Function of Private Singing in Instrumental Music Learning:

A Multiple Case Study of Self-Regulation and Embodiment

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Abstract

The aim of this paper is to explore a range of largely embodied vocalisations and sounds produced by learners of string instruments and how they relate to the potential self-regulatory use provided by such vocalisations. This type of 'singing' while learning to play an instrument may have similarities to the use of private speech in other types of learning tasks. This report describes a multiple case study based on the naturalistic observation of learners playing string instruments in different situations. We observed private rehearsals by six adult guitarists from different music cultures (classical, flamenco and jazz) who had different approaches to learning (traditional and constructivist). In addition, we observed the one-to-one lessons of a constructivist cello teacher with a 7-year-old beginner and a 12-year-old student. All sessions were recorded. We applied the *System for Analysing the Practice of Instrumental Lessons* to

the video-lessons and/or practices and participant discourse for constant comparative analysis across all categories and participants. From the theoretical framework of private speech, we identified a set of qualities in private singing, such as whistling, humming, and guttural sounds, with different levels of audibility. Self-guidance and self-regulation appeared to be the functions underlying both psychomotor learning and reflective-emotional learning from an embodiment approach. Guitar learners from popular urban cultures seemed to use less explicit singing expression than classical guitar learners, the explicitness of which may be related to the instructional use of the notational system. In the one-to-one cello lessons, we observed a process of increasing internalisation from the younger to the older student. Both results are consistent with the literature on private speech, indicating that this process is a natural process of internalisation at higher literacy levels. Singing is not as frequent in music lessons as might be expected, and it is even less frequently used as a reflective tool or understood as an embodied process. The examples provided in this article shed light on the multiplicity of applications and on the potential benefits of private singing in instructional contexts as a powerful learning tool.

Keywords: embodiment, instrumental learning, music rehearsal, one-to-one lessons, practice session, private speech, singing, self-regulation, self-guidance

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Singing has often been connected with musical instrument practice, as claimed by teachers and well-known musicians from the active didactics of the 20th century (Howard, 1996; Shamrock, 1997) as well as researchers (Gordon, 1988; Schleuter, 1997). However, current constructivist approaches to learning tend to focus on reflecting on the student's psychological processes so that teachers can guide them to improve. This notion has fostered research on the use of singing as a mechanism that produces a musical image (aural and/or creative) before a symbolic (visual) one (McPherson & Gabrielsson, 2002) to become more musically literate before becoming literate in music notation.

However, singing has been found not to be as common a practice in music lessons as might be expected (Burton, 1986; Kretchmer, 1998), and the research suggests that instrumental music teachers and performers could learn from the approaches taken by singing teachers to musical instruction (Burwell, 2006). In addition, there is no evidence of research addressing the use of singing as a reflective tool in the line of private speech. It is surprising that singing is used little educationally, especially considering the recent research studies that link singing with the great phylogenetic rootedness of the human being (e.g., Hagen & Hammerstein, 2009) or the benefits of singing to instrumentalists (e.g., Lee, 1996; Sheldon, 1998, for a review please see Bernhard, 2002).

There have been almost three decades of research on learning music in which studies have focused on the amount and quality of practice (e.g., Chaffin & Imreh, 1997; Hatfield, Halvari, & Lemyre, 2016; Miklaszewski, 1989; Nielsen, 1999). The

emphasis on the development of learning strategies has often assumed that knowledge is acquired through formalisation and abstraction, which should subsequently be reflected in actions. However, in the past ten years, emphasis has been placed on the so-called *EEEE* mind (Pozo, 2017; Rowlands, 2010), an essentially *embodied* mind that learns through body actions and sensations, rather than an abstract device that learns through formal and symbolical processing but also an *enactive* mind that learns through action, *embedded* in a situated environment and at the same time *extended* such that mental activity will extend beyond the brain, not only to the rest of the body but also to the extracorporeal material and symbolic resources by which it is supported.

We will begin our analysis by examining the manner in which we learn from the body, followed by a more detailed investigation. If we ignore the body when we research the notion of learning, we will have forgotten the key that can make learning difficult. Extra-linguistic factors, such as gestures, singing and musical actions, are currently acquiring great importance in the research on musical learning. Formal and informal studies of musical education in different contexts (Folkestad, 1998; Green, 2002) and cross-cultural research (Casas-Mas, 2016; Casas-Mas, Pozo, & Scheuer, 2015; Thompson & Balkwill, 2010) have contributed to shifting the focus to implicit and sometimes subtle learning strategies and to a broadening of the scope of studies in the formal sphere to attain further understanding of the basis of music learning.

One approach to the research on extra-linguistic elements is through private speech. Private speech for self-regulation and mastering skills is defined as speaking to oneself for communication, self-guidance and the self-regulation of behaviour. Although private speech is audible, it is neither intended for nor directed to others. Private speech is a crucial window providing insight into how language mediates and regulates thought processes (Lantolf &Thorne, 2006). Beyond Vygotsky's writings

(1987), which discuss how children's private speech changes significantly during the preschool years, Sánchez-Medina and Alarcón (2006) note the fact that private speech is a semiotic tool in problem-solving throughout one's life. They emphasise the differences between literate adults, who have less audible private speech and make use of regulating functions during task completion, and illiterate adults. We can distinguish between internalised and externalised private speech. The former is barely perceptible, more similar to guttural sounds, humming and breathing sounds, while the latter is perceptible and intelligible, such as singing, whistling or whispering. Internalised private speech is related to high educational levels in certain aspects of cultural reality, while more externalised processes are related to the intermediate phases of learning (Winsler, Díaz, & Montero, 1997).

Otherwise, we rely on the impact of literacy levels on the functions of private speech and on the work of Berk and Garvin (1984) on how Appalachian children experienced a lower rate of private speech (although not in quality) than middle-class children in previous studies. In this regard, we have found diverse educational conceptions and practices in different cultural realms (e.g., Pozo et al., 2006). We therefore decided to study different cultures of learning music: (i) classical (academic, based in music conservatories, formal, uses musical scores as a learning tool); (ii) jazz (not always academic, non-formal, uses schematic music notation [chart]); and (iii) flamenco (informal teaching and learning contexts, usually with family, uses oral transmission) (Casas & Pozo, 2008; Casas-Mas, Pozo, & Montero, 2014; Casas-Mas, Pozo et al., 2015).

Previous analyses (López-Íñiguez, Casas-Mas, & Pozo, 2012) have discriminated among different quality types of private singing (PSg) according to levels

of audibility: guttural sounds, humming, singing, whistling, whispering and breathing, as defined in Table 1.

Table 1. *Type of PSg according to audibility* (López-Íñiguez, Casas-Mas, & Pozo, 2012*).*

Type of PSg according to audibility	Definition
Breathing	The passage of air into and out of the lungs that causes barely perceptible sound.
Guttural	There is a little air friction and vibration of the vocal cords with a short sound, closed and opaque, usually with the mouth closed.
Whispering	Speaking or uttering in a soft hushed tone, without vibration of the vocal cords.
Humming	A musical phonation of the vocal cords with lips closed.
Whistling	Explicit, but without vibrating the vocal cords, just manipulating the air in the whole mouth and lips.
Singing	The most explicit phonation with musical vibration of the vocal cords.

We also found two main functions for private singing: self-guidance and self-regulation. The self-guidance function is a procedural script in rhythm guidance, memory with transfer, ear-hand comparison and searching for notes (aural and/or creative). The self-regulation function is applied in reflective and deliberate practice, for example, tuning supervision by the learner (metacognition), emotional discharge, guiding the learner to intrinsic motivation, error penalisation or musical flow. These are defined in Table 2. We would like to determine whether there are PSg profiles according to audibility level and the function they fulfil for the learner.

Table 2. *Type of PSg according to the functions of use* (López-Íñiguez, Casas-Mas, & Pozo, 2012).

Type of PSg according to functions		Definition
Self-Guidance	Rhythm guide	Used to understand and control the rhythm that sounds or is written and what the learner wants to play.
	Memory with transfer	Verbalizations or gestures, which refer to knowledge acquired (in the past) and for use as anchorage for a new learning.
	Ear-hand comparison	Used to establish a relationship between the sound sought and running the fingers over the fretboard.
	Searching for notes	A simple search of a position on the fretboard involving sound output.
Self-Regulation	Tuning supervision	The learner uses a metacognitive strategy to supervise the tune being played by singing some notes.
	Emotional discharge	When the learner is faced with a difficulty and needs a break to return with a decision.
	Intrinsic motivation	The learner experiences it by singing music that encourages him after a very conceptual task or task demanding high psychomotor input.
	Error penalization	Guttural "muffled" sound following an erroneous production and preceding correction. It is a negative evaluation whose production could be related to the synkinesis, i.e., a superfluous involuntary muscular movement accompanying another voluntary movement.
	Musical flow	The period in which the learner is playing continuously, and where the musical discourse is not interrupted and is synchronized by breathing, which encompasses the musical phrases and the flow experience (Csikszentmihalyi, 1990), associated with positive emotions.

Finally, we would like to compare the two opposite poles of different approaches to teaching and learning, which use self-regulation and reflective tools in different ways. Table 3 compares the roles of teachers and students, and the teaching and learning processes and the results in the traditional versus the constructivist approaches to musical education. These different conceptions are expressed in teachers'

and learners' discourse when speaking or thinking about their processes (Bautista, Pérez-Echeverría, & Pozo, 2010; López-Íñiguez, Pozo, & de Dios, 2014; López-Íñiguez & Pozo, 2014a, 2014b). It is important to note that the two ways of managing music learning are not mutually exclusive. Indeed, they are usually combined in each person, but with a characteristic profile in which one of the approaches tends to predominate over the other (Casas, Pozo, & Scheuer, 2015; Marín, Scheuer, & Pérez-Echeverría, 2013).

Table 3. *Comparisson of the roles of teachers and students, and the teaching and learning processes and results in traditional versus constructivist approaches to instrumental musical education. Taken from López-Íñiguez & Pozo (2014a)*

	Traditional Approach T&L	Constructive Approach T&L
Teacher's Role	-Highest hierarchy ("Maestro") -Gives orders -Explains -Corrects mistakes	-Guide -Helper -Asks what to do and how to do it -Mistakes as potential learning tools
Student's Role	-Non autonomous -Asks what to do and how to do it -Follows orders	-Autonomous -Reflects on how to do -Thinker
L&I Processes	-The teachers -Repetitive-rehearsal -Extrinsic motivation -Modelling	-Collaborative assessment -Reflection-on-action -Intrinsic motivation -Inner listening -Attention management/ Focussing -Memory with transfer
L&I Results	-Quantity of practice -Psychomotor (position of fingers and hands) to play in tune -Perfect exam -Exact reproduction of the symbolical material of the score	-Quality of the practice -Inner listening to tune -Learning how to practice/study -Understanding of why we do things

Our assumption is that *singing* could work as a tool for learning to play an instrument in the same way as private speech, with similar phases of internalisation. Two aims derive from this assumption. The first aim is to describe *private singing*[1] (hereinafter PSg) qualitatively as a self-regulatory and self-guidance tool for string

instrument players from different learning cultures and educational realms (flamenco, classical and jazz). Popular cultures of learning –such as jazz and flamenco– are characterised by a greater use of orality in the transmission of knowledge and likely are more embodied, and therefore the approach is a more internalised mode of PSg than in the classical culture of learning, where notation has helped to render sound explicit through external representations such as the score. Within each culture of learning, we consider two polarised conceptions of learning: the constructive conception versus the traditional or more repetitive conception. We assume that the former will reflect a more self-regulated use of PSg (for an overview of self-regulation in instrumental music learning, see López-Íñiguez, 2017; and Varela, Abrami & Upitis, 2014; and in relation to the popular cultures of learning, jazz and flamenco music, see Casas-Mas, Montero, & Pozo, 2015).

The second aim focuses on elementary-level cello students with regard to Vygotsky's (1987) assumption that PSg is a complex case. The proper performance at an early age of some of the learning tasks analysed herein may be outside their zone of proximal development (Winsler et al., 1997). Traditionally, the study of notation has served as the instrumental medium for learning music. We propose that a more "natural" medium, such as the body, or more specifically, the voice, could be a rather powerful learning tool that could be explicitly used by teachers. Thus, the greater the expertise is, the more internalised PSg the learner would show.

Method

This is a multiple case study that analyses tasks based on naturalistic observation. We have followed the traditional research methods in the study of the psychological processes behind learning (Pintrich & Schunk, 2002) and other

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qualitative studies, which emphasise studying the approach adopted by each participant to the musical learning task (Casas-Mas, 2013).

Participants

We observed six semi-professional guitarists from three different cultures: flamenco, classical and jazz (two each) in Spain. Within each culture of musical learning ("culture" for short), the participants were required to have a similar level of practical skill in all three cultures, which we define as a semi-professional level, so that they would have considerable qualitative enculturation while still fulfilling the role of apprentice. This made it easier for us to access learning processes than if we had interviewed experts, in whom learning is usually automated and not explicitly accessible. Culture also conditions other aspects at this level of expertise, such as the age of the participants, or their formal schooling degrees, providing a wealth of information on the goals and means of each one, as explained in Casas-Mas (2013).

Of the 31 initial participants, we selected two from each culture who held the most polarized conceptions (traditional versus constructive), as shown by their answers to a multiple-choice questionnaire (Casas-Mas et al., 2014). Casas-Mas, Montero, et al. (2015) define these approaches to learning according to certain epistemological, ontological and conceptual assumptions that are explained in the next section. This resulted in six instrumental case studies (Stake, 1995), which were selected according to the variable "conception" within each culture of musical learning. This enabled us to observe whether there were any differences in the participants' subsequent musical learning practices (Clarà & Mauri, 2010), both between cultures and between conceptions. The participants were observed during their private practice sessions while preparing a musical piece, and they were subsequently questioned about the practice

session through a post-practice interview and reflection on the practice interview (hereinafter RPI).

In addition to the guitarists, we conducted a double case study of two female beginner-level classical cello students (7 and 12 years old). They were observed during four real lesson situations (approximately 30 minutes in duration each) with their teacher in Finland. We observed this particular teacher's students because the teacher and her students were found to hold constructivist conceptions and practices of teaching and learning after using different materials from previous studies. These materials included structured interviews with different engaging tasks for children such as watching videos of typical learning situations or playing with cards that included learning content of musical scores (López-Íñiguez & Pozo, 2014a, 2014b) as well as interviews, diaries and questionnaires for the teacher (López-Íñiguez & Pozo, 2016).

The younger cello student had been studying with this teacher for three months and was in first year of elementary musical studies, while the older cello student had been studying with the teacher for four years and was therefore attending the fourth elementary level course at the music school. Both students had normal scholastic performance and came from middle-class Finnish nuclear families with higher education in which one or both parents were professional musicians. They had both studied cello only with this teacher. The second author was present during the four lessons, taking notes and obtaining video documentation, and all the verbal data collected was transcribed by a Finnish native who later translated the material into English prior to the analysis. The analysis also included all gestural of the information collected.

We obtained informed consent from all of the research participants prior to recording their images for data collection. In the case of minors, parental and guardian

authorization was obtained, and the parents were assured that the children's personal data would be treated with absolute confidentiality following the guidelines of the Finnish Advisory Board on Research Integrity.

Materials and Procedure

In previous studies, these cases had already been classified as representative of a more polarized approach to learning within their musical culture (Casas-Mas, Pozo et al., 2015). Casas-Mas, Montero, et al. (2015) define these approaches to learning according to some epistemological, ontological and conceptual assumptions. The substantial property of the constructivist conception resides in its epistemological principles: in this case, reality is considered to be multiple, and it is encouraged that it should be constructed by the individual, so the acquisition of knowledge implies the transformation of both the content and the learner. This contrasts with a more traditional view whereby the learner's mind is compared to a blank slate, and learning is based on copying, repetition and imitation, without the intention of integration with previous knowledge or transformation of the learner. It simply contemplates the quantitative acquisition of content.

We began to analyse the learning practices of these participants on the basis of a multiple case study. After several video recording sessions of each participant's practice or lesson, we performed several pre- and post-practice interviews and a reflection on the practice interview- RPI- with the guitarists. The post-practice semi-structured interviews consisted of questions about the planning, difficulties, supervision and evaluation of their practice session, while the RPI involved joint viewing with the learners of their recorded practice sessions and asking them about specific scenes previously selected by the researcher. Next, we applied the *System for Analysing the Practice of Instrumental Lessons (SAPIL)* to the video-lessons or practices and to the

participant discourse (using ATLAS.ti software). This system is organised according to the conditions, processes, and results identified by Pozo (2008) in relation to teaching and learning practices (for a detailed application of this system in classical music, see López-Íñiguez & Pozo, 2016; and in jazz and flamenco music, see Casas-Mas, 2013).

This system relates classroom episodes (analysis units) to what and how teaching and learning occur (dimensions) during music lessons according to 1) the learning outcomes (what is learned or what learning is intended); 2) the learning processes (what processes and activities will enable the student to achieve those outcomes, how musical learning is managed cognitively, emotionally and metacognitively and why); and 3) the learning conditions (how the activities or practices are organised, i.e., what type of teacher-student interaction and what materials are used in the lessons). We performed a constant comparative analysis (Boeije, 2002; Glaser, 1965; Glaser & Strauss, 1967; Strauss, 1987) across all categories and participants.

In this study, we report only the results obtained from the analysis of the typical classroom activity category (TCA) "Singing". The categorical analysis of this TCA is described in the findings. A single interviewer (the first author of this article) was present during the guitarists' practise sessions and lessons with the cello students and teacher to facilitate the production of private speech, as is usual in research on the subject (Behrend, Rosengren, & Perlmutter, 1989). The inter-rater agreement of the TCA was calculated following Bakeman and Gottman's (1997) level of absolute agreement for observational coding (i.e., assigning codes to the agreed behaviours after inductive analysis) employing Fleiss' Kappa, which was favourably calculated as .80.

Results

A few examples from the total occurrence of PSg in the eight case studies are described below.

Findings from the Six Guitarists from Three Different Cultures: Flamenco, Classical and Jazz

Flamenco learners.

Traditional flamenco learner.

Speech during interviews: On two occasions, the learner explicitly sings samples of what he is explaining in the verbal discourse. In the remaining cases, we only observe guttural sounds that accompany both verbal and musical discourse.

Practice: In Video S1 (42 minutes 13 seconds; for all video files see Supplemental Material Online section) we see an example of private speech emerging with difficulty, with very guttural whispering, in which we have identified that the learner says "no, let's see" just after the stop at the scales, before the rhythmic cuts. A second example of whispering is found in this example of repetitive learning in the post-practice interview:

> I- [I ask him about the difficulties he had during the previous session. The learner claims not to have had any. Then I hint at some difficulties, asking him to explain the difference to me. He does not recognise them until I sing the fragment, after which he reacts immediately and plays it, but does not recognise that it was a difficulty].
> FL-D-the end? [plays and sings the example] [Whispering right at the beginning of chorus] was [plays example], where the rhythm increases? [plays example], Yes, a little.
> I-Do you think you can play it now?
> FL-D-but now it's complicated, yes, as an end.
> I-How would you solve it?
> FL-D-[playing] well, by linking them, things [plays] to the other part [plays], of course, by joining the parts [plays]. (Post-Practice I.)

Constructivist flamenco learner.

Speech during interviews: He uses the singing procedure rather than the guitar up to four times to illustrate his speech. He integrates various forms of expression to

communicate his musical ideas. The mode of communication, such as dancing, singing

or instrumental performance, is only a means for the transmission, not an end. He

explains that one of the difficulties has been to notice the expressive musical content,

and the type of solution offered holistically integrates the above ideas.

> [To resolve this difficulty I do it] by ear, as the teacher did, and I sing it to myself as if it
> was danced. (Post-Practice I.)

Practice: A process of rhythm guidance (beat counting) is detected, about which

we also inquired. He counts the beats to set the beginning to the phrase. This process is

illustrated in Figure 1, which shows that he uses the self-guidance strategy by counting

twelve times in the same session, made visible by whispering.
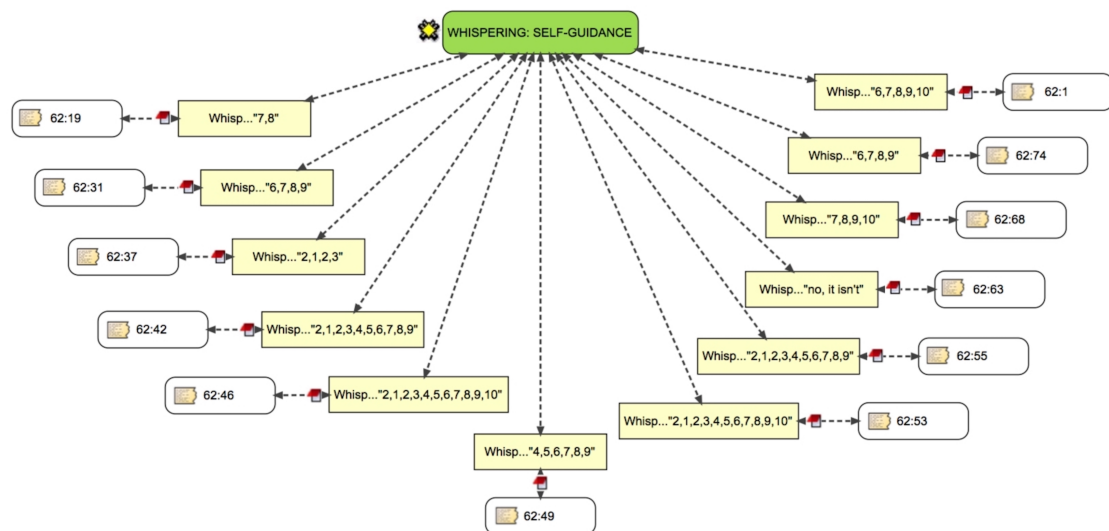
Figure 1. Frequency of rhythm guidance (counting the beat), from the whispers observed,

in the FL-C learner.

Jazz learners.

Traditional jazz learner.

Speech during interviews: He sings melodies as a strategy to help him memorise. It involves using a system other than the production of playing, which helps him to internalise the music before producing it with his hands.

> [...] you look at the lyrics a bit, if you even sing them, well, you see, it's better for saving them [memory]... [...] I recognise many tunes, I do not remember the harmony and I have gaps in the melody, and I even know tunes [sings], go there [on guitar] and I play by ear. However, I remember the harmony and that is because I have sung it, or because I have heard versions, and the lyrics [sings]. (Post-Practice I.)

Practice: First, the participant writes the *chart* on paper. He performs a harmonic analysis.

> [...] It is a two-five, and it is typically set such as that, a II-V with an arrow. (Post-Practice I.)

The video also illustrates how he sings at times while writing the analysis so he can evoke the melody and better imagine the harmonic context, activating a process of memory with transfer.

Constructivist jazz learner.

Speech during interviews: This is the learner who most often exemplifies singing during his speech (14 times). This singing is very interesting to see in relation to his practice.

Practice: We observe breathing as regulation and the absence of singing. The learner uses breathing as an extra-linguistic tool for self-regulation, both in the learning sections of the piece (Lazy Bird, jazz standard) and in the improvisation sections. This is a very good example of an internalised tool. This breathing is inserted in the musical phrasing and divides parts of practice before starting a repetition or prior to a difficulty, for example.

Figure 2 shows the times when the learner makes a breathing sound inserted in the musical phrasing in the written chart. On the right, we see the times that the learner issues this type of breathing synchronised during the improvisational musical phrasing.

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What this tells us, first is that it is an automated tool, and second, that it is not linked to the phrasing of the melody of the chart but that it arises from the internal phrasing of the participant to think or feel the music. There may not be a deliberately controlled activity when the mind is focused on improvisation, which is a very difficult activity in real time and with the speed of the tune.
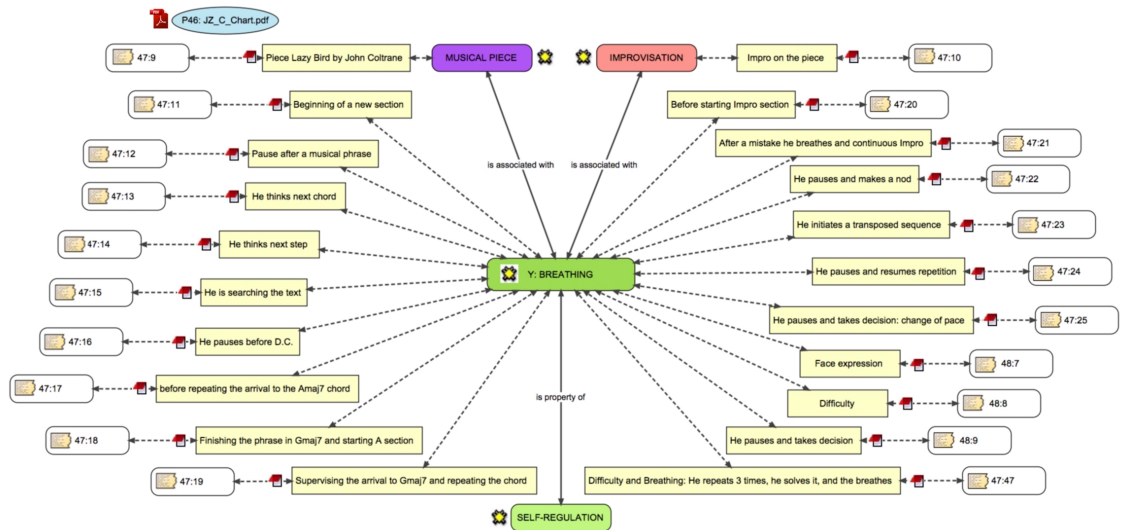

Figure 2. Comparison of the frequency of breathing pauses between the interpretation of the chart and the interpretation of improvisation.

This phenomenon occurs in only one of the learners, who predominantly uses singing to illustrate the explanation of his practice; however, in contrast, we were unable to record any singing while playing. Our interpretation is that singing is a tool he uses for learning, but when he plays, the singing has been almost completely internalised. The PSg in cases where it is internalised is negligible, or identifiable by guttural sounds and humming. Additionally, in this case we identify it through breathing in pauses during the musical phrasing, as was described and compared to the verbal language by Pyron (1982).

Classical learners.

Traditional Classical Learner.

Speech during interviews: The singing procedure is used three times during the interviews to illustrate the verbal discourse.

Practice: The explicit use of the external representation tool of singing is characteristic of this learner. Singing fulfils several functions, which we identify and illustrate in Figure 3: to search for notes or sounds on the fretboard, to understand musical material, as materialisation of a mental representation, and to emphasise expressive elements and as a generator of emotion or motivation.
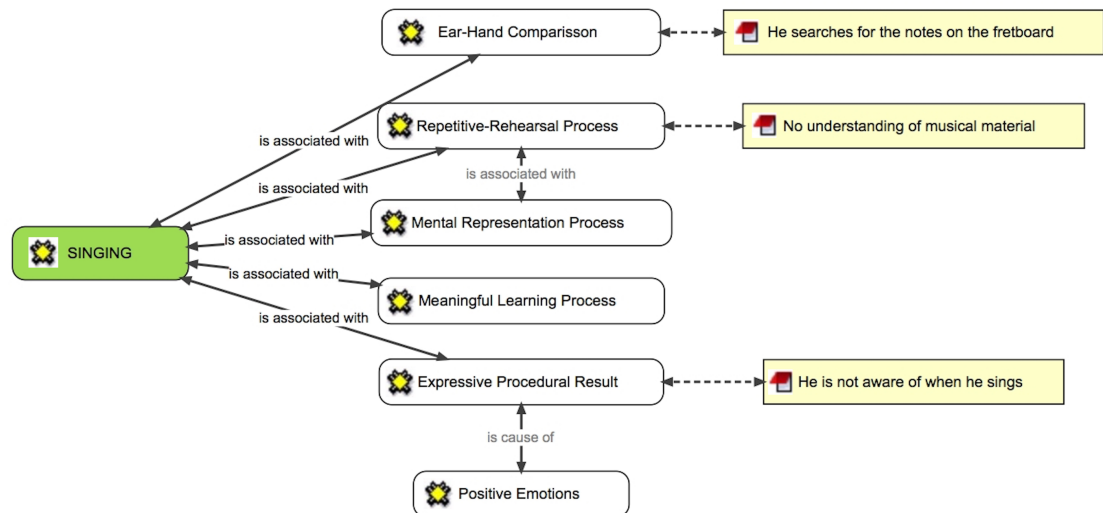
Figure 3. PSg functions in the apprentice CL-D.

The most basic function found is that the sound output (from the mouth) gives a command to the motor cortex for finding and locating a finger on that note on the guitar fretboard. We called this the 'ear-hand comparison' because the learner needs to establish a relationship between the sound he wants to produce and the movement of his fingers.

> [I'm thinking] to find the note, haha. Singing in general. When you study an instrument I think that it is used to understand the music. It's great for me, singing [...] you realise when you play,

without looking at the score, searching for notes. (RPI; Comments 40 minutes 5 seconds and 40 minutes 22 seconds)

The second function is observed in a situation in which the learner is engaging in the repetitive learning of an unsuccessful passage. The learner insists on playing some notes by sliding his hand over the fretboard; however, repetitions do not solve the problem. The act of singing enables him to understand the passage, which is a design of lower flourishes on a descending minor G arpeggio (G-F#-G, D-C#-D, Bb-A-Bb, G-F#-G). That is, although he did not perform a rational analysis of the musical phrase, when he sings, understanding occurs, which then enables him to play it correctly. This can be seen in the Video S2 (38 minutes, 23 seconds).

A third function is when the learner mentions how a musical piece that has generated a mental representation comes to his working memory through singing.

[...] However, when I'm playing and I have in mind, the song. (RPI; Comment 40:6)

A fourth function is the understanding that the singing tool gives him, which he associates with the origin of instrumental music. It is not a tool that he uses in a controlled manner. He is aware that he uses it, but not when he does so. He applies it automatically.

[...] it helps me, yes, because instruments are made to replace singing, so singing helps you to understand music better. If you sing a melody, you know more [...] sometimes, not? [I realise]. I have forgotten it. (RPI, 40 minutes 7 seconds and 40 minutes, 8 seconds, Comments)

In addition, he relates its application to the expressive musical elements he wants to perform. It is a fifth function.

[...] because when you're playing it, sometimes you do not realise, if you want to do more *cantabile* you try singing it... and there is always something that can help you. (RPI; Commentary 40 minutes, 9 seconds)

Even with positive emotions that he feels when implementing it, it serves as a sixth function.

[...] Sometimes we sing because we love it, because it is music and we sing without reason, and

we're musicians, ha ha. Yes, [it] is very dramatic. (RPI; Comment 40:10)

Constructivist classical learner.

Speech during interviews: None.

Practice: Singing with the emotional function. In this learner, we found two examples during practice that illustrate two types of singing with the same emotional function.

The learner uses the specific forms of singing and audible whistling, both of which are explicit and provide emotional discharge after great concentration or effort. By singing he interprets the problem, then takes a moderate pause and gains renewed motivation. The example of singing is illustrated in Video S3 (52 minutes, 52 seconds), and the whistle in Video S4 (53 minutes, 5 seconds).

Synthesis of the Six Participants: Singing as a Continuum in the Six Participants

Our study of the six cases shows different forms of PSg externalisation and internalisation, represented in Figure 4 by musical dynamics regulators that express variation in loudness between the forms of PSg. The internalised forms are shown on either side – guttural utterances and breathing synchronised with phrasing. Moving inwards towards the centre of the figure are humming and whispering to count the beat internally. The more explicit activities of singing and whistling are found in the centre. Whistling is a representation of singing. The bottom of Figure 4 shows the different psychological functions realised by these external and internal utterances, which range from self-guidance – of procedural character for channelling and controlling behaviour – to self-regulatory functions – which, rather than a controlling behaviour, serve the purpose of emotional management, thereby exerting a significant impact on behaviour.
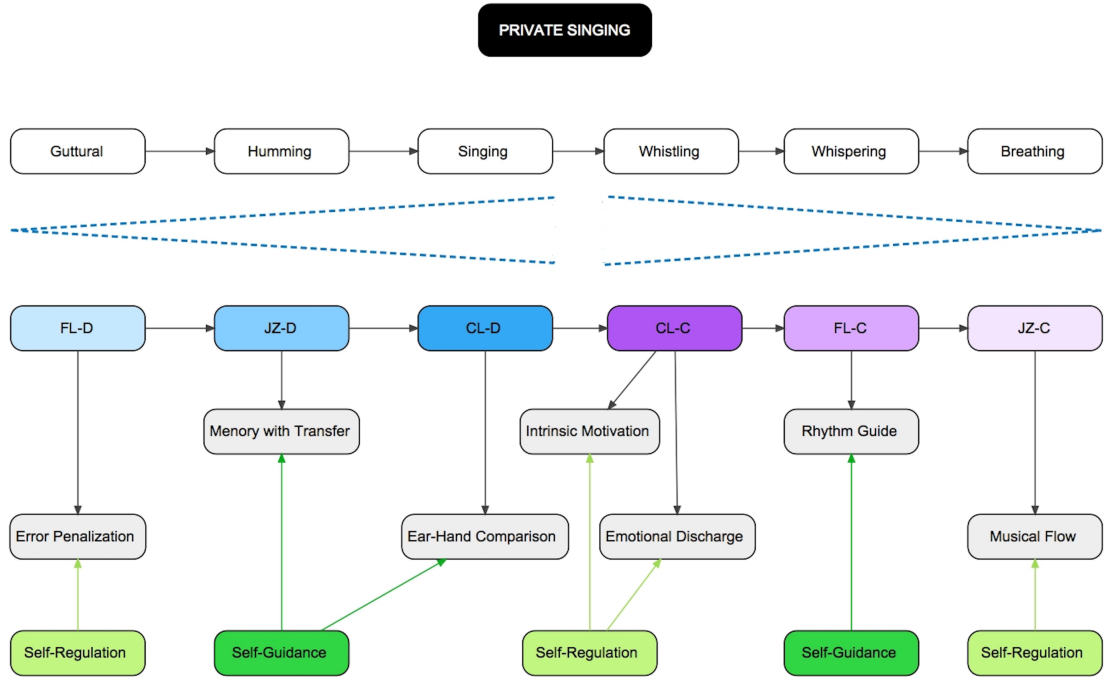
Figure 4. PSg in the study of the 6 cases of semi-professional guitarists.

The self-guidance functions observed are as follows: memory with transfer in the evocation of the aural mental representation of the melody (and perhaps also the harmony and rhythm) in working memory while the learner analyses the score; ear-hand comparison, linking the aural representation to the psychomotor movement of the hand on the fretboard; and, finally, rhythm guidance, counting parts of the beat to produce accurate motor skills. We did not observe these guitarists simply searching for notes. In addition, the self-regulation functions observed are as follows: penalisation of errors, intrinsic motivation, emotional discharge and musical flow. We did not observe tuning supervision in these guitarists.

Findings in the Two Beginner Cello Students

After describing the characteristics of the six guitarists in depth, we also wanted to analyse whether PSg is used as a tool for teaching and learning in string instrument lessons with young children. More specifically, we wanted to analyse whether PSg

appears as a strategy in the context of constructive approaches to teaching and learning, and whether there are differences in the ways PSg appears in the lessons of 7- and 12-year-old students, considering the attitudes of both learners and teacher to PSg.

Before describing each case, we will note that the types of guttural sound, error penalisation and breathing have not been found in the discourse analysis of the participants, and although some breathing examples were found, they appear simply as isolated elements and are not part of PSg, as shown in Figure 5.
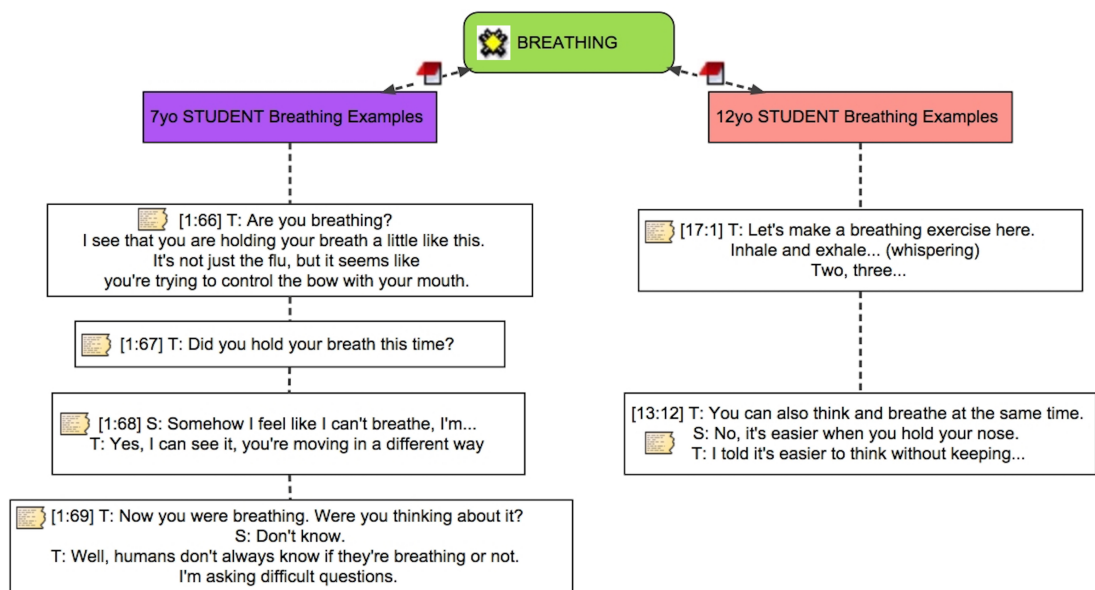
Figure 5. Examples of breathing when it is not connected to PSg in the cello students.

It is also important to mention that although we found only a few examples of humming and whispering as types of PSg, most of them were connected to other issues, but not to PSg, as illustrated in the following example:

> Student: Do you know what, teacher?
> Mm?
> Student: I got a new bike yesterday.
> Teacher: mm-hmm.
> Student: Which costs 400 €.
> Teacher: Mm-hm, mm-hmm.
> (Humming example: 12 yo Student, Lesson 2)
>
> Teacher: How would you play this if you did not have flageolets, how would you play it?
> Student: (something in a soft voice, thinking for 4 seconds).

(Whispering example: 7 yo Student, Lesson 3)

Seven-year-old child.

Role of the teacher: Out of all the different types of PSg, this teacher uses only singing three times in connection to rhythm and musical flow, and humming once connected to rhythm (see Figure 6). However, she encourages the student to self-guide and self-regulate her learning activities by suggesting that she should sing:

Teacher: Can you sing it?
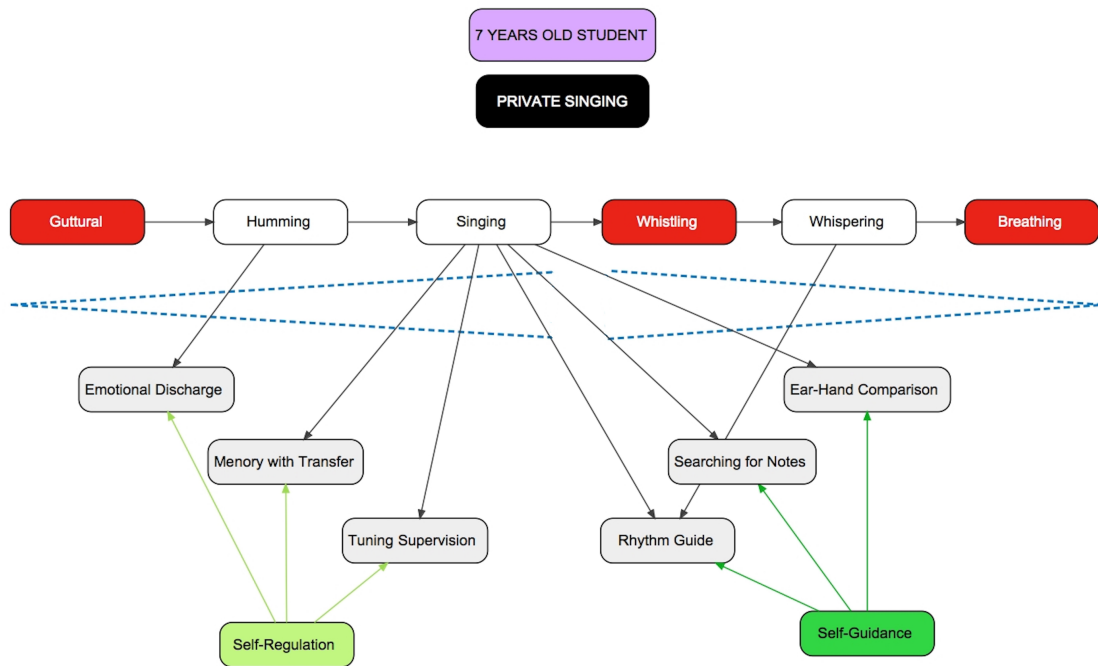Student: DO-RE-DO-RE-RE-DO-DO
(Singing suggestion example: 7 yo Student, Lesson 1)

Figure 6. Summary of the PSg used by the teacher in the case study with the 7-year-old student.

Role of the student: The role of this student is quite active in the type of singing, since it is used 12 times in connection for both self-guidance and self-regulation, as

shown in Figure 7. Humming is used by this student when connected to emotional

discharge:

> Teacher: Now we put our wings (arms) here to rest.
> Student: (humming and moving her body in a relaxed way)
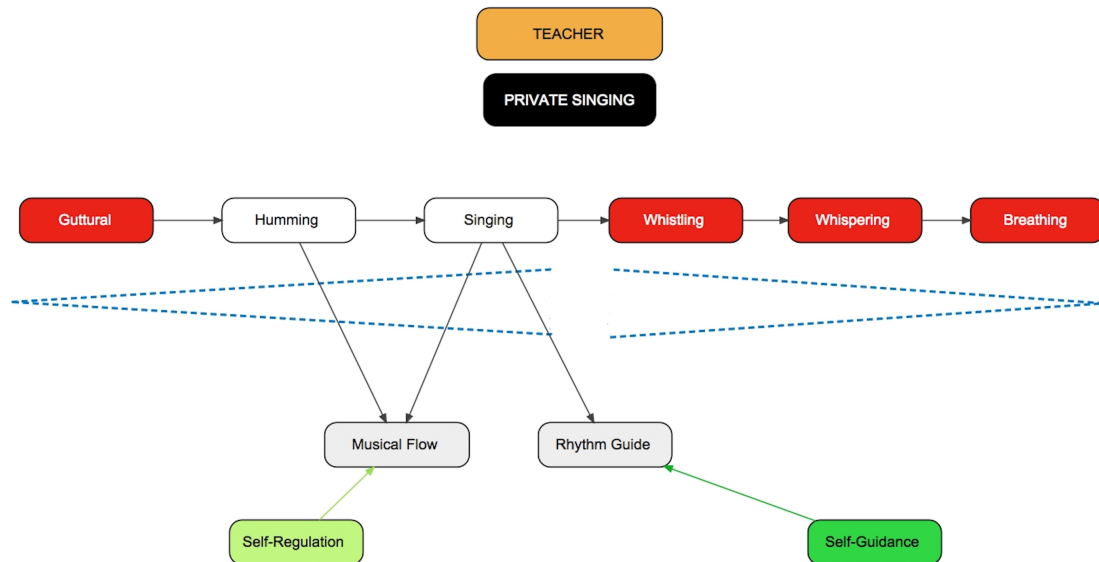> (Humming example, 7 yo Student, Lesson 4)

Figure 7. Summary of the PSg used by the 7-year-old student.

Twelve-year-old child.

Role of the teacher: In this case, the teacher uses PSg much more actively than

with the younger student. This type of 'singing' appears 19 times connected to

activating the student's self-regulation and self-guidance (see Figure 8), and she uses

whistling once to guide the student's inner listening in relation to the ear-hand

comparison:

> Teacher: So. Could we make the beginning sharp? (singing)
> (Student plays)
> Teacher: Yes. In addition, then if I could ask for this one note (singing) and every time
> your bow flies (singing)
> (Student plays)
> Teacher: Try that sharper (whistling)
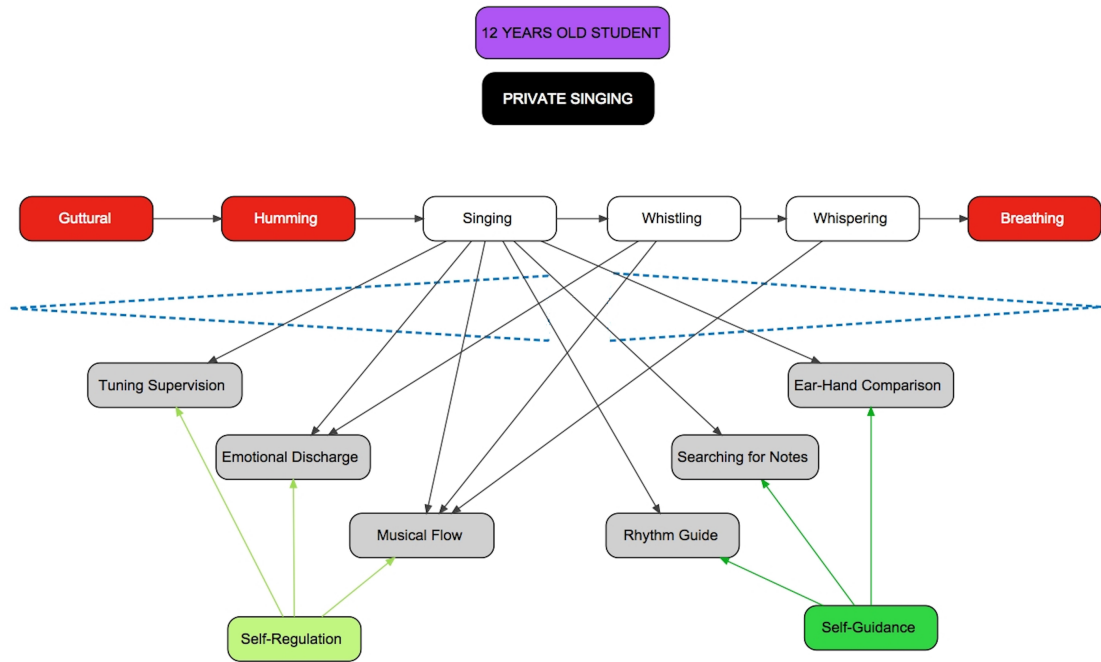> (Whistling example: 12 yo Student, Lesson 4)

Figure 8. Summary of the PSg used by the teacher in the case study with the 12-year-old student.

Role of the student: This student uses whistling twice in connection to her emotions and to the musical flow of the piece she is playing. This type of singing did not appear in the younger student, and the teacher uses it only once in the lessons with the older student, as described above. Although whispering has scarcely appeared in connection to singing, the only time it does is when this student uses it for musical flow:

> Teacher: No one is coming after you (the lesson is finishing)
> Student: Why is not anyone coming? (looking upset)
> Teacher: They're coming tomorrow, so we have time. This has improved... (Student interrupts Whispering the piece in a big crescendo and showing anxiety with her body movements).
> (Whispering example: 12 yo Student, Lesson 2)

The type of singing appears 11 times, which is similar to the younger student, although it usually occurs in connection with her emotional discharge and the musical flow of the pieces she is playing, which are characteristic of self-regulation, whereas the

younger student mostly uses it in connection with self-guidance procedures, as illustrated in Figure 9.
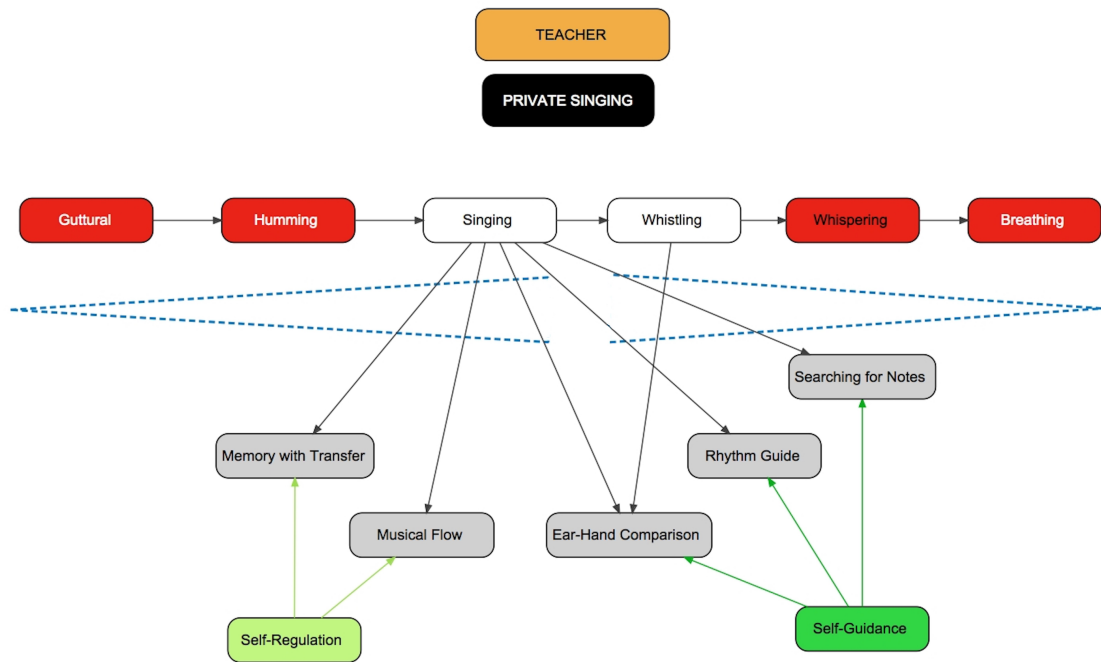

Figure 9. Summary of the PSg used by the 12-year-old student.

Conclusions

Two main conclusions can be drawn from our analyses. The first refers to the embodiment of PSg as a tool used over the entire range of knowledge, from the most implicit to the most explicit, but not always accessible to the learner's or performer's awareness. Although the need to adopt the embodiment approach in research into musical and psychological processes is clear and has been discussed in studies that address the importance of the body (Gritten & King, 2006; Keebler, 2014), it is still at an early stage.

The second conclusion suggests that the use of extra-linguistic elements, such as those described in the broad spectrum of PSg, refers to the tools of knowledge mediation that can be used in a regulatory and self-regulating manner. Thus, PSg is a

great help to sustain motivation, cognition, affects and behaviours (such as practice persistence) when trying to improve musical performance and achieve the learner's goals (McPherson & Renwick, 2011; McPherson & Zimmerman, 2002).

Discussion

In this discussion, we first address issues related to the explicitness of an external representation tool, such as PSg, in different cultures of musical learning and the possible musical literacy factor. Second, we consider how the participants used this tool differently, according to more traditional or more constructive approaches to learning, and we address the tool's possible relationships to the regulation of embodiment in advanced learners. Thirdly, we outline the differences observed with learners in the previous and initial stages of instrumental learning and the transition from self-guidance to self-regulation, as well as the internalization of the singing result of the natural development of expertise. We conclude by emphasising the benefits of the use of this tool in instrumental learning and identifying the limitations of this study and future lines of continued research.

The case studies of guitarists show that learning to play an instrument in popular urban culture settings seems to use less explicit singing expression. In other words, although the PSg is audible, it is not a faithful representation (or substitution of one element by another) of the music, but rather, it fulfils different functions. Due to the limited sample used, we cannot make a strong claim for the idea that the learning process can be interpreted as less explicit and more in line with the development of the mother tongue[2]. In contrast, PSg in participants from the classical culture more explicitly replaces the melody or musical parameter that it emulates. We observed that PSg is related to the role of paper with regard to explicitness, or the role of the score

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with regard to many of the elements of learning. This might indicate that the approach to music is similar to the process of second language acquisition, which would be a very interesting proposal to analyse in future research.

What follows is a description of certain nuances we have observed. In the popular cultures we studied, the jazz participants most explicitly sing along with their verbal discourse in interviews. In addition, the participants with a constructive conception sing more than those with a traditional conception. This may be related to the fact that constructive learning activates the quantity and quality of the self-regulation processes to a higher extent than repetitive learning does (Casas-Mas, Montero et al., 2015). In the classical participants, who have a high musical literacy compared to music learners in popular cultures, we observed two poles. The behaviour of the traditional learner correlates with the findings of Winsler, Ducenne, and Koury (2011), who observed that children immersed in music programmes used more private speech (in this case PSg) during the selection of tasks involving attention than children without musical instruction. However, in the practice of the constructive participants, the internalised PSg, self-regulatory PSg, and PSg preceding action were each positively related to performance and higher literacy levels, following Alarcón-Rubio, Sánchez-Medina, and Winsler (2013). This was also true of the three constructive participants, within the parameters of each of their musical learning cultures, who are emotionally connected and whose learning experience is deep and embodied (Pozo, 2017).

In the one-to-one cello lessons, both students clearly differ from the guitarists because they are regulated externally by the teacher, use very little or no humming, guttural sounds and breathing or error penalisation, and they only use whispering and whistling a few times, and they focus predominantly on singing. In this regard, both cello students use externally regulated PSg because of the difficulty in the psychomotor

movements in the early stages of instruction. This may occur because their activities are challenging for beginners and require greater teacher involvement, therefore affording less scope for self-regulatory behaviours. This is consistent with the research conducted on self-regulation in other educational contexts, which posits that children show more elements of self-regulation when they are in control of challenges, perform more open-ended activities (Boekaerts, 2011; Perry, 1998; Perry & VandeKamp, 2000; Perry et al., 2006), or are engaged in playful contexts[3] (Bruner, 1972; Vygotsky, 1978).

More specifically, in the older student, PSg seems to appear less frequently in connection to self-guidance and more often in connection to the self-regulation process, whereas in the younger student, it appears to be connected to a "simpler" process of self-regulation, similar to the processes used by young children when talking to themselves while playing games (Vygotsky, 1987). We see a process of increasing internalisation from the younger to the older student as a result of the natural development of expertise. Evidence of this is the fact that although the older student produces three times as many words and has longer lessons, she uses singing less often than the younger student. It is the teacher who uses PSg more often with the older student, since this type of PSg no longer appears so easily. However, more internalised types of PSg, such as whistling and whispering, appear in the lessons of the older student. Once again, in agreement with Alarcón-Rubio, Sánchez-Medina and Winsler (2013), internalised private speech correlated with performance and higher levels of literacy.

This was a descriptive study to provide a first approach to the phenomenon. Further studies should be undertaken to contrast these results in larger samples. After reflecting on the results presented herein and discussing them with all of the participants, we consider that the use of PSg both in individual practice sessions and

one-to-one instrumental lessons provides some of the following benefits: an understanding of musical discourse, active learners (and teachers), attention management and focusing, reflective tools for visual and aural skills and early intonation-rhythm that develops better sound production. Furthermore, it helps memorisation, symbolic and rhythmical learning and the creation of new material, understanding harmony, structure and intervals, learning the map of the instrument (fretboard/fingerboard distances) and connecting with the deepest layers of the material (referential, holistic). Contrasting these results in different musical instruments and levels of expertise would be a valuable research aim for the future.

The educational implications of these results resonate with those reported by Hatfield, Halvari, and Lemyre (2016), in which the use of psychological skills in learning music could be predicted according to student self-regulation. We could thus encourage a spiral type of learning, whereby learners with more developed regulation strategies could improve their learning, and vice versa, i.e., better learning would produce more regulated learners. The point that distinguishes PSg from other learning regulation strategies such as mental imagery (Gregg & Clark, 2007) is precisely the body. Thus, the key to this self-regulation scaffolding would be to pay attention and be mediated by the body to foster what Rowlands (2010) and Pozo (2017) referred to as the EEEE mind (embodied, enactive, embedded and extended), a true form of learning that is consistent with traditionally studied psychological processes.

Endnotes

1. 'Private singing' should not be confused with "mental imagery" (Gregg & Clark, 2007). Mental imagery refers to the psychological process of creating an internal mental image, while PSg is a tool already outsourced even in its more subtle forms

such as breathing, reflex of the use of a psychological process and mediated by the body.

2. Cases such as Keith Jarret and his vocalisation during improvisation have been analysed precisely because of the curiosity aroused by this explicitness and justified by the freedom that enables music that resides in the body rather than in the score (Gritten & King, 2006; Johnson, 1993). It can be interpreted as an example of self-regulation when the performer's improvisation requires cognitive and/or emotional support.

3. In This regard, there is strong evidence that, for example, musical play affords opportunities for the development of children's self-regulatory abilities (Zachariou & Whitebread, 2015).

Conflicts of Interest

The authors declare no potential conflicts of interest with regard to the research, authorship, and/or publication of this article.

Supplementary Material

Files with the index "S" are available as supplemental online material, which can be found attached to the online version of this article at http://msx.sagepub.com. Click on the hyperlink "supplemental material" to view the additional files.

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