subsequent studies further support Horwitz's findings. MacIntyre and Gardner (1991) studied 94 first-year college students in Canada using nine anxiety scales: classroom anxieties, french use anxieties, trait anxieties, computer anxieties, test anxieties, audience sensitivity, state anxieties, paired associates and vocabulary test. The students who demonstrate low communicative anxiety tended to have higher scores on free recall on the paired-associates learning task and oral and written vocabulary tests. Thus, a conclusion is made where "the results presented tend to indicate that anxiety leads to deficits in learning and performance". This study affirmed Horwitz *et al.* (1986)'s generalizations in communicative apprehension and social-evaluative anxiety which were asserted to have a damaging effect on learner's production.

The current study observes learner's self-control and heart rate variability when learning Mandarin as a Foreign language. Self-control is one's capacity to inhibit or modify dominant impulses related to thoughts, behaviours or emotions and is a main factor for success in goal-oriented behaviours within a wide range of domains including activities like exercising, healthy eating, job and school performance (Ridder *et al*., 2012). This is closely related to anxiety learners feel when performing their speaking tasks in the classrooms.

On the other hand, Heart Rate Variability (HRV) has been indicated as a correlate of self-control (Baumeister *et al*., 2007). HRV is the beat-to-beat variation in heart rate and reflects the interplay between

sympathetic and parasympathetic influences on heart rate. The flexibility of the autonomous nervous system which is necessary to modulate cardiac activity according to changing situational demands arising from changes in physiological as well as psychological states further explains HRV (Appelhans and Luecken, 2006). In regards to this study, speaking assessments conducted in the Mandarin classrooms cause the changes among learners.

In enhancing HRV, there are studies which show the beneficial e ffects of Tai Chi (Motivala *et al*., 2006; Chang *et al*., 2008). Besides, yoga can also improve HRV (Krishna *et al*., 2014). By observing learners stress or relax levels during Mandarin speaking assessments, better ways to help them can be initiated and their needs when learning a Foreign language can be better understood.

MATERIALS AND MEHTODS

Respondents: A total of 86 students from Mandarin for Intermediate course took part as the respondents as presented in Table 1. All of the respondents were non-native speakers from Mandarin for Intermediate course. They were non-Chinese students, namely Malay, Indians, Dusun and Melanau. About 32% of the students were from Mandarin class of Section 01G while students from Mandarin class of Section 02G and Section 05G were of the same percentages which were 34%.

A number of 30 of the 86 students were chosen as the focus group as seen in Table 2. From these students in the focus group, 15 students were good performers and 15 students were weak performers in Mandarin speaking tests. For each Mandarin class, five good performers and 5 weak performers were chosen in their Mandarin speaking test.

The grades achieved in the Mandarin speaking test among the focus group students are shown in Table 3. The Mandarin speaking test was an individual speaking test with the percentage of 15. The good performers scored Grade A in the Mandarin speaking test which was between 13 until 15%. The weak performers got the marks of between 7-9% with Grade C. None of the students scored marks of <7% and failed in the speaking test.

Research instruments: The instruments of the study were Mandarin speaking script, bio-feedback instrument and Mandarin speaking test evaluation form. Students were given a same Mandarin speaking script with the title "My Travel Experience". This was to control the variable of the speaking test where all students had to present same content during the speaking test. The Mandarin speaking script had 18 sentences and students should fill in some vocabularies that they have learnt. The

Table 1: Respondents

Mandarin class	No.	Percentage
Section 01G	28	32
Section 02G	29	34
Section 05G	29	34
Total	86	100

Table 2: Focus group students

Mandarin classes	No. of good performers	No. of weak performers	Total of respondents
Section 01G	5	5	10
Section 02G	5	5	10
Section 05G	5	5	10
Total	15	15	30

Table 3: Grade of Mandarin speaking test among focus group students

Focus groups	Grade	Marks (%)
Good performers	A	13-15
	B	10-12
Weak performers	C	7-9
	D	4-6
	E	1-3

second research instrument was emwave. Emwave is a bio-feedback instrument to display Heart Rate Variability (HRV) of students by using USB ear sensors. The power spectrum displays the amplitude of various frequency components in heart signal such as Heart Rate (HR), Coherence Ratio (CR) and Accumulated Coherence Score (ACS). Coherence Ratio (CR) has three components there are Low Coherence Ratio (LCR), Medium Coherence Ratio (MCR) and High Coherence Ratio (HCR). It provides frequency analysis by heart rhythm of students. Heart Rate Variability (HRV) aims to investigate the level of stress and relax on Mandarin speaking test and rest time among focus group students.

The third research instrument was Mandarin speak test evaluation form. The evaluation form evaluate in 3 components which are language, accuracy and time. The total percentage of the Mandarin speaking test was 15% in which each component carried a weightage of 5%.

Research procedure: The Mandarin speaking test was run after the students learnt Mandarin for 40 h. Travelling topics was taught in Mandarin course. Respondents were requested to describe their experience in travelling in Mandarin within 1 min which consisted of eighteen sentences in Mandarin. The Mandarin speaking performance was evaluated by using the Mandarin speaking test evaluation form.

All students sat for the Mandarin speaking test twice which were speaking test 1 and 2. The contents of both speaking tests were the same. Before the Mandarin speaking test, students were invited to have a sit and they clipped the USB ear sensors on their ears. They were given 3 min to rest before beginning speaking test 1.

Then, students were requested to present their Mandarin speaking in front the class and HRV was recorded. Students were requested to repeat the steps as before after taking a rest for another 3 min and to have speaking test 2 during the second time.

RESULTS AND DISCUSSION

This study discusses description of performance of Mandarin speaking test between good performers and weak performers through HRV.

Comparison of performance between Mandarin speaking test 1 and Mandarin speaking test 2 among good performers through HRV: The HRV investigates the average heart rate, average score of coherence ratio and accumulated coherence score among good performers between Mandarin speaking 1 and Mandarin speaking test 2 as presented in Table 4.

A total of nine out of 15 good performers showed decrease in average heart rate and five good performers showed increased average heart rate in speaking test 2. Only one good performer did not show any change in average heart rate in speaking test 2. The result showed that most good performers were able to control their emotions during the Mandarin speaking test.

A total of nine out of 15 good performers demonstrated decreased percentage in low coherence ratio between speaking test 1 and 2 and four good performers maintained a same percentage in low coherence ratio. The results showed that stress of good performers decreased. Only two good performers felt stress in the Mandarin speaking test and had an increase in low coherence ratio between speaking test 1 and 2. The medium coherence ratio shows that the respondents were relaxed in the Mandarin speaking test. Eight out of 15 good performers had an increase percentage in medium coherence ratio between speaking test 1 and 2 and they were relaxed in the speaking test. Only three good performers showed decreased percentage in medium coherence ratio between speaking test 1 and 2 and four good performers showed no change in in medium coherence ratio.

Percentages in high coherence ratio show the balance between stressful and relaxed respondents. Out of the 15 good performers, 12 of them had no change in high coherence ratio between speaking test 1 and 2. Only three good performers showed an increased percentage in high coherence ratio and nobody had a decreased percentage in high coherence ratio. The result shows that all good performers had a balance between stressful and relaxed and they were good in controlling their emotions.

In accumulated coherence score, nine of the 15 good performers showed improvement. Only two good performers showed a decrease in accumulated coherence score and four good performers have no change in accumulated coherence score. The result shows that students have good performance in Mandarin speaking and increased in accumulated coherence score.

Comparison of performance between Mandarin speaking test 1 and Mandarin speaking test 2 among weak performers through HRV: Table 5 shows the comparison of performance between Mandarin speaking test 1 and Mandarin speaking test 2 among weak performers through HRV. Two out of the 15 weak performers had an increase in average heart rate and 9 weak performers showed a decreased average heart rate in speaking test 2. Only 4 weak performers showed no change in average heart rate in speaking test 2. The result shows that most weak performers were able to control their emotion in the Mandarin speaking test (Appendix 1 and 2).

Table 4: Comparison of performance between Mandarin speaking test 1 and Mandarin speaking test 2 among good performers through HRV

Performers	No. of good performers in average heart rate	No. of good performers in low coherence ratio (stress)	No. of good performers in medium coherence	No. of good performers in high coherence ratio (balance) ratio (relax)	No. of good performers in accumulated coherence score
Increase	5	2	8	3	9
Decrease	9	9	3	0	2
No change	1	4	4	12	4
Total of good performers	15	15	15	15	15

Table 5: Comparison of performance between Mandarin speaking test 1 and Mandarin speaking test 2 among weak performers through HRV

Performance	No. of weak performers in average heart rate	No. of weak performers in low coherence ratio (stress)	No. of weak performers in medium coherence ratio (relax)	No. of weak performers in high coherence ratio (balance)	No. of weak performers in accumulated coherence score
Increase	2	8	4	5	4
Decrease	9	5	8	3	8
No change	4	2	3	7	3
Total of weak performers	15	15	15	15	15

Table 6: Comparison of performance in Mandarin speaking test between good performers and weak performers through HRV

	Average heart rate		Average of low coherence ratio (%)		Average of medium coherence ratio (%)		Average of high coherence ratio (%)		Accumulated coherence score	
Variables	GP	WP	GP	WP	GP	WP	GP	WP	GP	WP
Mean	101.23	93.47	85.20	76.56	12.0	13.46	2.86	10.00	1.7	6.00
Min.	79.50	65.00	30.50	24.50	0.0	0.00	0.00	0.00	0.0	0.00
Max.	115.00	150.00	100.00	100.00	49.0	34.50	21.00	43.50	10.0	22.50
Medium	97.25	107.50	65.25	62.25	24.5	17.25	10.50	21.75	5.0	11.25

The 8 of 15 weak performers had an increase percentage in low coherence ratio between speaking test 1 and 2 and the results show that their stress level increased in the Mandarin speaking test. The 5 weak performers had a decrease in low coherence ratio between speaking test 1 and 2. Only 2 weak performers maintained a same percentage in low coherence ratio between speaking test 1 and 2.

The medium coherence ratio shows the respondents were relaxed in the Mandarin speaking test. The 8 of the 15 weak performers had a decrease percentage in medium coherence ratio between speaking test 1 and speaking test 2 and they were not relaxed in speaking test. The 4 weak performers felt relaxed and had an increase percentage in medium coherence ratio in the Mandarin speaking test. Only 3 weak performers showed no change in medium coherence ratio.

Percentages in high coherence ratio show a balance between stressful and relaxed among respondents. The 7 of the 15 weak performers had no change in high coherence ratio in the Mandarin speaking test. The 5 weak performers had an increase percentage in high coherence ratio. Only 3 weak performers showed a decrease percentage in high coherence ratio. The result shows that only few weak performers were able to balance between stressful and relaxed conditions in the Mandarin speaking test.

The 8 of the 15 weak performers showed a decrease in accumulated coherence score in the speaking test. Only 4 weak performers showed an improvement in accumulated coherence score and three weak performers showed no change in accumulated coherence score. The result shows that students have weak performance in Mandarin speaking and decrease in accumulated coherence score.

Comparison of performance on Mandarin speaking test between good performers and weak performers through HRV: The comparison of performance in Mandarin speaking test between good performers and weak performers through HRV is as presented in Table 6. The result shows that the average heart rate of good performers on Mandarin speaking test was higher than weak performers which were 101.23 and 93.47. The minimum of average heart rate among good performers was 79.5 while for weak performers was 65. Besides that, the maximum of average heart rate of weak performers was higher than good performers which were 150 and 115, respectively.

The mean of average of low coherence ratio between good performers and weak performers were 85.2 and 76.56%. The good performers scored minimum average of low coherence ratio which was 30.5% while the maximum of low coherence ratio was 100%. However, the weak performers scored minimum averages of low coherence ratio and maximum of low coherence ratio of 24.5 and 100%. The medium of low coherence ratio among good performers (65.25%) was higher than weak performers (62.25). The data shows that the stress level of good performers was higher than weak performance. Hans Selye proposed positive and negative stress. His study shows that not all stress is bad for people, that in fact, some stress is good for people and they depend on the responses of people in stress (Szabo *et al*., 2012). In fact, positives stress will motivate students to perform well.

Average of medium coherence ratio shows the score of relaxed condition among students. The mean of average of medium coherence ratio between good performers and weak performers were 12 and 13.46%. The good performers showed the minimum average of medium coherence ratio which was 0 and 49% was the maximum average of medium coherence ratio. In contrast, minimum and maximum of the average of medium coherence ratio among weak performers were 0 until 34.5%. The medium shows that the good performers were relaxed than the weak performers with the score of 24.5% which was higher than 17.25%.

The balancing of stress and relax is shown in average of high coherence ratio. The mean of high coherence ratio among weak performers was 10% while the good performers only scored 2.86%. The minimum and maximum of average high coherence ratio between good performers and weak performers were 0 until 21 and 0 until 43.5%. The

medium of average high coherence ratio among good performers was 10.5% while the weak performers scored 21.75%.

The mean of accumulated coherence score shows that weak performers was higher than good performers, with 6 and 1.7%, respectively. The minimum and maximum of accumulated coherence ratio between good performers and weak performers were 0 until 10 and 0 until 22.5%. The weak performers scored medium of accumulated coherence ratio that was higher than good performers with 11.25 and 5%, respectively.

CONCLUSION

Previous research have evidently shown that language performance by questionnaire did not demonstrate the score of stressful and relaxed conditions among students. Several sources have used the HRV in study of mathematic, athlete, anxiety and others. However, these studies did not show the score or performance of respondents in average heart rate, average coherence ratio (low, medium and high) and accumulated score. Therefore, this study has been conducted by using a bio-feedback instrument which is emwave to investigate language performance in Mandarin speaking test between good performers and weak performers through HRV.

The findings of this study show that most of the good performers showed decrease in average heart rate between speaking test 1 and 2. Stress of good performers were decrease during Mandarin speaking test 1 and Mandarin speaking test 2 while increasing in relax score. The result shows that students have good performance in Mandarin speaking and increased in accumulated coherence score. In proof good performers were good in controlling their emotions during Mandarin speaking test.

On the other hand, the score of stress increased among weak performers between Mandarin speaking test 1 and Mandarin speaking test 2 while decreasing in relax score. Decreased in accumulated coherence score shows that students were unable to controlling their emotion during Mandarin speaking test, they were perform weak in Mandarin speaking.

The result shows that the average heart rate of good performers in Mandarin speaking test was higher than weak performers which is 101.23 and 93.47. The good performers scored minimum average of low coherence ratio which was 30.5% while the maximum of low coherence ratio was 100%. However, the weak performers scored minimum average of low coherence ratio and maximum of low coherence ratio of 24.5 and 100%. From the mean of low coherence ratio shows that good performers were stressful than weak performers. The minimum score of stress among good performers (30.5%) was higher than weak performers (24.5%). In addition, the medium of low coherence ratio among good performers (65.25%) was higher than weak performers (62.25). The data shows that the stress level of good performers was higher than weak performers. Overall, it was found out from the study that positive stress will motivate students to perform well.

Furthermore, the result of relax score in Mandarin speaking test between good performers and weak performers were contrary with the stress score. The mean of medium coherence ratio shows that weak performers were relax than good performers. It was found that too relaxed among students can cause weak performance in Mandarin speaking test.

In fact, the responses of students in stress and relax were influence their performance in Mandarin speaking test. The positive stress can motivate students to perform well while the negative stress can cause students anxiety. On the other hand, too relax can cause students did not motivate to perform in Mandarin speaking test. However, appropriate to relax can increase the student's performance in Mandarin speaking test. it can be concluded that the balance of stressful and relax by controlling emotion can influence to student's performance in Mandarin speaking test.

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Appendix 1: Sample script of Mandarin speaking test

My travel experience
Good morning/afternoon everyone
I have been travel to country A
I travel to country A on time A
I go to country A by transport A
Taking transport A is faster/slower than transport B
Place A is far/near to my house
I go to place A by transport C
I travel from state to country A
I go to travel with people A
I bring object A to travel
I think country A very enjoyable
My friend travel to country B
I have not travel to country B
I travel to country B next time
I travel to country B by transport D
Taking transport D to country B is very far/near
Taking transport D to country B is the fastest/slowest

Appendix 2: Centre for modern languages and human sciences UHF 2111 Mandarin for intermediate SEM II 2015/2016 speaking test 1 (15%) evaluation form (1 min presentation)

Title presenter day/date	Matric No. time descriptors					
	0	1	2	3	4	5
Appropriate and varied choice of words according to the topic	Choice of words is inappropriate and not varied to the topic and level of communication	Choice of words is inappropriate and contains words which are overly used and repeated	Choice of words is fairly appropriate and contains words which are overly used and repeated	Choice of words is moderately appropriate and contains words which are slightly varied	Choice of words is appropriate and good and contains words which are varied	Choice of words is appropriate and excellent and contains words which are varied
Clear and appropriate pronunciation	Pronunciation is not clear and incorrect	Pronunciation occasionally correct but often hesitant and inaccurate	Pronunciation sometimes correct but sometimes hesitant and inaccurate	Pronunciation and intonation are usually correct and indicate moderate confidence	Pronunciation and intonation are always correct and indicate confidence	Pronunciation and intonation are always correct and indicate high confidence
Time management	Too short or too long (10 min)	Too short or too long (8 min)	Too short or too long (5 min)	About 2-3 min less or more	About 1 min less or more	Within allocated time

Descriptors		Presenter					
Language (5 marks)	Choice of words is appropriate and excellent and contains words which are varied	0	1	2	3	4	5
Accuracy (5 marks)	Pronunciation and intonation are always correct and indicate high confidence	0	1	2	3	4	5
Time management (5 marks)	Very fluent within allocated time	0	1	2	3	4	5
Total marks					/15		

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