

**How effective, or not, is demonstration as a pedagogical tool
in the voice studio?**

by

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Assignment 1 : Portfolio

And

Assignment 2: Narrative Review of Literature

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Assignment 1: Introduction

During my 27 years as a singing teacher, I have become interested in the wordless exchanges between teacher and student in the voice studio, occurring during demonstration and student repetition. I wondered if the emergence of a new teaching strategy might be the consequence of exploring this and the neurological phenomenon of mirroring. The Human Mirror Neurone System (HMNS) was touched upon in my previous research and findings suggested that the HMNS might be important in the transference of motor-knowledge between individuals (Granot et.al., 2013; Lévêque et al., 2011). Rajmohan and Mohandas (2007, p 66) explain the HMNS as particular brain cells that enable movement and feelings to be felt by whoever views these actions.

In a focus group of voice experts, 'mirroring' in teacher demonstration and analysis of students' vocal attempts was discussed. The group considered mirroring and empathy to be important aspects of student/teacher exchanges (Cummings, 2023). Their remarks provided the impetus for this review of literature which will investigate the demonstration of singing as a motor-process and motor-learning as a possible training protocol. Additionally, the role of mirror neurones at the planning stages of a vocal attempt will be explored. Alternative strategies to demonstration, such as Feldenkrais method will be included in the review so that comparisons may be drawn. The topic of empathy will be touched upon, but a full analysis of this subject is beyond the scope of this current assignment.

Rationale

In consideration of possible bias from the outset, I here include a brief personal background to underline my objectivity regarding the subject of demonstration. In 2019, subsequent to a cancer diagnosis, I had partial thyroidectomy (Marciniak et.al., 2021, pp 829-835) which left me with nerve irritation resulting in a substantial reduction of pitch, range, and vocal control (Chomsky-Higgins et al., 2018 pp 271-276). Both the modulation of my speaking voice and singing were rendered impossible in the short term (Zakaria, et al., 2011; Varaldo et al., 2014).

I continued to teach during my 18-month recovery but was no longer able to demonstrate vocally, relying instead upon gestures and description in my lessons. Additionally, lockdown restrictions meant that teaching had to be delivered exclusively online (Rucsanda, Belibou and Cazan, 2021). My instinctive expectation was that instructional teaching would be less effective than demonstration, and would frustrate my students (Lonczak, 2020; Keefe, Lefebvre, and Smith, 1999), however I found that students continued to make progress and I became proficient in verbal explanation of vocal

technique (Lawler, 2022). Having found both instructional delivery and demonstration useful teaching strategies, I approach this view of literature with an unbiased view.

Topics

The subject of demonstration will be divided into the physical act of sung demonstration and the neurological planning of a vocal attempt to replicate it. Instructional lesson delivery will then be considered so that the two contrasting strategies may be evaluated. The topics covered in this literature review will be: motor-learning, Feldenkrais method, the HMNS and empathy. I will provide a justification for my choice of topics in my aims section, but will first give a brief definition of each subject.

HMNS

The HMNS is the population of specialised brain cells that allow mirroring of sensation between actor and viewer. Physical demonstrations may help students to neurologically process, or decode, motor-skills such as singing; they offer a visual and auditory experience in real time (Han, Sayed Ali and Ji, 2020). The HMNS may be important in producing a mental map of this process.

Motor-learning

Motor-learning is a training strategy created by Fitts and Posner (1967), which aims to maximise athletic potential by utilising psychology. Motor-learning theorists posit that external-focus could be beneficial in improving performance of a motor-skill (van der Veer et al., 2022; Verdolini, 2000; Crocco, 2020; 2021). Demonstration could be seen as an example of external-focus, certainly in the planning stage of a trial (Damasio, 1994;1999; 2010). Feedback from somatic sensations produced whilst singing, may assist the student to encode, or physically reconstruct the process of vocal technique (Varga Khadem et al., 2005).

Feldenkrais

Moshe Feldenkrais created a system of somatic learning in an attempt to increase neuroplasticity, (the brain's ability to adapt) with the intension of relearning movement, to reduce superfluous exertion and alleviate tension. The Feldenkrais method is an example of a lesson delivery system that is mostly, yet not exclusively, instructional (Nelson and Blades, 2018). Teaching-based on verbal instructions, may be effective if used to help students to experience and-understand sensory feedback (Popp et al., 2020) and will be contrasted with demonstration in order to evaluate both pedagogical tools.

Empathy

Empathy is the way we experience the emotions of others. The ability to empathise has been considered an important quality in a teacher (Millican and Forrester, 2019). Empathy will be briefly explored as a topic, to consider its possible links to demonstration.

Aims and possible impact

Many studies exist on the topics of Motor-learning, Feldenkrais method, and the HMNS but I have not found literature that links these studies. A narrative review of literature that considers the more general topic of demonstration, could unify these diverse fields of study by exploring what demonstration is; how it works, and its potential efficacy as a teaching tool. It may then be possible to consider how much time should be spent on demonstration in the voice studio, and how demonstrations should best be delivered, if evidence suggests they are useful. A unifying teaching strategy, utilising aspects of Feldenkrais method (instructional delivery – internal focus) and motor-learning theory (demonstration - external focus), might then be formulated to maximise student learning. For the purposes of this assignment, I define demonstration as the physical enactment of a motor-process for the purpose of teaching that particular skill to a group or individual. Instructional delivery consists of a verbal description of a motor-process without its physical execution; it may include description of a sensation, imagery or anatomical information.

In defining empathy, one could evaluate its role in the voice studio and consider how it can be utilised to facilitate teacher analysis and student learning. If empathy is found to be important to the practitioner/student relationship, then consideration of its role should be included in future teaching strategies (Aldrup, Carstensen, and Klusmann, 2022).

Planned programme of study

This study plans to ascertain the popularity of demonstration as a pedagogical tool and compare it to instructional delivery. Additionally, to investigate the processes involved in demonstration, evaluating how effective it is, or is not, as a teaching strategy. In defining what occurs during demonstration studies on motor- learning; body-mapping; Feldenkrais method, mental-mapping and the possible role of the HMNS will be researched.

Methodology

A brief scoping review will be undertaken, to gauge volume of published literature relevant to the chosen topic. Scoping reviews aim to investigate a wide-ranging subject to decide on the feasibility of carrying out a full systematic review. Scoping reviews define the parameters or scope of research where there may be no pre-existing studies connecting disparate topics (Grant and Booth, 2009). Arksey and O'Malley (2005) note that the term 'scoping review' has not been formalised but suggest the following framework. Firstly, researchers look at a broad topic via electronic databases using key words; results are sorted according to defined inclusion and exclusion criteria; duplicated items are discarded; results are categorised and finally the documents are analysed.

Systematic reviews follow the same process as scoping reviews but aim to answer a specific question, critically evaluating studies with a similar methodology (Arksey and O'Malley, 2005). Scoping reviews are a scholarly vehicle for comparing studies with different methodologies in order to answer a less specific question (Arksey and O'Malley, 2005). Dijkers (2015) recommends that extra validity and depth could be attributed to scoping reviews, if an element of evaluation was included. The methodology of narrative reviews differs from scoping and systematic reviews, as the author decides on the importance of each study after the initial inclusion and exclusion process (Grant and Booth, 2009). Narrative reviews synthesize the most important literature on a subject to answer a research question, often combining several rigorous systematic reviews (Green, 2006). Scoping and narrative reviews are suitable for exploring a broad subject such as demonstration in the voice studio, and both can include studies with differing methodologies (Grant and Booth, 2009). Scoping reviews however, are usually used at the preliminary stage of researching a topic and do not answer a specific question (Munn, Peters and Stern, 2018). A scoping review, therefore, will contextualise this broad study and help define the type and scope of the main literature review.

The PubMed database will be used to search for studies relevant to the topic of demonstration in the voice studio, using the key words; singing, demonstration, motor-learning, Feldenkrais, and empathy. The parameters of the study will be defined by the results of the scoping review which will be sorted, with any duplications being deleted at this point. Exclusion criteria will be any studies that are not written in English, where a translation is unavailable. Studies written prior to 2000 will also be excluded, unless they contain a seminal piece of research that is important to this review. Research that does not directly concern demonstration, motor-learning, singing or is mostly concerned with singing in a

healthcare setting, will also be excluded. Literature considered to be especially important to the review but fitting the exclusion criteria will be included. Inclusion criteria are any studies that were written between 2000 and 2023 that concern singing, demonstration, and motor learning, or explain the neurological processes involved in processing demonstration or the planning and execution of singing.

Programme of Study

The literature review process was commenced on the 26th of January 2023 and the deadline for completion of the project is on 5th June 2023. During this time-frame repeated searches were made using the aforementioned criteria (see appendix).

Context of study: preliminary scoping literature review

When all key words (singing, demonstration, motor-learning, empathy, Feldenkrais method and mirror neurones) were input simultaneously, no matching studies were found. Limiting the search by using only the key words, demonstration, singing and motor-learning, 40 results were found on the PubMed database. Repeated searches, were subsequently carried out, varying combinations of the key words, which yielded differing quantities of results (see table in appendix). For the purpose of the scoping review the 40 results matching the criteria of singing, demonstration and motor-learning were treated according to the Arksey and O'Malley (2005) framework.

Of the 40 studies retrieved from the PubMed database, research papers were excluded that related to the therapeutic use of singing in healthcare settings, as these did not appear immediately relevant to the research title. A further 28 of the search results concerned studies of birds, primarily finches. Schlinger and Remage-Healey (2012) explain that songbirds are similar to humans in that they are awake during the day (diurnal); communicate utilising both sight and sound; and are capable of learning complex melodic patterns. Although it has been the findings of numerous studies (Abe and Watanabe, 2011; Jarvis, 2004; Moorman et. al., 2012 Hyland et al. 2021) that there are marked similarities between song-bird and human brains, the volume of data on this subject is overwhelming (Brien et al. 2010, Cronin de Chavez et al. 2005). I therefore decided to exclude studies concerning birds as being beyond the scope of my current study. I accept the possible relevance to vocal pedagogy of studies involving birds overall, but in the available time I am unable to pursue this line of enquiry (Bostock et al., 2009; Brodie et al., 2009).

As a consequence of the scoping review process, subjects which had attracted the greatest volume of research were evidenced, additionally research that linked topics could be seen. Having considered various types of literature review, a narrative review has been chosen as a framework to answer the question of the efficacy or otherwise of demonstration in the singing studio. Studies from the diverse fields of pedagogy, neurology, and psychology will be linked to answer the broad research question. A full, systematic review would not be feasible within the limited time constraints of this assignment and given that this is a solo research project.

Narrative reviews appraised

As previously defined, narrative reviews provide a summary of literature to answer a research question (Green, 2006), and improve understanding of a topic (Greenhalgh, Thorne and Malterud, 2018). Scoping reviews are a preliminary assessment of literature pertaining to a broad subject, whereas systematic reviews answer questions of focussed specificity through a comprehensive study of literature within a narrower span (Grant and Booth, 2009).

Systematic reviews have long been considered the gold standard as far as rigorous methodology and limitation of bias (Mulrow, Thacker and Pugh, 1988) and narrative reviews have often been unfavourably compared to them despite serving different purposes (Greenhalgh, Thorne and Malterud, 2018). Many narrative reviews synthesise and critique rigorously executed systematic reviews, to provide a concentrated synopsis of the subject. They can be biased, given that the author decides which literature is included (Mulrow, Thacker and Pugh, 1988), but new conclusions can be reached based on the accumulation of studies reviewed (Green, 2006). Systematic reviews, moreover, can be commissioned to support a particular perspective, and the unbiased reputation of systematic reviews can be utilised to support the veracity of a claim (Greenhalgh, Thorne and Malterud, 2018).

De Kock et. al. (202, p1) found that 90% of systematic reviews are failing “to conduct comprehensive searches”. Schmidt, Lasse and Gotzsche (2005) found that 42 out of 70 narrative reviews, in their systematic review of reviews, contained reference bias, however 40 out of 50 systematic reviews in their study were flawed. Critical evaluation of the summarised literature in the narrative review, and efforts on the part of the author to find studies with opposing conclusions, may help to minimise bias (Green, 2006), but narrative reviews need not necessarily be devalued due to their methodology (Greenhalgh, Thorne and Malterud, 2018).

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A critical reflection of the learning process: justification of reflective model

A justification for the choice of Brookfield's (1995) reflective model will be investigated here, followed by consideration of personal learning experiences during this assignment.

Rodgers (2002) reminds us that reflective thinking has its basis in scientific enquiry and follows a structure, therefore differing from everyday thought processes. Brookfield (1995) recommends four 'lenses' of focus to improve teaching: Self-reflection, student perspective, peer interaction, and analysis of literature.

Incorporating Brookfield's structure into my reflective process has enabled me to consider events that happen in the studio in greater depth as I am viewing them from multiple perspectives. Taking time to notice small changes in student behaviour has caused me to engage with them in dialogue, which in turn has led to insights into their thought processes and feelings. I have encouraged my students to question and evaluate their thought processes and this has been beneficial in helping to alleviate their performance anxiety by investigating its root causes. Ever mindful of ethical considerations, I make available to students, contact details of professional bodies where staff are qualified to deal with emotional trauma (see appendix). When I have noticed anomalies in a student progress, I have found that going back to literature and discussing the matter with colleagues has often solved the problem. The studio has a calm and pleasant atmosphere and students' compliments on my teaching, from have had a positive effect on my self-perception as a practitioner.

Simpson, Jackson and Aycok (2005) suggest that it is only through a process of becoming better educated ourselves, that we are able to fulfil our potential as teachers, and through reflective thinking we learn how to learn. Brookfield argues that although experiential learning is of value it contains an innate bias, in that supposed truths are framed by the experience of the individual; initial understandings and sensations, can only be reaffirmed unless critical evaluation is continually employed (Brookfield, 1995).

Revisiting the topic of reflective thinking I discovered Brookfield's work (1995) and considered this to be an appropriate framework for this current assignment, regarding the efficacy or otherwise of demonstration in the vocal studio. I sought to understand on a neurological level, what my students perceive during a vocal demonstration. My own analysis would form the first lens of reflection and understanding what the student perceives from a demonstration would form the second lens. The eventual application of motor-learning theory and Feldenkrais method learnt from literature, would form the third lens of reflection. Finally, feedback from colleagues and examiners on my students' progress and achievement would either confirm or refute the success of the learning strategy. I would then be able to gauge the possible effectiveness, or not, of demonstration as a pedagogical tool.

Brookfield's second lens of focus follows the constructivist ontology in that the student constructs knowledge as they learn, rather than assimilating knowledge by rote (Alt, 2015). The student's perspective is crucial to deciding the content of the lesson. Students have differing experience levels, background and goals. Additionally, the variety of voices, age, fitness levels, and the individual's analytical ability in the context of a music lesson, must be taken into consideration (Rohan, 2023). An identical lesson for every student would therefore be untenable, as every aspect of a lesson, from the warm up, the pieces studied, and the discussion of technique will be different, as will the amount of time spent on each activity. Overriding pedagogical strategies however, could well be applicable to most students and the formulation of these strategies is one of my key learning goals.

It could be argued that practitioner and student have their own separate reflective cycles that do not necessarily correspond (Powell and Kalina, 2009). It is my experience that some reflective frameworks do not intertwine experiential learning with the study of academic literature. One might postulate that a reflective cycle if not augmented by other evidence streams, could lead to an insular view. I intended to gain insight into possible student experience by examining academic studies on neurological function, and the psychological impact of live demonstration. The literature, could then be compared with what students reported during lessons, and with my own experiences as a practitioner. Anecdotal evidence from fellow singing teachers and ideas from lectures and seminars could also be added to the growing body of knowledge, to explore vocal pedagogy from as many perspectives as possible.

Comments from a focus group of colleagues, and their anecdotal consideration of 'mirroring', were part of the impetus for this literature review and this provided a third lens of reflection

(Cummings, 2023). This assignment forms the basis for my fourth lens of focus, in that it is a narrative review of literature pertaining to demonstration in the voice studio.

Reflections on the learning process of writing this review

My experience of writing this literature review has differed from my previous experiences in that my progress has been slowed by perhaps my over consideration of the methodology. I appreciate that my research must be rigorous and systematic but I have experienced anxiety in not wanting mismanage my approach to finding literature. This has caused me to hesitate and doubt my research skills (Cohen and McConnell, 2018). Previously, I have had no difficulty in finding studies pertinent to my research questions, and my curiosity led me to investigate other works that were cited in the studies (Bates, 1989). I also sought out literature that was written subsequently, that referenced works I had read (Lillard and Ha, 2015). The more I read, the more questions I formulated. I found that my ideas, and often my research questions, evolved during my search for literature (Bates, 1989). Often I would make discoveries that caused an epiphany (Lindstrom and Gulz, 2008), and I would be excited to share what I had found with my peers. I have been inspired by the development of my academic skills and growing confidence as a researcher.

In attempting this assignment, my initial enthusiasm for my research topic was dampened by a desire to align my thoughts with my tutor (Hollins Martin and Bull, 2008). Self-system theory posits that students seek autonomy, competence and relatedness (Deci and Ryan, 2002) and I have recently doubted my ability to achieve both this learning module, and complete my MA course (Shanahan, 2000). My perception has been that this assignment requires a pattern of study that is divergent from my natural learning style. I have experienced a lack of relatedness to my tutor which has fostered feelings of inadequacy and thoughts that I am a frustration. This has made me withdraw from seeking assistance despite attempts on her part to engage with me. I have instead relied upon my MA cohort for support (Kumar and Johnson, 2017) although it has been the judgment of others outside our group, that our online platform could be a toxic environment. I have found that discussing this module with others who have already completed this assignment, due to their decision to approach the modules in a different order, has been helpful. Sharing anxieties with others in the same process has made me feel that I am not alone and that others are facing similar academic challenges (Kumar and Johnson, 2017). Many of us have felt the effects of imposter syndrome (Chapman, 2015) and knowing that my self-perception is not unique is comforting. Anderson's (2008) phenomenological study of adult learners, found that mature students had lived experiences that affected their creativity and the way that they responded to a return to academic stricture. When these students were told not to follow a desired path

it had a profound effect on their wellbeing and life choices. Anderson (2008) hypothesised that the tutors may have been steeped in academia to the extent that they did not necessarily understand that there could be divergent paths to academic success, and might have been reluctant to accept innovation. Student mistrust of tutors was intertwined with the tutors' control, in the Anderson study. The research participants tried to obtain their professors' approval in an attempt to improve their grades, and reported feeling confused and downhearted. Anderson notes that the constraints of the study were that it was limited to twelve participants from one state in America and that phenomenological methodology of the study meant that it focused on the lived experiences of the participants. She asserts, however, that the research conditions and the themes that emerged from the study would be repeatable.

The findings in this study are not necessarily generalisable, but as an adult learner, I can relate to some of the feelings expressed by the participants, although not all are applicable to me.

Persky and Robinson (2017) assert the path to expertise requires the learner to experience challenges that they must overcome by conscious effort and self-reflection. They go on to warn against the Dunning-Kruger effect (Duignan, 2023) in which the individual overestimates their abilities. Ever mindful of my own academic short-comings, I nevertheless, decided on an autonomous direction with my study, and have regained my composure and the pace of my work has increased.

The subject of mirroring has caused me to consider the wider implications of this practice. I am both teacher and learner, so factors that I face might be mirrored by my students' experiences. What I perceive as need in my context as learner, my students will perhaps require from me as practitioner. It is, however, equally possible that I am already providing enough guidance for my students and my care as a teacher is fuelling my own perceived need as a learner. Returning to Persky and Robinson (2017), the authors found that as students moved towards expertise, they became self-regulated learners (Aşkin Tekkol and Demirel, 2018). It could then be the case that as I am on a different learning path to my students, I might also require less tutorial input than I perceive.

My language in the studio is evolving as a result of my learning during this assignment. Instead of issuing instructions I am asking questions (Feldenkrais or reflective practice). I am trying not to lead my students, but to guide their thought processes so that they make discoveries on their own (Aşkin Tekkol, and Demirel, 2018). In group lessons I have felt calmer and more in control, although control does not seem to be an appropriate word for

the dynamic that now exists. There is an overall feeling of mindfulness and students ask questions that occur to them in the moment, and this is what decides the direction of the lesson (Gouda, et al. 2016). Group lessons have become a collaborative and exploratory process. Students are responding to each other in an open and respectful way and are noticing details which they mention constructively, to facilitate the learning of their peers. The student who is singing does not appear to feel judgment from the group, and they are as open to suggestions from their cohort, as they are to practitioner comments. Students welcome input from whomever is providing it, knowing that it is well intentioned, and potentially helpful. I do not sense an air of competition, but instead a desire for growth as a group and as individuals. It seems a mutually respectful and nurturing environment. I do not feel that I have to simplify my language for the students to understand what I am saying, and I do not have to work to hold their attention. Where silences occur in the lesson I do not have to fill these gaps because they are not gaps. The students are thinking about what has just been said and what they want to say to add to the conversation. We are all noticing tiny physical cues from each other so no one is interrupting and everyone has space to express themselves.

When I first took over group lessons, the students would be reluctant to sing and when they did the group would whoop and clap regardless of how good the performance was. It was a noisy, boisterous and competitive environment. I witnessed displays of bravado and extreme anxiety. This seemed to be the norm throughout the college and I would regularly hear whooping, chanting and applause coming from other classrooms. I wondered whether this was external conditioning from what they had seen in the media (Epting, et al. 2011; Koide and Shimada, 2018) or conduct specific to the college. I have noticed that this behaviour has changed. In class, a student's vocal attempt is met with murmurs of approval and encouraging comments that are specific to the performance and the performer. When enthusiastic applause is elicited, it has more of an effect as it is intentional and the student feels they have genuinely earned it.

I am an introvert by nature and have felt challenged by the context of a classroom, preferring to teach one-to-one lessons. In my early days of teaching, I felt that I must reinforce the teacher/student hegemony to maintain order (Rose, 2011). I now reframe social interactions as an opportunity to learn and I am more inclined to seek out opportunities to interact with students and colleagues. By empowering students, there is no need to control the class because we are all invested in the learning process equally (Anderson and Sandmann, 2009). I model behaviour that my students copy (Tierno, 1996). If I am calm, respectful and

emotionally available, so are my students. The topic of demonstration in the studio is far deeper than demonstrating a passage of a song. What has brought about this change in my teaching has been both consciously incorporating structured reflection into my lessons, and carefully considering my delivery. What I am saying, how much I am saying and the words I am using, are all important factors in the acquisition and retention of knowledge for my students (Crocco, 2020; Maxfield, 2011; Nisbet, 2003).

In conclusion, I have found that Brookfield's reflective framework creates a multifaceted perspective which leads to a balanced and objective approach to teaching. Greater reliance on somatic information may be effective in achieving repeatable results. Demonstration although a useful strategy, is not the only strategy and practitioners should carefully consider how, when and why it should be used.

Assignment 2: Narrative Review

Introduction

Demonstration is assumed to be a widely and extensively utilised pedagogical strategy for the acquisition of motor-skills such as sports, dance and singing (Angell, 2019; Nisbett, 2003). It could be argued that such a long lived and well-known approach must necessarily be effective (Maruša, 2022). The field of voice science may have challenged the prominence of demonstration, shifting the perspective toward empiricism and away from master/student model of previous centuries (Fantini, 2016). Having thus contextualised the topic of demonstration, an exploration its efficacy will be evaluated and alternative strategies considered in this narrative review. Emphasis will be given to the sub-topic of motor-learning and this will be linked to the neurological planning and processing of motor-acts.

A personal rationale for choosing this topic was a temporary loss of vocal function subsequent to thyroid surgery which prompted a re-evaluation of teaching methods. The delivery of lessons changed from a bias toward demonstration to verbal instructions and gestures (Nafisi, 2014). The expectation that instructional teaching would yield poorer results was revised when a consistency of quality was maintained despite the change in delivery. This epiphany led to the resolution to investigate demonstration and alternate strategies.

Aims

Demonstration will be defined and its popularity gauged as a pedagogical tool in the voice studio, by reviewing relevant literature. Having identified singing as a motor-skill, the topic of motor-learning will be introduced with a definition and an evaluation of its efficacy. An

exploration of the neurological encoding of demonstration will follow, identifying how visual and auditory information is decoded in the brain to reproduce a vocalisation.

Objectives, methodology and methods.

Using the framework of a narrative review, the principal methods of research utilised were 'berry-picking' and 'citation chaining'. Bates (1989) defines berry-picking as a search of multiple data bases, during which search criteria can be modified depending on the initial results. This produces an evolving search which has been described as perhaps more instinctive than search methods employed in systematic and scoping reviews (Lillard, 2015). Scoping and systematic reviews use key words to search databases for studies matching predefined inclusion and exclusion criteria. Although similar searches are used at the initial stage of a narrative review, other strategies such as citation chaining may be used later in the research. Citation chaining uses the list of references at the end of a paper to investigate the origin of the author's ideas, and searches for other studies that cite the paper one has found (Lillard, 2015). Seventy-nine studies were reviewed in this paper.

Definition of demonstration

Demonstration is the physical enactment of a motor process for the purpose of transferring knowledge (Oxford English Dictionary, 2006, p 381). There is an implicit mechanical process involved in demonstration; a visual component, and sometimes also a verbal explanation. The physicality of the process of demonstration will be investigated in terms of motor-learning later in this essay.

Popularity and reported results of demonstration

Mann (2008) puts the case for demonstration succinctly stating that modelling provides visual and auditory information simultaneously to students, facilitating neurological processing. Dickey (1992) agrees, finding that demonstration is popular in music education and recommends it as a practice. The popularity of demonstration can be evidenced by the worldwide spread of the Suzuki training model. This holistic practice is based on practitioner demonstration and student repetition; 46 countries currently have Suzuki training centres (Yankovych, 2020, p165). The Ukrainian author Yankovych (2020) quoting Suzuki in her study wrote: "If a whole nation jointly undertakes to raise (educate) children it may be possible to avoid war" and emphasised the holistic approach of the Suzuki method to raise a "noble person".

A systematic review on the Suzuki method found that there was an enhancement of “numerous cognitive, emotional, and social processes, as well as auditory perception” (Maruša, 2022, p1). Furthermore, the Suzuki method fostered a higher-than-average level of empathy in participants and their parents Hendricks et al. (2021). Significant benefits to student attitude, in both group and individual learning, have been evidenced by utilising vocal modelling (Mann, 2008). Practitioners who provide skilled demonstrations, may be held in higher esteem by students, resulting in improved class behaviour, although no studies support this notion. Equally, demonstrations may vary the content delivery of the lesson by maintaining student interest Nápoles (2006; 2007).

Demonstration was ranked 2nd out of seven essential teaching skills, in an online questionnaire of 898 participants (Millican and Forrester 2019), empathy being voted the most important quality. Vocal modelling amongst choral directors, as well as the use of gestures and imagery was found to be popular Grimland (2005), however Hinkley (2023), found that choristers copied the voice modeller regardless of their tuning accuracy. This underlines the need for the practitioner to have sufficient skill to demonstrate accurately, and to be clear what it is they are demonstrating.

Nisbet’s (2003) investigation of intrinsic versus extrinsic focus in singing lessons concluded, as her title suggests, that “Singing teachers talk too much”; her findings indicate that they might also demonstrate too much. Angell, (2019) warns against the overuse of demonstration in voice lessons positing that teachers might rely too heavily on what they consider to be their strength, having completed extensive training in performance. Furthermore, Angell (2019) argues that teacher errors may be copied by students, linking back to Hinkley’s (2023) findings.

Skill acquisition was overestimated by participants who watched repeated demonstrations on Youtube (Kardas and O’Brien, 2018). Although participants identified the steps necessary to undertake the motor task (juggling, throwing darts, moonwalk), they were unable to perfect the skill without some pre-existing motor knowledge of the task. Most people, however, know what it feels like to sing, so demonstration may well prove effective in the majority of instances. Dance might be a closer comparison to singing in that it is a motor-skill familiar to most.

In response to viewing a video demonstration of ballet steps, cognitive brain regions of non-dancers were activated whereas the motor-memory regions were activated in dancers (Fleming, Stinear, and Byblow, 2009). Non-dancers were trying to understand the steps and

dancers were remembering them. Cross et al. (2006) taught professional dancers a new choreography via repeated viewings of a video during five days. The dancers confidence in replicating the dance increased with each viewing. Kardas and O'Brien (2018) had similar findings differing only in that the dancers' existing motor-knowledge facilitated them in their task. Returning to singing, Bergan (2010) found that singers benefitted from witnessing a demonstration, however too many demonstrations resulted in an over-reliance on the model and reduced autonomy. From these findings one might extrapolate that refinements to an existing motor-skill such as perfecting a pop song by viewing YouTube demonstrations, may be possible but learning to sing an operatic aria would be comparable to a non-dancer attempting ballet (Fleming, Stinear, and Byblow, 2009). Several studies on motor-learning have reported that higher feedback frequency and added practitioner instruction are advisable in early-stage skill acquisition (Han, Syed Ali and Ji, 2022; Wulf et al., 2010). However, for long term retention of a skill, low-frequency feedback is recommended although the authors do not offer an explanation (Steinhauer, and Eichhorn, 2023).

Based on the literature discussed above, demonstration has been as wide-spread a practice in vocal pedagogy, as it has in other fields of motor-skill acquisition. Nevertheless, as previously discussed, this strategy can have mixed outcomes depending on frequency, accuracy and context. The efficacy of demonstration will be evaluated later in this paper

Internal and external focus in motor learning

Sports psychologists Fitts and Posner defined motor-learning principles in 1967 (Fitts and Posner, 1967; Taylor and Ivry, 2013). Singing, sports, dance and instrumental performance are motor-skills (Johnson, 2020). Motor-skills involve a muscular process that is implemented to achieve a physical goal and has been described as procedural learning (Kozioł and Budding, 2012). External focus of attention has been found to improve the performance of a motor-skill (Ghorbani, Dana and Fallah, 2019). Roth and Verdolini Abbott (2014, p 81) argue that students need not necessarily comprehend the intrinsic procedure to achieving a specific sound, only that the goal was reached and how that was experienced; knowledge of result (KR). Overthinking a practised motor-task interrupts the procedural flow by removing the task from the motor-region and reinstating it in the cognitive area, thus inferring that the task must be relearned (Treinkman, 2021). This can lead to a lessening of ability and physical tension (Vereijken et al. 1992).

Schmidt and Lee, (2005) define motor-learning as procedures brought about by experiences, or deliberate repetition, that result in permanent positive alteration of action. Motor-learning can be said to have taken place when a student is able to achieve the desired performance autonomously on an occasion and in a setting not connected with the initial learning process

(Verdolini, 2000; Holding, 2015). Varying exercises keeps students in the cognitive-learning mode (Verdolini (2006) whereas excessive repetition during early-stage skill acquisition, sends students into performance-mode where progress is limited, as fewer modifications are made. Murtori et al.(2013) confirm that in early-stage skill acquisition practise conditions should be exploratory and not repetitive as do Patel et al. (2017), who contend that although repetition of a motor process in the short term seems effective, these skills are not sufficiently retained or transferable. Takehide and Wataru (2019) found that repetition of a cognitive-skill, increased the speed of motor-skill acquisition.

There are four stages of motor-learning each utilising distinct regions of the brain, complex motor-task employ several areas simultaneously, to varying degrees (Spampinato and Celnik 2021). Cognitive strategies, is the first of the four motor-learning mechanisms, and involves the initial learning-phase of a motor-task. Hence, the singer must follow practitioner instructions, or demonstration, to achieve a new vocal goal or modify an existing procedure. Error-based learning is utilised in the short term (hours) where somatic information based on failed attempts, leads to adjustments in motor-processes; a prediction is compared to the unsuccessful result. A singer adjusting to a new acoustic environment would be an example of this, as they are using a pre-existing skill but having to adapt their vocal attempts according to changed auditory feedback (Tseng et al. 2007; Bastian, 2011). This might mean adding 'twang' (see glossary) to boost projection in an acoustic that lacks resonance or reducing overall energy in an acoustically vibrant space. Reinforcement is the third strategy whereby those actions found to be the most successful in the exploratory phase, are repeated (Sutton and Barto 2014). Use-dependent learning is where a movement, that has historically been found to achieve a goal, is repeated and refined, creating a bias towards this movement pattern. Use-dependent learning can optimise a repeated movement but excludes other movement patterns that could be more effective (Huang et.al.,2011).

Johnson (2020) contends that the method of delivery of the principles of motor-learning-theory is pivotal to student development. He goes on to state that motor-learning feedback is divided into internal (intrinsic) and external (augmented); the first the student experiences and the second is commentary from the teacher. Maxfield (2011) found that high frequency feedback benefitted experienced singers and Sidaway et al. (2012) discovered that complex tasks also necessitated higher feedback frequency. Fujii, Lulic, and Chen, (2016) found that high frequency feedback was beneficial to learning a new task. Multiple studies (Anderson et al, 2005; Badets and Blandin, 2010; Anderson et al., 2005; Steinhauer, and Eichhorn, 2023; Murtori et al.,2013; Patel et al., 2017) recommend that although teacher feedback

occurring during, or immediately after, a student attempt may boost performance in the studio, it does not aid motor-learning in the long-term, yet no explanation was suggested.

During the training-phase, augmented feedback interrupts student exploration, and feedback after an attempt interferes with self-regulation Otte et al., (2020). Practitioner feedback, therefore, should ideally follow a series of student attempts (Verdolini, 2000). Student attentiveness and subsequent learning and attainment can be affected by teachers' language style (Nápoles, 2006). She recommends reduction of teacher 'verbalisation' as beneficial to student engagement and achievement of learning goals.

Demonstration is an example of external-focus which is beneficial to motor-skill acquisition during the planning stage of a motor-task (Wulf, 2013). The student's attention is directed away from their physical processes, hence externally-focussed. This then, might be evidence for demonstration as an effective pedagogical tool.

Instructional delivery and internal focus

The delivery of singing lessons via instructions (verbal descriptions of motor-procedures) may have been less popular in the past, but there is a possibility that on-going discoveries in the field of voice-science may have had an unintended impact (Nisbet, 2003, Angell, 2019). A student instructed to "use thin folds" (see glossary) (Estill, 1988; Fantini, 2016) would be an example of instructional delivery and internal focus. The efficacy of instruction if not linked to an explanation or a somatic memory, may be debatable. Explicitly drawing a student's attention to a part of their anatomy is directing the focus of their attention inwards and as Wulf (2013) explains, this has been found to inhibit motor-learning and increase potential for physical tension (Vereijken et al.1992. Johnson (2020) terms instructional tuition 'declarative learning' and posits that it demands the attention of the learner and delivers in the form of words, either an instruction, description or analogy. He contrasts declarative with procedural learning, which involves physical participation and is arguably more instinctive. Koziol, Ely Budding and Chidekel (2012) hypothesize that the cerebellum anticipates and controls behaviour, acting as a planning system for decisions. A motor-process learnt by enactment is automatic, whereas a skill learnt via declarative means neurologically travels the long route round the brain and takes longer to become embodied (Koziol, Ely Budding and Chidekel 2012). Nisbet (2010) states that internal focus can be defined as thinking about specific parts of the body whilst singing, and goes on to assert that this can hinder student progress. Grant (2014) however, explains that a student may lack awareness of habitual physical tension, until attention is called to it. Subsequent to the student's realisation that

they are tense, a shifting between the minutiae of muscular motion (internal focus) and the physical act of singing, must be linked and contextualised for learning to take place.

Feldenkrais Method

The basis of the Feldenkrais Model, is the fostering of student awareness by experiencing the quality of exploratory movement without specific aim (Connors, 2010). This aligns with the initial cognitive-phase of motor-learning theory which is also exploratory, but where external-focus is typically used (Wulf, 2007, Ghorbani, Dana and Fallah, 2019). Historically, the inherent use of awareness in Feldenkrais method has been criticised by motor-learning exponents, who equate this with internal-focus, seen to be detrimental to motor-learning (Ives, 2003). Feldenkrais practitioners contend, however, that once a greater self-awareness has been fostered, the somatic information gained in the exploratory-phase can be utilised using external-focus to improve motor function (Mattes, 2016). In the Nisbet study (2003, p14) the author changed her language from instruction, to phrases recommending reflection ('notice') and found this facilitated learning. Buchanan and Ulrich (2001) also recommend that the practitioner guides the student's awareness to the quality of their movement to foster self-evaluation of a motor-process. Hillier and Worley (2015), note that there was a high risk of bias in the literature on Feldenkrais Method they reviewed, in that the effects of the practice were generic, but ultimately found sufficient merit in the method to recommend it.

The involvement of the whole-self is central tenet of the Feldenkrais method (Nelson and Blades, 2018), a holistic approach of total mindful engagement also seen in the previously discussed, Suzuki method (Yankovych, 2020). Self-directed learning and student autonomy are the desirable outcome of Feldenkrais pedagogy and student awareness in the context of the studio can be replicated in other settings, once mindfulness has been initially acquired (Mattes, 2016).

Planning a motor act in response to viewing demonstration; sensing.

The previous section explored the effect of internal focus on students' physical awareness. This section will consider proprioception; the body's ability to know where it is in space and how this is crucial to planning a motor-task.

To recreate a demonstration a student must have both physical awareness and a mental map, or neurological plan of the motor-process used (Bastian et al. 1998). Muscles send information to the brain regarding the effort level they are experiencing whilst opposing the effects of gravity (Winter, Allen and Proske, 2005). Through individual experiences of various

motor-acts, individuals create unique and numerous body-maps (Blakeslee and Blakeslee, 2007). If our initial pattern of movement is not optimal, then an inaccurate map is produced which all future movements are based on (Buchanan and Ulrich, 2001). Nichols (2004) cautions that distortions in a body-map may occur either as a result of disease or simultaneously with suboptimal motor function. Neuroplasticity is the mind's ability to reorganise throughout life, meaning that seemingly entrenched patterns of behaviour can be modified with cognitive effort (Schwartz and Begley, 2002). Cognitive effort (cognitive strategies) can be defined as the initial learning phase of a procedure (Spampinato and Celnik 2020) which can be accessed by slowing down the action and analysing each part. The effect of neuroplasticity can therefore enable the brain to re-draw a body-map (Blakeslee and Blakeslee, 2007) in response to injury or practise. A use-dependent motor-learning strategy can therefore be revised as a cognitive-strategy and relearned (Krakauer and Mazzoni, 2011). Visuomotor adaption is relearning a familiar motor-task and working memory has been found to be crucial in this process (Seidler, Bo and Anguera, 2012). Working memory is the system that enables holding information in the short term such as practising mental arithmetic. The size of working memory, equates to the quantity of information an individual can access at a time, and relates to how effective their visuomotor adaption is; hence how quickly they can learn a motor sequence (Seidler, Bo and Anguera, 2012). Instruction (external input) can interrupt visuomotor adaption but with practise the two systems can be integrated (Taylor and Ivry 2011).

This links back to the findings recommending the limitation of augmented (practitioner) feedback during the exploratory (cognitive) phase of motor-learning (Johnson, 2020). We have multiple maps (Damasio, 1999; 2010) and (Ranganathan et al., 2014) found that information from one map is transferable to another map, if enough common elements exist between the two tasks, thereby sharing motor-knowledge from one activity and using it the planning of another. Yiu, Verdolini and Chow (2005) found that by focussing on the movement of one muscle, that action might not benefit that specific area in terms of motor-learning, but adjacent regions not expressly used, may be positively affected. For example, by giving intrinsic instructions about tongue movement, jaw tension may be alleviated which is what I have anecdotal evidence of from the studio.

Jerome Bruner cited in Blanton (1998) states that the singer must develop a mind map by listening to other singers. Nisbet (2003) asserts that students with limited exposure to varied singing styles, would find difficulty in creating a 'mental map' and therefore recommended that student singers listen to as many recordings of professional singers as possible. Nisbet also noted that participants that had previous pedagogical knowledge made greater progress when motor-learning was subsequently applied to lessons. This links with the findings of

Cross (2006) and Fleming, Stinear, and Byblow (2009) who found that existing expert knowledge enabled experienced dancers to learn new choreography through video demonstrations; novices made some progress but the effect of demonstration was reduced. Zardi (2021) citing a study by Calvo-Merino et al. (2005) suggests that existing motor skills possibly increase HMNS activity. When a familiar motor skill is viewed it is embodied by the viewer (Cross, 2006).

Some experience of singing is beneficial, as this forms the basis of a mental-map which is then constructed from listening to recordings or live demonstrations. The student's mental map then acts as the framework for motor-learning delivered by the teacher which then bridges theory with practical application. Demonstration is linked with external focus which has been seen to be advantageous in motor-learning (Chua et al., 2021).

Nisbet (2003) finds that teacher demonstration followed by student imitation, involves not just the attempted reproduction of the sound but also the process utilised by the teacher in its production.

HMNS and empathy

The HMNS is a population of cells found in regions of the brain, that enable a viewer to embody the actions of a demonstrator. They evolved to process movement that has "social relevance" (Oberman, Pineda and Ramachandran, 2007, p1) and studies have found a link between AS (autism) and reduced function of the HMNS (Chan and Han, 2020; Wan et al., 2010). It has been hypothesized that individuals with AS find social interaction challenging or appear to lack empathy because of this deficit, which is sometimes termed the "cracked mirror" theory (Chan and Han, 2020; Jaffe, 2007). Buchanan and Ulrich (2001, p153) assert that if we perform expressively then the audience can feel our emotion due to the function of HMNS. Furthermore, by using demonstration, students' HMNS will form a mental-map and thereby distinguish between "effective and ineffective movement".

Music is created by movement therefore the decoding of music and movement could be processed by the same neural mechanism (Molnar-Szakacs and Overy 2006, p2). Broca's area, known as the speech-movement brain region, was found to have a concentration of mirror neurones (Chaplin, Rosa and Yu, 2020). Motion, language and music all stimulated these neurones, enabling the motor-experience to pass between doer and viewer and therefore "walk in another's shoes" (Molnar-Szakacs and Overy 2006, p2). Sabattini (2019) posits that visual input and movement are connected, as to see we must move our eyes and adjust our retinas. The brain then decides whether action or inaction is appropriate. Inaction

can be suppressed motor-impetus (deciding not to move) or the brain recognising that movement is not applicable, at which point the suppressed motor-impulse is looped back to the viewer's brain. Empathy is the looping back of a motor-impulse (Sabattini, 2019; Jankowiak-Siuda, Rymarczyk and Grabowska 2011).

The realisation that empathy is movement-processing, might explain why humans do not experience empathy when viewing inanimate objects. Kogler et al., (2020) carried out a meta-analysis that found an overlap between areas of the brain that register emotion, and areas that are activated when we witness emotion in others. Tanaka and Kirino, (2021, p1) found that the precuneus connected other regions of the brain responsible for language, mirror-neurons, reward-processing and emotion. The study found that imagined singing activated the precuneus the same way as when an aria was physically sung. Allen et al. (2020) agrees stating that demonstration and practical re-enactment stimulate the same regions of the brain, therefore seeing someone sing enables us to physically encode the motor process needed to replicate the demonstration (Molnar-Szakacs and Overy, 2006).

The HMNS is one of the systems that is utilised when we experience empathy (Paradiso et al., 2021) and similarly when a demonstration is viewed, the viewer experiences some of the physical sensation of the demonstration. This forms the basis for a mind-map or plan of the motor-process needed to achieve the target result. Ebie, (2004) found that children's ability to sing a phrase with specified emotions was enhanced after viewing demonstrations.

As previously discussed, we all have existing motor knowledge of how to sing, but carefully watching a demonstration adds detailed knowledge potentially improving the result (Cross et al., 2006; Fleming, Stinear, and Byblow, 2009). Cross et al. (2011) however, suggest that if a demonstration is perceived to be beyond the viewer's ability to replicate, then the skill demonstrated is rated more highly.

In summary, the HMNS enables a viewer to decode the motor processes involved in demonstration in order to replicate the action. The HMNS is also responsible for the transfer of emotion from performer to audience and the empathy that permits a singing teacher to feel tension or faulty technique when watching a student sing.

Impact

Strong anecdotal evidence exists of the efficacy of the researched strategies, from work in the voice studio. In consideration of ethical implications, new methods must be thoroughly researched prior to formal trials by way of practical research (Ethical guidelines for

educational research, 2018). All the pedagogical methodology studied in the reviewed literature, however, has been peer reviewed. Motor-learning theory has been used in the context of voice lessons since early studies by Verdolini in 2000. The practitioner, however, must always provide the best possible tuition, utilising recently acquired knowledge that may overturn or modify previous practices (Darling-Hammond, Hyler, and Gardner, 2017). It could be argued that to continue with outdated teaching methods whilst waiting to carry out a research project would also be unethical. Demonstration has been used in the voice studio for many centuries without any notable ill effect, and the aim of this review was to gauge its efficacy or to discover if better strategies were available.

Conclusion and recommendations

The conclusions drawn from this review are that it is desirable for students to witness both live and videoed demonstrations to form mind-maps (Allen et al. 2020). Teachers should strive to be accurate in their demonstrations and accompanying explanations should be explicit as to what is being modelling (Hinkley, 2023). Students should be exploratory in their vocal attempts and after multiple trials should reflect on their somatic feedback (Becker, and Fairbrother, 2019). Practitioners should comment after multiple student attempts or when prompted to do so by the student (Anderson, Magill, and Sekiya, 2001;2005; Nápoles, 2007).

Potential future impact

Students may become more self-motivated, taking a reflective approach to study by focussing on their physical sensations during their own performance of a task; critiquing themselves after multiple attempts (Verdolini, 2000). This could be interspersed with prompts from the practitioner (Johnson, 2020), to make minor adjustments based on somatic feedback, to achieve their target (Spampinato and Celnik, 2020). Limited practitioner verbalisation and increased self-reflection, brought about by an integrated approach utilising both motor-learning theory and Feldenkrais method, might shift the focus from teacher-led instructional pedagogy to student-led learning (Powell, and Kalina, 2009; Alt, 2015), bringing with it a greater sense of autonomy (Nápoles, 2006; 2007). This approach may encourage students who lack confidence. It might be argued that greater student engagement could be brought about by the teacher asking questions rather than issuing instructions (Nafisi, 2014). Considering external focus, (Jeannerod,1995) imagery suggested by the teacher may be found to be effective, particularly in students that tend to overthink or have areas of physical tension (Vereijken et al.1992; Roth and Verdolini-Abbott, 2014). Once external focus has been explained, the student may prefer to choose their own imagery to achieve a vocal goal,

the efficacy of which can be discussed with the practitioner. Alternating between internal and external focus may utilise differing strategies to their best advantage (van der Veer, 2022).

From the practitioner perspective, energy would not be wasted on repeated demonstrations, lengthy instructions or continual feedback (Nisbet, 2003). Instead, the practitioner's primary role would be listening to the student and facilitating their self-evaluation progress (Zimmerman, Bonner, and Kovach, 2002). A change in the power dynamic of the voice lesson might also occur, with the student feeling that they are being facilitated towards their own self-set goals rather than having to please the practitioner (Paris, and Paris, 2001; Grant, 2014). In time, the students may start to self-correct their vocal errors leading to new goals being agreed. Student practise may begin to have similarities to lessons, and may be more productive and pleasurable for the student singer. Parallels might be drawn to the mindfulness movement (Langer, 1997) which has been shown to be of mental and physical benefit (Zylowska, 2008; Flook et al., 2010; Keng, Smoski, Robins, 2011; Gouda, et al. 2016). In this way singing pedagogy may begin to be more holistic in approach, and align with complimentary therapeutic practices (Newham, 2005).

Directions for future study might involve how intersecting neural maps might facilitate skill acquisition when considering seemingly unrelated motor tasks, such as dance and singing.

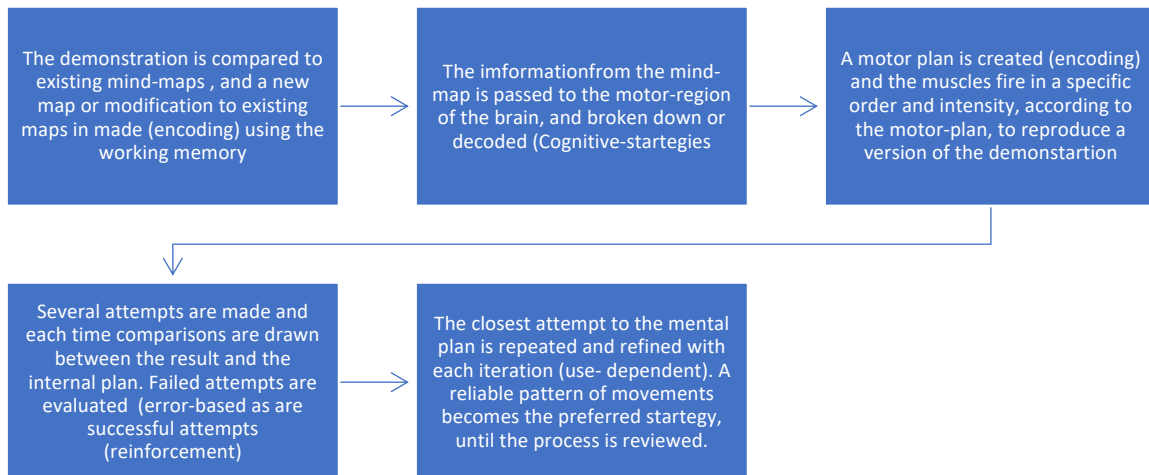
Glossary

Twang: Sometimes known by the Italian term “squillo” in classical vocal technique, involves the narrowing of the pharynx at mouth level to affect the acoustic output of a note. The technique boosts harmonics to the fundamental enhancing the perceived brightness and volume of a note (Perta, Bae, and Obert, 2020).

Thin folds: an Estill (1988) technique term for a voice quality whereby the vocal folds are lengthened and thinned to produce higher, lighter notes.

Appendices

Summary of the motor process



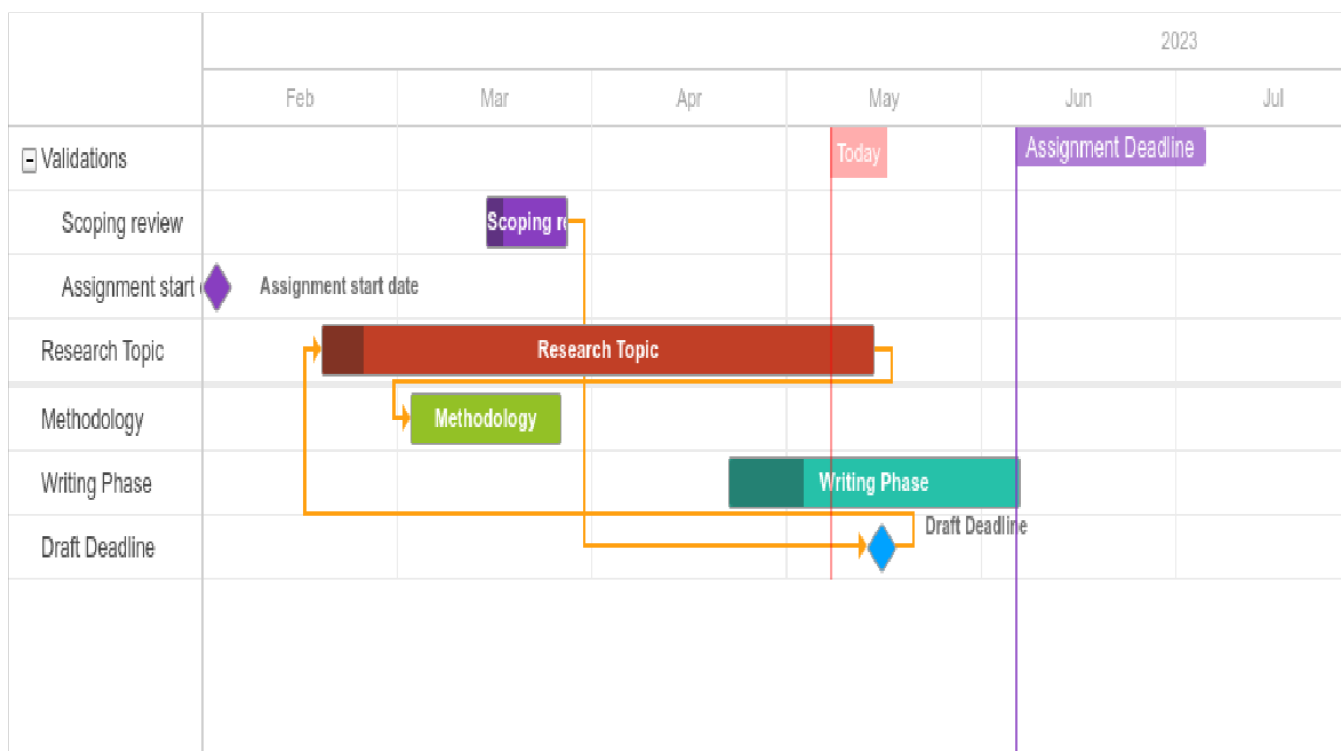
(Spampinato and Celnik, 2021)

Search results from the PubMed database

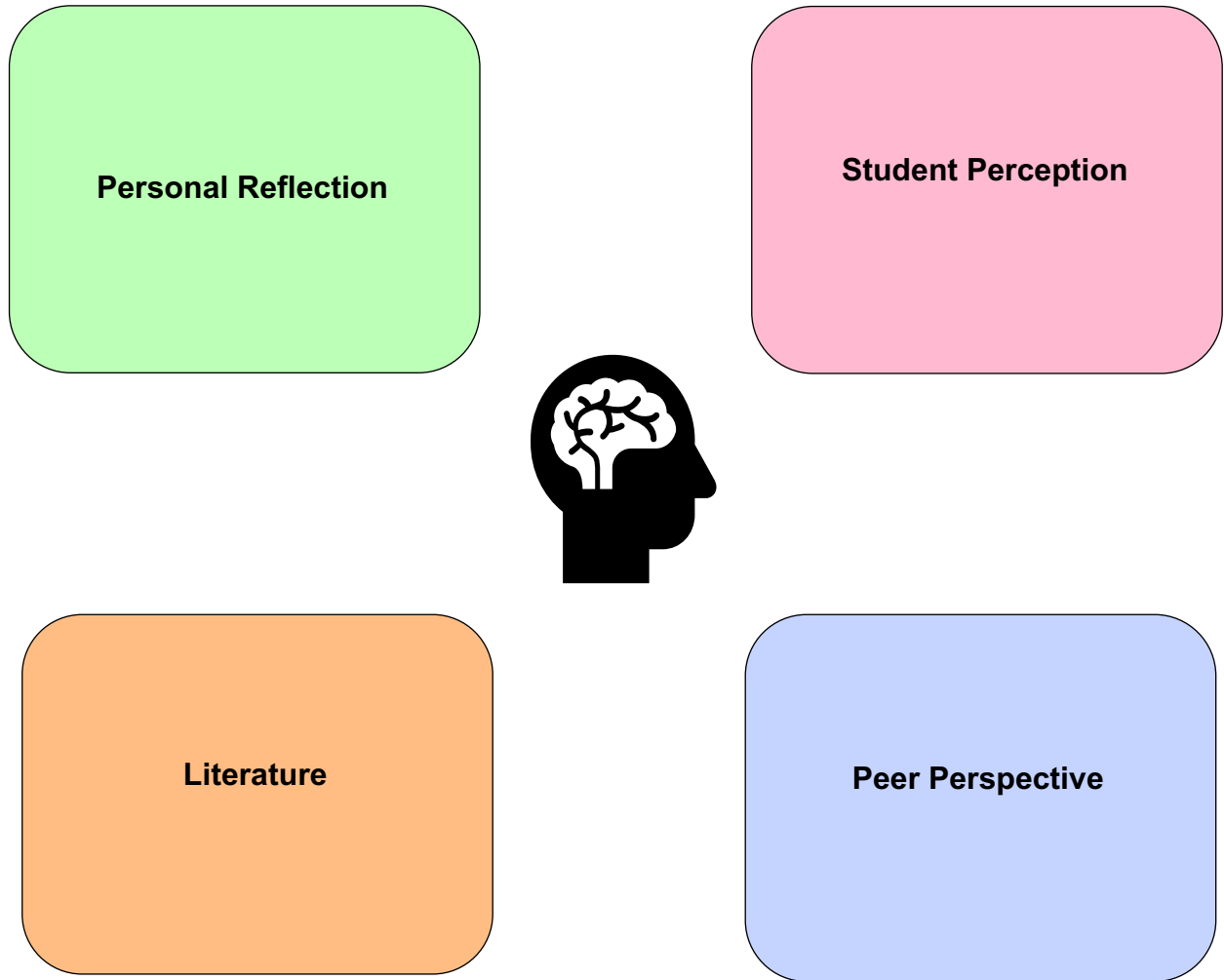
Feldenkrais + Mirror Neurones (N=0)	Empathy + Singing (N=14)	Mirror Neurones + Motor-learning (N=218)	Mirror Neurones + Singing (N=7)	Motor-learning + Singing + Demonstration (N=40)
Feldenkrais + Empathy (N=1)	Empathy + Demonstration (N=2,767)	Singing + demonstration + mirror neurones + empathy (N=0)	Singing + Demonstration (N=52)	Motor-learning + Empathy (N=79)
Feldenkrais + Singing (N=1)	Empathy + Mirror Neurones (N=157)	Mirror Neurones + Empathy + Singing (N=0)	Motor-learning + Singing (N=24)	Motor-learning + Empathy + Singing + Demonstration (N=0)
Feldenkrais + Demonstration (N=6)	Mirror Neurones + Demonstration (N=82)	Mirror Neurones + Singing (N=7)	Motor-learning + Demonstration (N=976)	Motor-learning + Feldenkrais (N=8)

From the above results it can be seen that empathy + demonstration produced the highest number of search results (N=2,767), followed by motor-learning + demonstration (N=976) and Mirror-neurones + motor-learning (N=218) and Empathy + Mirror-neurones (157) producing fewer yet still significant results

Programme of study



Brookfield's four lenses of reflection



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