THE EFFECTS OF A VOCAL MUSIC METACOGNITION E-LEARNING (VM-MEL) MODULE ON MUSIC METACOGNITIVE AWARENESS, SELF-DIRECTED LEARNING AND SINGING PERFORMANCE ACHIEVEMENT OF PRESCHOOL EDUCATION COLLEGE STUDENTS IN CHINA

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UNIVERSITI SAINS MALAYSIA

2025

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by

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Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

January 2025

ACKNOWLEDGEMENT

Reflecting on the past four years of my doctoral studies, this period undoubtedly represents the most fascinating and meaningful chapter of my life, leaving an indelible mark. Firstly, I express my deepest gratitude to my doctoral supervisor, Dr. Pravina, who has guided every step of my academic journey with her profound knowledge and selflessness. I remember when I first arrived in Malaysia and unfortunately contracted COVID-19, it was Dr. Pravina's encouraging words during my most challenging times that brought me unprecedented warmth and strength.

I am equally thankful to my co-supervisor, Professor Cui, who not only introduced me to the gateway of academic research but also provided a wide horizons for my academic growth. I must also acknowledge my wife, Mrs. Dai, who, while pursuing her own studies, took care of our two children. Her support has been a solid pillar throughout my academic journey.

Additionally, during the completion of my thesis, I received immense help from many friends, including Dr. Ma from Shandong University of Commerce. Teachers and students from Fuzhou Preschool Education College and Jinan Preschool Education College. I extend my sincerest thanks to all of them.

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LIST OF ABBREVIATIONS

APRIOSV	Auditory-Perceptual Rating Instrument for the Operatic Singing Voice Scale
CFA	Confirmatory Factor Analysis
CON	Control Group
EFA	Exploratory Factor Analysis
EXP	Experimental Group
MAI	Metacognitive Awareness Inventory
MCK	Musical Conditional Knowledge
MDK	Musical Declarative Knowledge
MOOC	Massive Open Online Courses
MPK	Musical Procedural Knowledge
MSML	Metacognition Scale for Music Learning
SBI	Stanford-Binet Intelligence Scales
SDL	Self-Directed Learning
SMMT	Seashore Measures of Musical Talents
VM-MEL	Vocal Music Metacognition E-learning

LIST OF APPENDICES

KESAN MODUL PEMBELAJARAN ELEKTRONIK METAKOGNISI MUZIK VOKAL (VM-MEL) KE ATAS KESEDARAN METAKOGNITIF MUZIK, PEMBELAJARAN KENDIRI DAN PENCAPAIAN PRESTASI NYANYIAN PELAJAR KOLEJ PENDIDIKAN PRASEKOLAH DI CHINA

ABSTRAK

Dalam tahun-tahun kebelakangan ini, e-pembelajaran semakin digunakan sebagai mod pembelajaran dalam pendidikan muzik vokal. Namun, peralihan dari pengajaran tatap muka tradisional ke persekitaran dalam talian membentangkan pelbagai cabaran. Guru sering kali sukar menyesuaikan diri dengan kaedah pengajaran baru, dan pelajar sering kali kekurangan strategi pembelajaran kendiri yang berkesan. Penyelidikan menunjukkan bahawa metakognisi adalah kaedah penting untuk meningkatkan pembelajaran kendiri dan prestasi akademik dalam tetapan e-pembelajaran. Sehubungan itu, kajian ini membangunkan modul E-Pembelajaran Metakognitif Muzik Vokal (VM-MEL), yang menggabungkan strategi pembelajaran metakognitif dan kendiri untuk meningkatkan kesedaran metakognitif, kemampuan pembelajaran kendiri, dan prestasi menyanyi para pelajar. Menggunakan reka bentuk kuasi-eksperimen, penyelidikan ini membandingkan prestasi kumpulan eksperimen (38 peserta) dengan kumpulan kawalan (42 peserta) sebelum dan selepas program latihan selama lapan minggu, disokong dengan temu bual bersama peserta untuk menilai keberkesanan pengajaran modul VM-MEL. Hasil kajian menunjukkan bahawa VM-MEL secara signifikan meningkatkan kesedaran metakognitif, pembelajaran kendiri, dan prestasi menyanyi pelajar. Modul VM-MEL, menawarkan strategi pengajaran dan pembelajaran kendiri yang praktikal untuk pendidik muzik dan pelajar.

Penggunaan meluas modul ini akan memastikan peluang pembelajaran yang adil untuk para pelajar, membolehkan mereka belajar secara bebas pada bila-bila masa dan di mana saja.

THE EFFECTS OF A VOCAL MUSIC METACOGNITION E-LEARNING (VM-MEL) MODULE ON MUSIC METACOGNITIVE AWARENESS, SELF-DIRECTED LEARNING AND SINGING PERFORMANCE ACHIEVEMENT OF PRESCHOOL EDUCATION COLLEGE STUDENTS IN CHINA

ABSTRACT

In recent years, e-learning has increasingly been adopted as a learning mode in vocal music education. However, the transition from traditional face-to-face teaching to online environments presents multiple challenges. Teachers often struggle to adapt to new instructional methods, and students frequently lack effective Self-Directed Learning (SDL) strategies. Research highlights metacognition as a crucial method for enhancing SDL and academic performance in e-learning settings. Accordingly, this study developed the Vocal Music Metacognition E-Learning (VM-MEL) module, which combines metacognitive and SDL strategies to enhance learners' metacognitive awareness, SDL capabilities, and singing performance. Using a quasi-experimental design, this research compared the performance of an experimental group (38 participants) with a control group (42 participants) before and after an eight-week training programme, supplemented by interviews with participants to evaluate the instructional effectiveness of the VM-MEL module. The results revealed that VM-MEL significantly improved students' metacognitive awareness, SDL, and singing performance. The VM-MEL module, offers practical teaching and SDL strategies for music educators and students. The widespread adoption of this module will ensure equitable learning opportunities for learners, enabling them to study independently at any time and place.

CHAPTER 1

INTRODUCTION

1.1 Background

As digital technology progresses, Electronic Learning (e-learning) is increasingly being adopted and is transforming traditional methods of music education (Karkina et al., 2023). E-learning involves utilising electronic tools and Internet technology to facilitate education and learning. It offers flexibility, a wealth of resources, and personalised learning experiences, thus gaining widespread acceptance (Kurteva et al., 2023).

In response to the global demand for high-quality education and to promote educational equity, numerous countries have developed plans for e-learning advancement. For example, in 2020, Malaysia launched 'Flexible Learning Pathways in Malaysian Higher Education,' which includes initiatives to promote open and distance learning and Massive Open Online Courses (MOOC) (Nordin et al., 2021). The United States has recognised online e-learning as an integral part of its long-term educational strategy (Legon et al., 2020). Similarly, in April 2020, the Chinese Ministry of Education launched several MOOC platforms, aimed at providing remote e-learning solutions to learners worldwide (Xiong et al., 2021).

The sudden outbreak of the Covid-19 pandemic in 2020 led to stringent travel restrictions and, more importantly, impacted multiple sectors including education. This gave rise to more institutions adopting e-learning modes of instruction (Maatuk et al., 2022). Consequently, many vocal music learners were compelled to adopt e-learning and SDL approaches (Liao, 2020). Today, even though the pandemic has subsided and face-to-face teaching has resumed globally, e-learning methods, having

been embraced extensively, continue to be widely accepted due to their convenience (Rivera et al., 2024; Yablochnikova et al., 2023).

Maatuk et al. (2022) and other researchers have explored issues within the e-learning environment, highlighting the critical role of SDL capabilities in ensuring efficient learning outcomes (Angriani & Nurcahyo, 2019; Zhu et al., 2020). The importance of these skills is underscored due to the absence of direct teacher supervision and peer interactions in e-learning settings (Chau et al., 2021). As a result, it is imperative for students to enhance their SDL skills to effectively manage their learning progress and maintain quality (Chau et al., 2021; Onah et al., 2021; Zhu et al., 2020).

Metacognition is widely recognised as a vital approach for fostering SDL in e-learning environments (Alamolhoda & Zeinali, 2021; Marra et al., 2022). Metacognition was first introduced by Flavell in 1976 and has been described as the introspection into one's own cognitive processes. It involves the reflection and regulation of cognitive and behavioural activities (Flavell, 1976). Key metacognitive learning strategies derived from metacognition include self-monitoring, planning, evaluating practice effectiveness, and regulate learning methods (Craig et al., 2020, 2020; Schraw & Dennison, 1994). These strategies are particularly critical in e-learning contexts. Moreover, research suggest that enhancing metacognitive awareness can significantly improve problem-solving capabilities and learning efficiency (Duman & Semerci, 2019; Khellab et al., 2022; Molin et al., 2020a).

1.2 Problem Statement

In the field of vocal music e-learning, both teachers and students face significant challenges. Traditional singing instruction relies on face-to-face

interactions, enabling teachers to directly observe students' practicing progress and provide real-time feedback (Hoppe et al., 2006; Liao, 2020). However, research indicates that vocal music instructors encounter substantial difficulties in transitioning from conventional teaching methods to e-learning formats particularly in China (Liao, 2020). The shift to e-learning is often compromised by technological constraints, especially network latency and unstable connections, which drastically affect communication and interaction, thereby diminishing teaching and self-learning efficiency (Primov-Fever et al., 2022). A review of current literature revealed a lack of research on vocal music SDL in an e-learning environment in China.

In China, vocal music learners, particularly those in preschool education majors, encounter significant challenges. While these students receive foundational vocal music training as part of their college curriculum, they often lack the specialised and systematic approach in vocal music training (Zheng & Zhao, 2021). This insufficient training can lead to various difficulties during self-practice, especially in e-learning environments where the is an absence of direct teacher guidance (Bucura, 2020). These practice inefficiencies are not confined to preschool education students, as many novice musicians also face similar obstacles (Mieder & Bugos, 2017).

Several studies have indicated that musicians who employ metacognitive learning strategies not only learn more but also learn faster (Bonnaire & González-Moreno, 2023a; Concina, 2019; Hart, 2014). Notably, excellent musicians often exhibit pronounced metacognitive awareness and SDL, demonstrating significant skills in independent practice and continuous self-reflection (Kosokabe et al., 2021; Power & Powell, 2018). Existing studies confirm a positive correlation between metacognitive awareness and SDL (Karatas & Arpaci, 2021; Khodaei et al., 2022b).

This raises the question: can such metacognitive awareness and SDL abilities be effectively cultivated through structured music training? If music training can indeed enhance these abilities, identifying the effective teaching strategies and learning methods becomes crucial.

Furthermore, research indicates a positive reports on the connection between metacognition and academic achievement suggesting that the use of metacognitive learning strategies significantly enhances both SDL and academic performance (Brooks, 2022; Cer, 2019; Khellab et al., 2022; Khiat, 2017; Leary et al., 2019; Molin et al., 2020).The use of metacognitive learning strategies to improve SDL and performance achievement has been studied in the areas of reading, writing, language learning etc. (Brooks, 2022; Cer, 2019), while little research in the field of e-learning vocal music education. This gap highlights the need for a comprehensive study that integrates these strategies into vocal music education to improve learner's vocal music learning outcomes effectively.

While, previous research have explored the topic of vocal music e-learning, most of them have primarily concentrated on teaching strategies for instructors (Li, 2017; Liao, 2020; Yokuş, 2021). Within the context of preschool education in China, vocal music learners often require extensive self-practice, the mastery of musical skills depends on learners undertaking prolonged periods of SDL (Mieder & Bugos, 2017). Consequently, the provision of effective e-learning strategies and module for vocal music is critically needed.

1.3 Research Aims and Research Objectives

The current study aims to fill these gaps by developing and evaluating the effectiveness of the Vocal Music Metacognition E-learning (VM-MEL) module on the

Metacognitive Awareness, Self-Directed Learning (SDL) and Singing Performance Achievement of preschool education college students in China.

To achieve the aim, four research objectives were established:

i) To develop a Vocal Music Metacognition E-learning (VM-MEL) module for preschool education college students in China.

ii) To determine the effects of VM-MEL module on preschool education college students' metacognitive awareness.

iii) To assess the effects of VM-MEL module on preschool education college students' Self-Directed Learning (SDL).

iv) To evaluate the effects of VM-MEL module on preschool education college students' singing performance achievement.

The first objective of this study was the development of the VM-MEL module, a vocal music e-learning module grounded in metacognition and SDL theories. Specifically, this instructional component of VM-MEL module is designed based on metacognitive reflective strategies, integrating the steps of planning, monitoring, evaluating, and regulating from metacognitive learning strategies. By incorporating e-learning tools, it guides the design of self-directed singing practices. Particularly important is the use of digital recording tools which can provide learners with timely feedback, allowing for real-time monitoring of practice sessions. This design addresses the challenge in online learning where vocal music students struggle to judge the correctness of their practices, thereby effectively enhancing the efficiency of self-practice.

The second objective of this study was to determine the effects of the VM-MEL module on enhancing students' metacognitive awareness. This goal was set with the following considerations: First, improving metacognitive awareness allows students to monitor their learning behaviours and engage in self-assessment and regulation, which are importance skills in today's e-learning environments (Altıok et al., 2019a; Karatas & Arpaci, 2021; Khodaei et al., 2022b). Second, students with heightened metacognitive awareness are more capable of mastering and adapting their learning strategies, which is crucial for academic success (Bulmer et al., 2022; Khellab et al., 2022). Furthermore, as the need for lifelong learning capabilities grows in society, metacognitive awareness becomes increasingly vital for lifelong learning (Duman & Semerci, 2019).

The third objective was to assess the effectiveness of the VM-MEL module effectively enhances students' SDL abilities. SDL capability is considered a critical skill in educational processes, particularly in online environments where face-to-face guidance from teachers is lacking (Chau et al., 2021; Onah et al., 2021). Evaluating the VM-MEL module's effectiveness in fostering students' SDL helped determine its impact on promoting students' self-management of learning, altering their learning behaviours, and increasing their motivation in learning.

Finally, the fourth objective evaluated whether the VM-MEL module effectively improves students' singing performance achievement. Since the goal of educational models is to enhance student outcomes, exploring the impact of the VM-MEL module on students' singing performance provides empirical evidence necessary for the module’s future implementation and application.

1.4 Research Questions

To achieve the above-mentioned objectives, this current study addressed the following research questions:

i) What are the content and structure of Vocal Music Metacognition E-learning (VM-MEL) module for preschool education college students in China?

ii) What are the effects of VM-MEL module on metacognitive awareness of preschool education college students?

iii) How does the VM-MEL module effect on Self-Directed Learning (SDL) among preschool education college students?

iv) How does the VM-MEL module effect singing performance achievement of preschool education college students?

1.5 Significance of the Study

This research contains both theoretical, practical and innovation significance.

The theoretical significance of this study can be discussed from three aspects:

1. Expanding theoretical applications in music education. This study extends the application of metacognitive and SDL theories to the field of music education, thereby promoting interdisciplinary research between educational psychology and music pedagogy.

2. Enhanced research on improving music learning through metacognition. This study provides valuable insights into optimising the music

learning process through metacognition, aiding researchers in better understanding how metacognitive processes can enhance learning efficiency.

The practical significance of this study is threefold:

1. Enhancement of Teaching Practices. The research outcomes have the potential to shape music teaching methodologies, prompting educators to adopt more effective instructional approaches and enabling learners to acquire advanced SDL capabilities.

2. Improvement of Learning Efficacy. By employing strategies uncovered in this study, music learners are expected to make significant strides in metacognitive awareness, SDL capabilities, and vocal music performance.

3. Development of Educational Resources. The VM-MEL module, developed as part of this research, is designed to support students' independent learning and personalized progression within e-learning environments.

Furthermore, this study also presents innovative significance:

1. Innovation in intervention methods. Real-time feedback training in singing was first attempt employed to enhance learners' metacognitive awareness, providing a novel research perspective for the academic community on improving metacognitive awareness from a musical standpoint.

2. Innovation in research instruments. This study designed and validated metacognitive questionnaires and SDL questionnaires tailored for the music learning context, allowing for more accurate assessment of changes in metacognition and SDL within music education.

3. Innovation in theoretical integration. The novel attempt to combine metacognitive theory, SDL theory, and e-learning applied to the field of online vocal music education represents an innovative stride in theoretical synthesis.

1.6 Research Scope

This study focused on the changes in metacognitive awareness, SDL and singing performance achievement of college students after receiving VM-MEL module training. The research target sample was 80 preschool education major students at Preschool Education college in Fuzhou City, Jiangxi Province, China. These students participated in a structured learning process that received metacognitive learning strategies, online singing instruction, and self-directed practice within an e-learning environment.

The study was conducted in two phases: a pilot study from January to February 2022, and the main study from June to August 2022. To collect data on metacognitive awareness, SDL, and singing performance achievement, a quantitative approach was used, involving questionnaires and a quasi-experimental study. Additionally, a qualitative research method was employed, which used feedback forms and interview methods to determine teachers and students' perceptions or suggestions about e-learning.

1.7 Definition of Key Terms

Metacognition was first introduced by Flavell in 1976 and has been described as the individual's knowledge about his own cognitive processes and their outcomes or related aspects (Flavell, 1976). In educational psychology, it refers to the self-awareness and self-regulation of cognitive activities, enhancing learning efficiency through monitoring, evaluating, and adjusting strategies (Brown, 1987a; Flavell, 1979a). In music education, music metacognition is characterised as the active control of cognitive and regulatory processes in music learning (Roberts, 2011). In this study, metacognitive theory guides the development of teaching and learning strategies for music education. Specifically, teachers use metacognitive learning strategies to guide students in online vocal music learning. Students learn to employ metacognitive learning strategies, which facilitate more effective independent practice.

Metacognitive Learning Strategies are practical applications of metacognitive theory. It is known that metacognition provides a theoretical framework, while metacognitive learning strategies translate this framework into actionable methods for guiding real-world learning (McCabe, 2011). In this study, key strategies such as reflection, monitoring, evaluation, and regulation were identified and integrated into the teaching and SDL components of the VM-MEL module.

Metacognitive Awareness is an integral part of metacognition. Metacognition is a broad framework that includes cognitive process and regulatory strategies. Metacognitive awareness specifically refers to an individual's perception of their own metacognitive abilities within this framework (Abdelrahman, 2020; Altıok et al., 2019; Schraw, 2001). Given the expansive nature of metacognition, which poses challenges for detailed empirical investigation, this study concentrates on metacognitive

awareness—a distinct and measurable aspect of metacognition. This focus allows for precise assessment and improvement using targeted strategies and tools. Based on existing metacognitive awareness scales, a Music Learning Metacognitive Scale was developed to assess the impact of the VM-MEL module effectiveness on enhancing metacognitive awareness. This part will be discussed further in Chapter 3.

E-learning is an acronym for 'electronic learning', a collective term for any type of learning that takes place through electronic media, first coined by Elliott Masie (Masie, 1999). E-learning includes the use of computer and internet technologies, the application of e-learning tools, computer-assisted teaching, computer-assisted learning, and massive open online courses. E-learning also allows for the integration of teaching modules and instructional and SDL strategies (Aparicio et al., 2016). In this research, "E-learning" denotes vocal music instruction conducted by teachers using online video platforms, with students engaging synchronously via smartphones or laptops. Furthermore, students employ digital recording tools and smartphone applications to provide feedback, monitor, and evaluate their self-practice sessions. For additional information on the e-learning tools utilised in this study, please refer to Appendix L.

Self-directed Learning (SDL) was first introduced by Knowles (1975), who describes SDL as the process in which individuals actively set learning goals, identify learning resources, select learning strategies, and evaluate learning outcomes with the help of others or on their own. In this study, SDL primarily refers to the process in which students engage in self-practice of singing, learn metacognitive learning strategies and singing skills in an e-learning environment.

Singing Performance Achievements in the context of this study refers to outcomes in the field of singing performance that can be measured. These outcomes

are assessed according to uniform criteria by APRIOSV scale (see Appendix I) and include the following components: Ring, Pitch Accuracy, Breath Management, Evenness of Range, and Strain (Gupta et al., 2022; Oates, 2009).

Preschool Education College is a term used in China to refer to an educational institution that specialises in preparing students to become preschool teachers, primary school teachers or early childhood educators. The education goal of preschool education colleges is to cultivate high-quality and applied talents with the theoretical foundation, professional skills and management ability (Zheng & Zhao, 2021). Taking Preschool Education College in Fuzhou, China as an example, its curriculum system include preschool education, primary education and music education. In this research, the term Preschool Education College Students refers to students who are enrolled in these colleges.

1.8 Summary

With the widespread adoption of e-learning, there is currently a notable shortage of effective vocal music teaching strategies and SDL methods within the e-learning environment. Both vocal music students and teachers are challenged by a lack of effective metacognition learning and teaching module in the e-learning environment. Therefore, there is a need for further research on effective ways to promote metacognition awareness and SDL among vocal music students.

The current study, grounded in metacognition and SDL theories and utilising e-learning tools, developed the VM-MEL module as Research Objective 1. Following an eight-week metacognitive training programme, the module's effectiveness in enhancing participants' metacognitive awareness (Research Objective 2), SDL

abilities (Research Objective 3), and singing performance achievement (Research Objective 4) was empirically validated.

The theoretical significance of this study lies in the integration of metacognitive strategies into vocal music education through the adoption of an e-learning module. This approach advances interdisciplinary research by bridging educational psychology and music education. It explores methods to elevate metacognitive awareness during the vocal music learning process and addresses the traditionally low efficiency of self-practice in music education. Additionally, the VM-MEL module equips students with crucial metacognitive awareness and SDL, essential for success in online e-learning environments.

The next chapter will conduct a comprehensive literature review related to the key theories and concepts pertinent to this research. It will discuss the application of metacognition in music education, including methods for measuring and enhancing metacognitive awareness. The review will also examine the characteristics of SDL and strategies for developing such skills. Finally, it will outline the potential and practical applications of e-learning, particularly its integration with vocal music education, establishing a theoretical and research foundation for the VM-MEL module.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

How to promote music metacognitive awareness, Self-Directed Learning (SDL) and singing performance achievement among preschool education students in an e-learning environment is the impetus for the VM-MEL module proposed in this study. Through a review of past research, this chapter identifies three key themes in metacognition, SDL, and vocal music e-learning that will present a guide and framework for the development of the VM-MEL module.

Firstly, this chapter provides a comprehensive review of Metacognition theory, highlighting the concept of 'meta' and its distinction from cognition, as well as clarifying the components that make up metacognition. Through an analysis of relevant literature, the use of metacognition in music learning, measures of metacognitive awareness, and strategies that promote its development are discussed.

Next, SDL theory, another theoretical pillar of this study is discussed. Including the characteristics of SDL, with a focus on teaching strategies to enhance learners' SDL. In addition, the relationship between metacognition and SDL and methods of measurement are reviewed and summarised.

The last section concludes with a discussion of the definition and the potential of e-learning, and practical applications of vocal music, metacognition, and SDL within the realm of e-learning. Through meticulous review of current literature, a solid foundation can be laid for the design of the VM-MEL module in this study.

2.2 Metacognition

Human cognitive activities have different levels. Attention, perception, memory and thinking are general cognitive activities, while how a person controls his or her own attention, memory and thinking processes, learns how to learn, think and develop himself or herself better belongs to a higher level of metacognitive activities (Brown & Smiley, 1977; Flavell, 1979b; Schraw & Moshman, 1995).

In the 1976, Flavell, a famous American psychologist, proposed a new concept of "metacognition" for high-level cognitive activities based on previous research. In recent years, psychologists have conducted substantial research on metacognition and have proposed a series of concepts related to metacognition, which has attracted wide attention and gradually made it a current research hotspot in education psychology (Khellab et al., 2022; Yokuş, 2021) and cognitive psychology (Molin et al., 2020b; Wannagat et al., 2024).

The importance of metacognition research is that it challenges the boundaries of the traditional cognitive domain. The traditional view divides human cognitive activities into perception, memory, thinking, and language (Jiang, 2007). This distinction has severed the inner connection between human mental processes, while the concept of metacognition and its research emphasise the connectedness of human cognitive processes (Wang et al., 1999).

2.2.1 The concept of "meta"

At the end of the 19th century, Auguste Comte, the founder of French positivism, introduced the "Comte's paradox" in response to research on self-consciousness in psychology, stating, "The thinker cannot divide himself into two

parts; one part is reasoning, the other observing this reasoning." The concept of "meta," meaning "about" or "beyond," emerged from philosophical reflections on Comte's paradox, distinguishing between the object level and the meta-level in human consciousness (Liang, 2021). The object level involves representations of the object itself, whereas the meta-level involves representations of these object-level processes. This distinction allows for analysis of these as separate yet simultaneous processes, where the lower-level process can be the subject of the higher-level process (Wang & Guo, 2000).

Building on this conceptual foundation, the model of metacognition has developed significantly. It features three main characteristics: First, Monitoring (Self-Awareness), where information flows from the object level to the meta-level, enabling the meta-level to know the state of the object level. Second, Control (Self-Regulation), where information flows from the meta-level to the object level, guiding the actions to be taken next. Third, the Evaluation and Reflection, which involves monitored and controlled repeatedly through the exchange of information between the meta-level and the object level to achieve effectiveness of one's learning and thinking processes (Liang, 2021; Wang et al., 1999). From these characteristics, it is evident that metacognition bridges the theoretical to practical applications in the real world.

2.2.2 Definition of Metacognition

According to HarperCollins (2021), metacognition is defined as "thinking about one's own mental processes." Flavell initially defined metacognition as "the individual's knowledge about his own cognitive processes and their outcomes or related aspects" (Flavell, 1976). Concurrently, he described it as "the active monitoring and regulation of cognitive processes to achieve specific goals" (Flavell, 1976). Later,

he succinctly redefined metacognition as "knowledge or activities that reflect or regulate cognitive processes" (Flavell, 1979b). Baker and Brown (1980) also defined metacognition as "an individual's knowledge and control over the cognitive domain."

All the definition encompasses two main aspects: first, knowledge about cognition, and second, the regulation of cognitive processes. This means that, on one hand, metacognition is a knowledge entity containing information about both static cognitive abilities and dynamic cognitive activities. On the other hand, it is also a process that involves the awareness and regulation of ongoing cognitive activities (Brown & Smiley, 1977; Schraw, 2001; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

2.2.3 The concept between metacognition and cognition

Metacognition and cognition are two concepts that are often confused. The discussion on "the relationship between metacognition and cognition" aims to delineate their distinctions. It is essential to enhance our understanding of the nature of metacognition and to effectively implement metacognitive strategies, thereby adopting methods to improve metacognitive awareness. Four main differences distinguish metacognition from cognition, there are:

First, the content of the activities varies. Cognitive activities involve performing intellectual operations on an object, like repeatedly listening and memorising a piece of music (Sala & Gobet, 2019). Conversely, metacognitive activities involve regulating and monitoring these operations, which include goal setting, self-monitoring, evaluating effectiveness, and adjusting strategies (Wang et al., 1999; Jiang, 2007).

Second, regarding the object of focus. Cognitive activities focus on external and tangible objects. For example, in music education, the object of cognition is a specific musical composition. In contrast, metacognition focuses on the learning processes (Liang, 2021; Sala & Gobet, 2019).

Third, cognitive and metacognitive abilities develop at different rates. Research shows that while infants exhibit cognitive capabilities from birth, metacognitive abilities begin to emerge later, typically not until the preschool stage (De Jager et al., 2005; Liang, 2021; Wang, 1993). Among the target population of the current study, college students, there is significant individual variation in metacognitive abilities. By enhancing the learning and cultivation of metacognition, college students can rapidly develop and improve their metacognitive skills (Khellab et al., 2022).

Fourth, regarding the mode of action. Cognitive activities directly facilitate advancement in cognitive tasks. In contrast, metacognition indirectly promotes progress in these tasks by regulating and overseeing cognitive activities (Liang, 2021).

2.2.4 The Components of Metacognition

Discussing the components of metacognition is crucial for several reasons. First, breaking down the concept into its fundamental elements helps clarify and deepen understanding. Additionally, this discussion can guide research efforts, such as exploring the application of metacognitive regulation in educational practices to enhance learning efficiency. Lastly, understanding the components of metacognition facilitates the evaluation of the concept. By identifying these components, it becomes possible to develop measurement tools that assess the effectiveness of metacognition interventions.

Regarding the components of metacognition, there were initially different viewpoints in the academic community. There are two mainstream perspectives, which are: Flavell, (1979) identifies the components of metacognition as metacognitive knowledge and metacognitive experiences. Brown (1987), Schraw and Dennison (1994) proposes that metacognition comprises as knowledge about cognition and regulation of cognition.

A comparison of the metacognitive components analysed by Brown and Flavell reveals that both recognize metacognitive knowledge as a fundamental component of metacognition. However, their views differ on the second component. Brown identifies the second component as the regulation of cognition, a concept not addressed by Flavell. Flavell's second component is metacognitive experiences. Brown's proposed regulation skills—such as planning, monitoring, debugging, and evaluating—are closely related to metacognitive experiences. The application of these skills leads to metacognitive experiences (Liang, 2021). In essence, metacognitive experiences accompany the entire process of cognitive regulation, making cognitive regulation impossible without them.

While there are numerous components in Metacognition proposed by different scholars, in this research, the researcher has primarily focused on the model proposed by Brown (1987). The Brown model offers a comprehensive perspective, enabling researchers to delve deeply into improving metacognitive abilities through educational interventions (Brown, 1987; Brown & Smiley, 1977). Additionally, the components outlined by Brown emphasise practical metacognitive skills such as monitoring, planning, and regulating, allowing learners to apply these metacognitive strategies in vocal music practical contexts.

For this reason, the current research is based on two primary metacognition components: metacognitive knowledge and metacognitive regulation. Metacognitive knowledge involves understanding one's own and others' cognitive activities, processes, and outcomes (Brown, 1987; Ohtani & Hisasaka, 2018; Schraw & Dennison, 1994). Metacognitive regulation investigates the psychological mechanisms and strategies through which individuals consciously control and regulate their cognitive activities to achieve specific goals and complete tasks (Brown, 1987; Ohtani & Hisasaka, 2018; Semerari et al., 2012; Schraw & Dennison, 1994).

Each component of metacognitive knowledge and metacognitive regulation encompasses various factors, and there is ongoing debate about how these factors are defined. The following will discuss the categorisation of factors within metacognitive knowledge and metacognitive regulation.

2.2.4(a) Metacognitive knowledge

Regarding the categorisation of components within metacognitive knowledge, there are two types. The first one, proposed by Brown (1987), Schraw and Dennison (1994), categorises metacognitive knowledge into three parts: declarative, procedural, and conditional knowledge. The second one is from the work of Flavell, the originator of the metacognition concept, in 1976 and 1979. He identified the primary components of metacognitive knowledge as knowledge of person, task, and strategy.

Below, the specific concepts within each type will be introduced first, followed by a comparison of the classification methods.

1) Declarative, procedural, and conditional knowledge

Declarative knowledge, also called descriptive knowledge, is knowledge that individuals can directly state in words. This kind of knowledge is mainly used to answer the questions of "what" of things, and can be used to distinguish and identify things (Yang, 2006). This kind of knowledge is more consistent with the connotation of the concept of knowledge that people use every day (Brown, 1987; Schraw & Dennison, 1994; Sperling, 2002; Yang, 2006). For example, Diaphragmatic Breathing, which is a breathing technique where singers use the diaphragm, a large muscle located between the chest and the abdominal cavity, to control their breathing.

Procedural knowledge, also called operational knowledge, is the knowledge that is difficult to state clearly and whose existence can only be inferred indirectly by means of some operational process. This kind of knowledge is mainly used to answer the questions of "how to think" and "how to do", and is mainly used to solve the problems of what to do and how to do it (Brown, 1987; Schraw & Dennison, 1994; Sperling et al., 2002). An example of specific procedural knowledge is the singing exercise, Step 1, Vocal Warm-ups. Step 2, Supportive Breathing. Step 3, Holding the Placement of Voice.

Conditional knowledge is a type of knowledge that refers to when, why, and under what conditions individuals can better use declarative and procedural knowledge (Brown, 1987; Schraw & Dennison, 1994; Sperling, 2002). An example of specific conditional knowledge is the selection of an appropriate vocal texture based on the stylistic and emotional demands of the repertoire being sung. When dealing with classical music, such as art songs, the singer needs to adapt the voice to the historical and cultural context of the piece. When singing a rock song, the singer chooses a grittier, more powerful voice.

2) Knowledge of person, task and strategy

Knowledge of person refers to all the knowledge that individuals have about themselves and others as cognitive objects, which includes knowing oneself and knowing others. For instance, individuals should identify their own strengths and weaknesses, as well as those of others (Flavell, 1976, 1979; Pintrich, 2002).

Knowledge of task involves an individual's understanding of the requirements and characteristics of cognitive tasks, encompassing the nature, attributes, presentation, logic, familiarity, and difficulty of the task materials, as well as the task's objectives (Flavell, 1976, 1979; Pintrich, 2002). For instance, when a student encounters a new piece of music, their understanding of the piece's performance techniques, the composer's background, and the overall performance style all constitute their knowledge of the task.

Knowledge of strategy variables refers to the individual's knowledge of what is needed to accomplish a certain cognitive task. For example, what strategies one has for the cognitive activities; the characteristics between various strategies and their advantages and disadvantages: how the conditions and situations in which various cognitive strategies are applied (Flavell, 1976, 1979; Pintrich, 2002).

In summary, two main differences can be identified by comparing the two types of categorisation of components within metacognitive knowledge,. First, the classification by Brown (1987), Schraw and Dennison (1994) focuses more on an individual's understanding of cognitive processes (namely, knowing what, how to operate, when, and why to use certain strategies). In contrast, Flavell (1976)'s framework emphasises the variables influencing metacognitive knowledge, such as who is learning, the nature of the task at hand, and the strategies being employed.

Secondly, the framework by Brown (1987), Schraw and Dennison (1994) is primarily targeted towards educational settings, whereas Flavell (1976)'s approach is broader, encompassing a variety of cognitive operations across different contexts.

Given that this study focuses on the application of metacognitive in teaching and learning, it will follow the classification of metacognitive knowledge from an educational perspective as outlined by Brown (1987), Schraw and Dennison (1994). This is because, this classification aids students in understanding and reflecting on the knowledge, facilitating deeper learning (Ohtani & Hisasaka, 2018). At the same time, teachers instruct metacognitive reflection strategies, also reflecting from these three aspects of knowledge classification to enhance vocal music learning efficiency.

2.2.4(b) Metacognitive regulation

The concept of metacognitive regulation has been developed from the collective research of scholars such as Brown (1987), Schraw and Dennison (1994), and Sperling (2002). It is primarily divided into five key components: planning, information management, monitoring, evaluation, and debugging. Many studies in the past have primarily selected learning strategies from the concept of metacognitive regulation, with these strategies being directly applied to guide music learning (Benton, 2014; Bonnaire & González-Moreno, 20; Peynircioğlu et al., 2014; Yokuş, 2021).

Metacognitive regulation is a crucial theoretical source for designing the VM-MEL module because it provides essential strategies for learners to plan, monitor, and evaluate their learning activities effectively.

Metacognitive regulation can be categorized into the following aspects:

Initially, planning, which involves the individual preparing for forthcoming cognitive activities. In the early stages of cognitive activity, planning primarily entails clarifying the problem, setting goals, recalling relevant knowledge, selecting appropriate strategies, and contemplating potential solutions. Indeed, planning is not confined to the initial stages, it continues throughout the cognitive process, with plans being continually revised and, at times, completely reformulated (Brown, 1987b; Schraw, 2001; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Secondly, information management mainly refers to the need for strong management and processing of various knowledge, strategies and skills. Effective cognitive processing requires methods such as summarizing, generalizing, and selecting critical knowledge (Brown, 1987b; Schraw, 2001; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Third, monitoring. During cognitive activities, self-monitoring entails assessing progress, identifying errors or deficiencies, and evaluating the feasibility of proposed solutions (Brown, 1987b; Schraw, 2001; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Fourth, evaluation, which refers to the individual's assessment of the process and effectiveness of his or her cognitive activities. During and after the cognitive activity, the individual should evaluate the effect of the cognitive activity (Brown, 1987; Schraw, 2001; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Fifth, debugging, which refers to an individual's ability to apply corrective actions in cognitive activities based on information from monitoring and evaluation. This includes self-correcting errors and adjusting thought processes. Through metacognitive monitoring and evaluation, necessary adjustments and improvements