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Cognitive Strategies in Sight-singing

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ABSTRACT

This paper presents a part of a wider study that is based on interdisciplinary research of sight-singing (music education and psychology). We aimed: 1. to determine the kinds and levels of strategies that music students use in the cognitive processes involved during sight-singing; 2. to explore strategies of problem solving when difficulties appear; 3. to investigate the self-evaluation perspectives of students; and 4. to relate students' learning experience to the strategies used. The sample consisted of 89 music students from higher music education in The Hague and Belgrade. They filled in the questionnaire based on self-reports, covering general data about their music education background, different issues of sight-singing, such as planning, problem solving, monitoring and evaluation of outcomes, and three melodic examples written in different musical styles. Strategies used during sight-singing could be roughly sorted into three groups that differ according to the "key accent" given: cognitive, intuitive and no-strategy. The music cognitive strategies involved cover three levels of musical organization and representation: a) relying on smaller chunks of the musical piece, referring to existing knowledge and learning experience b) leaning on a slightly "bigger picture" of familiar patterns; and c) mental representation of melodic/rhythmic/harmonic structures. When faced with a problem, half of the students employ analytic approaches. Comparisons between sub-samples showed, e.g., that future performing musicians more often use "tone-to-tone" thinking and "bottom-up" strategies in approaching musical structure, while music theory students have better insight into the whole and have "top-down" strategies. Research results give a possibility for evaluation of learning outcomes and improving teaching practices.

I. INTRODUCTION

This paper presents part of the results of a wider interdisciplinary empirical research investigating cognitive strategies in sight-singing, an issue that is interesting and important for both disciplines engaged: music education/theory and psychology of music. We had the intention of joining the practical approach of music teachers, based on methods, techniques and procedures of mastering sight-reading-singing skills on the one hand, and psychological knowledge of cognitive processes on the other.

Sight-reading-singing signifies performing at the level of rehearsed performance, but without or with just brief preparation. Sight-singing is an "online" activity that asks for quick insight and problem solving in order to maintain fluency and accuracy. The sequence of events is: perceiving notation, processing it and executing the resulting motor (or vocal) program. During sight-reading-singing, pattern recognition is in progress and it is related to long term working memory which supposes that experts are able to access quickly the contents of their long term memory. In order to manage that, musicians need to possess a mental template that serves as the focus for all learning and performance activities (Whitaker, 1996). Combinations of notes that occur frequently over time are stored in memory as discrete entities/patterns and they can be easily retrieved from memory and used in novel contexts. Experienced sight-readers take larger chunks of visual information and generate more accurate predictions about what may be coming next. This process encompasses mechanisms of interference, anticipation and guessing (Thompson & Lehmann, 2004). The ability to perform on sight, with little or no preparation, may be regarded as a reconstructive activity that involves higher-level mental processes, which are initiated primarily by visual input but also by conceptual knowledge and specific expectations (Lehmann & McArthur, 2002). Sight-reading provides a complex problem solving situation with an intricate interplay of "bottom-up" mechanisms (driven by the input stimulus of the score and auditory feedback) and "top-down" processes (driven by expectations and cognitions) (Lehmann & Kopiez, 2008).

Musicians usually tend to have an overview of the piece they intend to play or sing and the way to acquire that is to have a good internal aural representation of the music from examination of the score only (Hallam, 2006), which also could be referred to as inner hearing. In the educational context, developing the skill to generate audio schemata from written notation is usually associated with sight-singing, which is taught in the framework of solfège tuition. There are many methods to achieve this goal and most of them rely on creating associations of some sort that will help in finding the right pitch when seeing a note. As these associations are of different kinds and levels (tonal-functional, intervallic, mnemonical, etc.), students learn to develop strategies for choosing and using them while singing. If they start at an early age, pupils develop this skill through a "trial and error" learning approach; at a later age this process is basically cognitive, in a sense of a problem solving. The final goal of sight-singing instruction is routinized skill which enables the student to "hear" notated music through the combination of melodic, rhythmic, harmonic and structural reading. Two pedagogical directions are always present in solfège instruction: one, which puts emphasis on enriching the music vocabulary by practicing melodic/rhythmic/harmonic elements, and the other, where the focus is on understanding of musical flow and content, expressivity, musicality (Bogunović and Vujović, 2011).

While many books are written to help teaching sight-singing, developing learning habits and strategies is often left to students themselves. At a time when Lifelong Learning is becoming an unavoidable concept, the skills needed for autonomous learning or practicing are becoming essential. One of the implications of this concept is a focus on learning, instead of on teaching (Smilde, 2009). Metacognitive strategies are crucial to all aspects of music practice and they cover planning, monitoring and evaluation, which lead to self-regulated learning when they are well developed. Well developed meta-cognitive skills

include self-awareness of strengths and weaknesses, extensive knowledge regarding the nature of different tasks, strategies in order to respond to different needs. Beginners, novices and experts differ considerably in their deployment of these strategies, and there are also individual differences between musicians at the same level of competence (Hallam, 2006).

Starting from this kind of frame of reference, we wondered how students learn sight-singing: to what extent do they try to understand/follow the whole of a music example/piece, and to what extent are they aware of the musical parameters? How do they define the difficulties they meet? How do they solve these problems? To what extent are they aware of the domain-specific cognitive strategies which they use in the course of sight-singing an unfamiliar melodic exercise? We were interested in the ways in which music students apply strategic actions, such as using theoretical musical knowledge, skills and experience, then planning, problem solving, monitoring and evaluating outcomes, which can lead to effective self-regulative learning. The research has a cross-cultural perspective through comparisons of students from different music educational systems and hence with specific musical backgrounds. This research is meant to be a pilot research, diagnostic, with the intention of discovering students' habits and strategies that need more attention or are interesting for further exploration.

II. AIMS AND METHOD

We aimed to:

- Determine the kinds and level of strategies music students use in the cognitive processes involved during the first contact with unfamiliar melodic examples, namely sight-singing;
- Explore strategies of problem solving when difficulties appear;
- Investigate the self-evaluation perspectives of students;
- Relate students' learning experience to the strategies used.

Explorative empirical research was used. *The sample* consisted of 89 music students from the Faculty of Music in Belgrade (N=65) and the Royal Conservatoire in The Hague (N=24). Students were aged from 17 to 30, 41 male and 48 female. They played many different instruments, but for the purpose of the study we grouped them into a performers group (piano 20; strings 24; wind and singers 19) (N=55) and a music theory/pedagogy group (N=34); also into jazz (N=12) and a classical music direction (N= 77). They had played instruments (major and minor subject) for between 1 and 17 years and learned solfège (as major for music theory/pedagogy departments or minor for instrumentalists) for between 1 and 15 years. The sample was rather heterogeneous. Some of the sample from The Hague Conservatory had had only one year of systematic solfège instruction prior to our inquiry (because there is no systematic long-term education before higher music education); others had longer experience, due to the fact that they had previous education in other countries. Students from Belgrade Faculty of Music had already received 8 to 10 years of specialized music education, where solfège was continuously taught.

Participants filled in the questionnaire (28 self-report items) which had three parts: first, general music education background, then multiple choice with the possibility of choosing appropriate answers or "open-ended" items considering different issues of sight-singing: experience and didactical methods used in learning solfège, habits during individual solfège practice, use of musical instrument, ways of problem solving, reflection upon the learning process and evaluation of outcomes. The third part consisted of three melodic examples written in different musical styles (classical, jazz, and quasi-atonal).The students were asked to sing them and reflect upon their own performance, considering different aspects of sight-singing.

Variables included in the research study addressed: general data (music direction, instrument played, country of study), learning experience (duration of instrumental and solfège instruction, didactic methods used), awareness of own skill and knowledge of musical elements (awareness of "strong" and "weak" points), cognitive strategies used (in preparation, practicing, melody segmentation, defining and solving difficulties), and self-evaluation of educational outcomes. The questionnaire was handed out by the solfège teachers and students had to fill it in during the lesson or at home. The questionnaire was semi-anonymous, and only the students' numbers (optional) were requested in case they were to participate in the next stages of the research. Qualitative content analysis and quantitative data analysis (SPSS 17.0) were applied. In both cases, data were represented as categorical variables, binary or using a five-point Likert-type scale. Statistical analysis was applied: descriptive, χ square and correlation.

III. RESULTS

The results are presented according to the previously stated aims of the research. Each section refers first to the students' answers about the processes during sight-singing in general, and subsequently to the analysis of students' answers related to one of the three melodic examples given in the questionnaire, the one in jazz style, as illustration (see Figure 1).

A. Strategies Involved in Sight-singing

The results considering methods that the students reported using prior to and during performing the melodic examples (in general) strongly suggest that several (music) cognitive strategies, differing in their level of complexity, were applied and that they provided kinds of deliberate action objectives for the sight-singing process. Other reported strategies include "relying on musical intuition" and "immediate singing" (Table 1). At the first contact with an unfamiliar melodic example, so before singing it, approximately half of the students tend to analyze the melody in order to make a preview of the elements they think are important for performing it in the best possible way. Their approach seems to be also with a view to getting an insight into the metric and harmonic organization of the example in order to have general orientation.

Table 1. Sight-singing habits and strategies in general (during preparation and performing).

Students' strategies	Frequency	%
Before sight-singing		
Making an analysis before singing	45	51
Determining the meter and the key before singing	48	55
During sight-singing		
I focus on stable tones	39	44
I recognize known intervals, motives, tonal relations	41	46
I focus on important tones in the melody	21	24
In the case of a difficult leap, I sing other notes (e.g. the scale) to help me find the right pitch	21	24
I think of the harmonic progression	25	28
I pay attention to rhythm groupings	10	11
I think of the tonal plan of the melody	4	5
I often sing tonic in my "inner hearing"	20	23
I "hear" the tones ("inner hearing") before I sing them	29	33
I rely on my musical intuition	31	35
Immediate start of singing	16	18

As to strategies used during sight-singing, it seems that these can be roughly sorted into three groups that differ in the "key accent" given: cognitive, intuitive or no-strategy ("immediate start of singing"). The cognitive strategies involved cover three levels of musical structure organization and representation: a) the most frequent was relying on smaller chunks of the musical piece, mostly referring to the application of existing knowledge and learning experience (e.g. tonal functions of certain tones, recognition of known intervals, important tones, sequences of tones); b) relying on a slightly "bigger picture" as an orientation for performing through recognition of familiar patterns (e.g. tonal, harmonic and rhythmical); and c) mental representation of melodic/rhythmic/harmonic structure. We could say that the proportion is opposite – the higher the hierarchical level of the strategies used (from tone to harmonic organization and mental representation) - the smaller the percentage of its representation. Rather interesting is the "relying on intuition" strategy which is a bit vague to explain, because it is not quite clear if this kind of "using automatic pilot" means "not thinking at all" or relies on tacit knowledge. There is a view that it could be understood as using knowledge that is automatically retrieved from long term memory and that there is no active awareness of it (Lehmann et al., 2007; Beočanin-Mijanović, 2008), which would indicate highly learned and integrated skills of sight-singing. Starting sight-singing "immediately" could be understood as a no-strategy approach or a no-deliberate approach, which would mean that either students are not aware of the automatic strategies they use or they have a "trial and error" strategy or are not concerned about the sight-singing results. What is interesting anyway is that none of the strategies used is really prevalent, and none of them is represented by more than 46%. That means that students use a considerable number of diverse strategies and also several simultaneously, which implies the presence of divergent approaches toward sight-singing.

The utilization of musical instruments as an "auxiliary strategy" is certainly expected, and could also be useful during the learning process. In the long run, however, the concrete procedures could be expected to change. Students use their instruments mostly to check intonation during singing (56%) or to check the last tone (24%). 34% of the student sample use the instrument to hear difficult leaps, which could be regarded as too often, since this strategy is often discouraged in solfège lessons. Using instruments happens more often in the performers group (χ^2=(1)4.54; p<0.03), which is understandable. So, this "auxiliary strategy" or "help strategy" is present in up to 56% of the student sample at the beginning level of higher music education, which could suggest "field-dependent" (Witkin et al., 1977) musical behavior. There is a tendency (though not statistically significant) for good sight-singers not to use instruments as their auxiliary strategy.

Table 2. Segmentation - type, level and completeness (Melodic example)

Type of segmentation	Frequency	%
Structural grouping	51	59
Melodic figures and motives	22	26
Visual perceptive chunks	14	16
Non-logical grouping	11	13
Rhythmic figures and motives	0	0
Hierarchical level of segmentation		
Combination/Mix	27	31
Medium level	21	24
Micro level	14	16
Macro level (four bars and more)	3	4
Completeness and absence of segmentation		
Complete	56	64
No segmentation	19	22

The students' answers relating to the melodic example in the third part of the questionnaire showed how their general statements are applied in concrete sight-singing. Related to preparation prior to sight-singing, most students report taking a general overview of the melody, at least checking the meter and the key(s) (69%). Many students also reported analyzing basic "solfège parameters", such as difficult leaps, intervals or alterations (31%). Not so many reported making a preview of the harmonic progression (19%). This is interesting given that this melodic example comes with chord symbols above the notes. Voice preparation (10%) is actually a kind of tuning or setting of the auditive frame for the melody. Some students analyzed melodic structure (8%), and some did not do any analysis or preparation (11%). It is noticeable that rhythm had a relatively low role in preparation, which could also be a consequence of the rather simple/transparent rhythmical pattern of the melodic example. But it was also noticeable that jazz students reported a focus on rhythm patterns more often than classical music students.

We asked the participants to mark any group of notes (phrase, motif, figure) they perceived during singing. We assumed that structural segmentation could be one of the cognitive strategies involved and that students who have better insight into the whole structure would have better outcomes. We were investigating the type and hierarchical level of segmentation, as well as the completeness and absence of segmentation (Table 2). When the type of segmentation was in question, the highest proportion of answers referred to

structural groups (59%). We listed in this category all the markings where it was clear that metrical proportions played a decisive role (Figure 1). Many answers revealed a structural division in single bars (divided by bar lines, or copying the delayed entrance of the melody to m.2, or considering the last note of m.1 as anticipation / early beginning of m.2). Melodic figures and motives (26%) could also be one-bar long, but are categorized as such when the segmentation does not cover the whole melody or when other type of notes-grouping is also present. Visual perceptive chunks (16%) refer to groups of notes that form visual units that cannot otherwise be considered a musical unit (e.g. stepwise progression, symmetric leaps, etc.). The inner logic of all three groupings is distinct – formal, music-logical and perceptive. We noticed that students who did not find this melodic example difficult perceived units on the higher level of abstraction, meaning also bigger wholes.

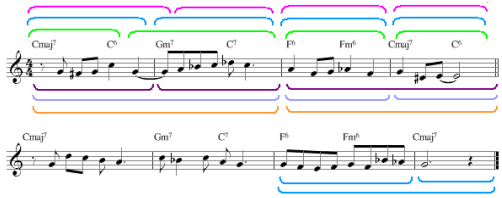

Figure 1. Structural segmentation according to students' analysis. Micro (one bar), medium (two bars) and macro (four bars) level (Melodic example: The Berklee Correspondence Course (lesson 5). Boston: Berklee Press Publications. [original exercises no.19 and 20, changed mm.1,2, 6, added chord extensions]).

It is worthwhile considering that a rather large number of students (22%) did not make an attempt to gain an insight into the structure of the melody through segmentation. The most frequent level of segmentation the students made was a combination of the medium and micro level (melodic and rhythmic figures and motives, one bar). This is probably connected to tonal and harmonic patterns and it shows flexibility in using "bottom-up" strategies. It is also a sign of reflective thinking, combining knowledge about musical form and structuring the whole.

B. Problem Solving Strategies

Perhaps the most important aspect of self-regulated learning is the question of perceiving and defining the problem and then choosing the way to (try to) solve it, eventually identifying the missing skills and missing knowledge. Hence we wanted to investigate what is always "easy" for students and what kind of insight into musical parameters makes it easy; also, what is "difficult" for them, and what strategies they use to solve these difficulties. We asked the students to name some melodic/rhythmic/harmonic elements they can perform in any context. Students listed many single musical elements which we categorized into four groups: "scale degrees"' is the most populated category (M=2.46; SD=1.73), then "chords" (M=1.33; SD=1.10), "rhythmical figures" (M=1.00; SD=1.12) and "intervals" (M=.98; SD=1.49). These data reflect the methodical approach used in the majority of solfège methods/schools, namely a focus on tonal functions. In concordance with this is a result that students who have learned solfège for less than 5 years more often report singing the tonic to (re-)establish the key or to check performance (χ^2=(2)11.34; p<0.0), which is one of the first strategies learned in various functional methods. When it comes to difficult musical elements (Table 3), the most problematic for students are: "many leaps"' (73%), and then "alterations" (35%) and "'modulations" (24%), as well as, complex rhythm and meter (28%).

Table 3. Elements difficult for sight-singing

Difficult elements	Frequency	%
Many leaps	64	73
Altered tones	31	35
Complex rhythm and meter	25	28
Modulation in melody	21	24
Tonality with many sharps or flats	6	7
When melody does not start with tonic	4	5
Fast tempo	1	1
Tones out of voice range	1	1
Nothing makes it difficult	4	5

When faced with difficulties and "problematic places", students use diverse strategies to solve the problem:

- Practicing in order to "repair" the critical point (57%) by using previous knowledge and skills, and transferring them to a new situation;
- Some 1/3 of students reflected on and analyzed possible causes/reasons for their mistakes (32%);
- An "auxiliary strategy" of relying on a musical instrument (playing the "right" tone on it) (28%);
- Dysfunctional strategies, such as "singing from the beginning" (10%) or "singing till the end without stopping" (8%).

When the given melodic example was in question students were asked to mark on the paper (with different colors) parts of the example that were "easy" and "difficult" for them. Thereafter, they were asked to define the problematic notes and to explain how they would try to solve it. As a result, we obtained slightly richer data about the music elements that facilitate sight-singing: "feeling of key" 67%) which refers to learned tonal schemata, "intervals" (49%) and "memory of previously-sung tones" (40%), which all come from the same source, namely learned skills and knowledge. Elements to rely on, which involve a certain degree of higher organizational level, were: "following the harmony flow" (35%), "recognition of melodic patterns" (25%) and "recognition of rhythmical patterns" (10%). Interestingly enough, some students mentioned psychological attributes they possess as a strong leaning point, namely, concentration and abilities (3%).

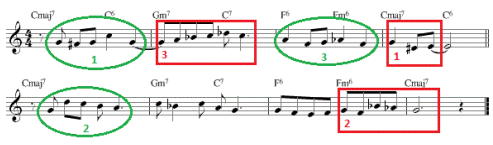

Figure 2. "Easy" and "difficult" bars/notes marked by students (in melodic example). Oval lines represent "easy" bars/notes and numbers present the grading: 1 is the easiest bar/notes, 3 is the least easy of the three. Rectangular lines indicate "difficult" bars/notes, 1 is the most difficult.

Commenting on their approach to this melody, students repeated the previously expressed statements about musical elements they find difficult to perform (Figure 2). These are: alterations (38%), then, leaps, several subsequent leaps, large intervals (29%) and modulation and "losing the feeling of the key" (17%). We noticed, when students marked several difficult parts of melodic example, that their segmentation was on a lower level or they did not perceive units. Then, tones tend to be grouped by perceptive (visual) closeness.

Reported problem solving strategies, related to the melodic example (open-ended question) showed in more detail how students work out their above-mentioned practice strategies, which they declared using in a general setting (57% of them). It is clear that they are very much engaged in finding ways to overcome difficulties and to master skills, relying significantly on music theory knowledge, solfège skills, simple drill and using well known methods (Table 4). But it is also clear that analysis and looking for solutions were prevalent, mainly based on tonality and harmony, which is very important because grasping harmonies quickly enables performer to sing better and to produce more musically meaningful performances (Karpinski, 2000).

Table 4. Problem solving strategies (Melodic example)

Problem solving strategies	Frequency	%
Solutions related to tonality and/or harmony	20	23
Solutions related to intervals and chords	17	20
Drill	15	17
Application of learned methods	13	15
Analysis – looking for a strategy	2	2
Dysfunctional strategies	8	9

One thing is very interesting, considering strategies related to key/harmony: students' definition of difficulties they encountered in this melody revealed that many of them were singing it in G major (or minor), while the given chord symbols clearly indicate C major. This shows they ignored the chord symbols. On the one hand, this could be interpreted as a non-musical approach to sight-singing, since it does not try to reveal the music in the notes, but rather tries to put the notes in the context where they could be easier to sing. So we read also among students' interpretations that m.4 is difficult because it modulates to E minor – while the chord symbol says that a C major chord is sounding. In some contrast to this is that many of other students reported that they would try to solve the problem in m.4 exactly by modulating to E minor. This is not strange, seeing that students consider alterations (statistically) more difficult than modulation. They then use modulation as a strategy to solve the problem of alteration. As Gary Karpinski has already noticed, sight-singers who read by tonal function generally make more frequent changes of tonic than one would find in any rigorous academic analysis (Karpinski, 2000).

C. Self-evaluative Perspectives of Students

This aspect of self-regulative learning was investigated through self-evaluation of sight-singing skills. We tried to infer the skills of students who estimate themselves to be higher achievers. Also, we were interested in students' awareness of the process of learning, namely monitoring and outcome evaluation.

The results of the self-evaluation of sight-singing skills in general showed that the students' estimation tends to be mainly around average (42%), then "sometimes good, sometimes bad" (27%), while the categories "very good" (13%) and "excellent" (12%) are not so frequent. A rather small number of students (6%) perceived themselves as poor achievers. These data bring us to the conclusion that students do not feel confident in their sight-singing skills, which emphasizes the importance of research in this educational area.

Significant differences exist between the two sub-samples of students (from Belgrade and from The Hague) considering their self-evaluation of their sight-singing skill mastery. Those who had learned solfège, namely sight-singing, for many years (Belgrade) had higher estimations of their skill mastery (χ^2=(4)10.95; p<0.03). On the contrary, 54% of those who had been taught for a shorter period (The Hague) thought that their skill was "poor" or "sometimes good". Supposing that the level requirements are relatively equally far from the students of each group, we could assume that this has to do with the duration of learning solfège: beginners are often aware of all the things that they cannot yet do, while professionals are often (at least also) aware of their knowledge. It is interesting that female students estimate their sight-singing skills as more successful more often than male students (r=0.23; p<0.05). There are no significant differences between the sight-singing estimation for different instrumental groups and musical genres.

The findings indicate that those students who have higher opinions of their sight-singing skills have a "bigger picture" of the singing melody, they do not have to recall the tonic often (r=-0.31; p<0.00), and they rely on "inner hearing" or auditive/mental representation of the tones that should be sung (r=0.45; p<0.00). They significantly more often analyze before singing (r=0.25; p<0.02).

When asked about monitoring during solfège practicing and evaluation of outcomes, a relatively high number of students (53%) reported that they use previous knowledge and skills in defining the problems needing to be solved, which reflects a transfer of existing skills to new situations. About 1/3 think that they acquire new skills and learn while practicing solfège (36%) and 1/5 only "work out" a task, with no insight into the learning process or the possible effects of learned materials and skills.

D. Sight-singing Strategies related to Students' Learning Experience

Significant differences considering cognitive strategies for sight-singing and diverse learning experience and general variables appeared. Namely, performers more often drew on the micro-level of tone relations (intervals, motives, tonal relations) (χ^2=(1)5.46; p<0.02), while music theorists focused on harmony flow (χ^2=(1)4.66; p<0.03). We could understand the former as using a more linear approach, focusing on the current position, more often using "tone-to-tone" or "interval-to-interval" thinking and "bottom-up" strategies in approaching the musical structure, and the latter as having better insight into the whole and using "top-down" strategies.

Correlation between the duration of solfège learning and relying on scale degrees as easy elements (r=0.24; p<005), meaning functional thinking in sight-singing, leads to a conclusion about reinforcing the effects of learning and embedded functions of the tonal system that "work"

automatically. This finding is in concordance with the following. Those students who have learned solfège for less time (1 to 5 years) often sing the tonic as a strategy to find other pitches (χ^2=(2)11.34; p<0.00) and those who have learned for longer (6 to 15 years) rely on the harmony flow of the melodic example (χ^2=(2)6.31; p<0.04), hence developing harmonic thinking. This is coupled with our finding that students with a short solfège training (less than 5 years) consider modulation "always difficult" (χ^2=(2)13.90; p<0.00). Analyzing the example before singing is significantly more often the case with women musicians (χ^2=(1)4.05; p<0.05). No specific results refer to instrumental groups. It is interesting that future performers, with growing experience in instrumental training, rely more on their musical intuition (χ^2=(2)6.04; p<0.05). Concerning strategies for solving problems, when facing them, there is a difference between the students in The Hague and Belgrade: the former are more apt to analyze the reasons for mistakes made (χ^2=(1)7.60; p<0.00) and the latter to apply already learned methods (χ^2=(1)3.92; p<0.05).

IV. CONCLUSION

The findings showed that there is an interplay of learned knowledge and skills on the one hand and reflective processes on the other, and that cognitive strategies can be taught and learned. Students exhibit diverse strategic approaches in the phase of preparation, practicing, defining and solving problems during sight-singing. We could say that learned strategies are prevalent and mostly refer to functional thinking, to tonal and harmonic knowledge. Analysis of the melody before singing and perceiving units of the higher music hierarchy level are also present, and segmentation, as part of an insight into the whole of the example, takes place on the micro and medium levels. Intuitive approaches are also indicated as a highly embedded or tacit knowledge of basic patterns of melodic and harmonic flow. Students, to a certain extent, have a clear awareness about their "strong" and "weak" points, and also strategies for how to solve difficulties – again using existing knowledge application, then analysis, and "auxiliary strategies" (using an instrument). Subsequent research should examine the students in actual singing, to check how accurate their estimation is. Students who estimate their sight-singing skills highly do not solve problems using dysfunctional strategies or drill. They analyze the example and have an inner musical representation of it before singing. There remains the question, to what extent is sight-reading-singing a matter of learned skills and to what extent it has to do with the level and quality of abilities.

The results of this pilot research gave some directions for further investigation and eventual improvement of teaching practices. One of the issues that arose is the question of where we want to place sight-singing, on a line between musical action and "strategic game". Should we teach students to focus more on musical flow while sight-singing, or should we train them to be better players of "strategic games"? Whatever the answer, we may want to upgrade the level of the students' understanding in the learning process, and to apply new knowledge in teaching methods, with an emphasis on analysis, reflection and meta-cognitive strategic approaches in each phase of the process. In this way, students' self-regulative learning could be raised, which assumes knowing one's "weak and strong points", having one's own set of strategies that can be used in daily mastering of diverse musical tasks, and therefore self-efficacy, autonomy and independence in the learning process. The next step could be to investigate the possibilities of transferring students' sight-reading-singing skills to learning and practicing of sight-reading-playing a musical instrument.

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