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MENTAL PRACTICE OF MUSICALLY GIFTED ADOLESCENTS

In the last decade, the growing interest in the subject of musicians' mental practice has produced a significant increase in research on mental and instrumental practice. More than half of all the studies concerns professional musicians, and relatively little research is conducted on children or adolescents. The article will describe research on the mental practice of teenagers attending music schools in Poland and Germany. Questionnaire surveys answer the question of whether young people use mental practice, how they do it, and what the content of mental training while practicing an instrument is. The analysis suggests that gifted adolescents from both countries (1) do not use mental rehearsal very often and (2) use mental practice strategies in a similar way. What they differ in is the frequency of using mental practice as an integral part of their instrumental learning, using musical-analytical strategy, and the quality of mental practice. The study indicates the need to teach mental practice and its importance in increasing the effectiveness of instrumental practice.

Keywords: mental practice; adolescents; musical giftedness; practice strategies.

INTRODUCTION

Practice is the most important component of every musician's life. There is no doubt that the time musicians spend practicing their skills plays an important role in the development of their expertise (Ericsson, Krampe, & Tresch-Romer,

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1993). Studies on musicians' practice strategies and rehearsal techniques were commenced in the 1980s in the wake of the opportunities offered by audio and video recordings. Most of the studies have focused on students and professional musicians (e.g. McPherson, 2005; Nielsen, 1997; Hallam, 1997, 1995; Miklaszewski, 1989; Chaffin, Imreh, & Crawford, 2002; Williamon & Valentine, 2002; Ginsborg, 2002).

Mental practice (MP) is one of the most frequently applied off-task methods promoting learning and consists in mentally rehearsing a task in the absence of physical practice (PP). The topic of mental practice has been discussed in many disciplines, including sports science (Feltz & Landers, 1983), medical rehabilitation (Braun, Beurskens, Borm, Schack, & Wade, 2006), or music (Theiler & Lippman, 1995; Cahn, 2007). The debate on mental practice in music has a long tradition; some studies were conducted as early as the 1930s (Rubin-Rabson 1937, 1941) and in the 1980s, (Ross, 1985; Wapnik, Gilsig, & Hummel, 1982; Coffman, 1990; Kopiez, 1990). Some information on music students using mental rehearsal can also be found in Fine and Bravo (2011), Haddon (2007), Connolly and Williamon (2004), and Kaczmarek (2012, 2019). More detailed information will be provided in the subsection on mental practice in music.

There are some studies (e.g., McPherson, 2005; Nielsen, 1997; Hallam, 1995) discussing practice strategies used by children or musically gifted adolescents, yet there is relatively little research dedicated to mental practice. "Since mental practice constitutes a significant element of general practice, this type of research seems to be of particular importance" (Kaczmarek, 2019, p. 316).

Mental Practice in General

Mental practice is generally defined as a cognitive rehearsal of a task without its actual execution or a visible physical movement, using imagery techniques (Driskell, Copper, & Moran, 1994). Broader definitions include emotional and mental training to prepare a performance (e.g., relaxation training, meditation, or visualization).

The effectiveness of MP has been researched, but has not been fully proven. It is commonly believed (e.g., Ross, 1985; Cahn, 2007; Oliver & Rockmann, 2008; Magill & Anderson, 2013) that MP can be effective as a technique for skill acquisition, especially when combined with physical practice. Several studies have revealed that proper combinations of MP and PP may lead to results resembling or equal to those of PP alone (Feltz & Landers, 1988). For the motor skill acquisition process, some research has shown that thinking about performing

a task combined with physical performance is more beneficial for memorizing the task than its physical execution alone.

MP should not be confused with meditation, daydreaming, or visualization (Schmidt, Lee, Winstein, Wulf, & Zelaznik, 2019). The effectiveness of MP is related to one's imagery ability. People with high imagery ability are expected to benefit more from mental practice than those with a low level of this ability.

Two roles of mental practice can be distinguished: (1) improving the acquisition of motor skills and (2) establishing optimal conditions for learning motor skills in conjunction with physical practice (Hird, Landers, Thomas, & Horan, 1991).

Mental Practice in Music

As in other disciplines, in music it is also possible to distinguish between motor (physical) practice and mental practice. Mental practice refers to a complex network of strategies, aimed at improving musical performance without actual physical instrumental performance (Bernardi, DeBuglio, Trimarchi, Chielli, & Bricolo, 2013). Mental practice, being a standard part of psychological and training programs in sport, is not covered by most art/music teaching programs (Gregg, Clark, & Craig, 2008).

Mental practice in music involves a formal analysis of the score, listening to a recording of a music piece, kinesthetic representation of a hand movement, mental representation of difficult passages, etc. (Klöppel, 1996). The content of mental practice may also include the following: motorized finger movement, learning to move the whole body, or mental representation of a concert performance. Fine and Bravo (2011) are of the opinion that music performers use mental practice at all stages, from initial sight-reading to memorization and polishing the performance (thus enhancing the learning and performance of motor skills). MP then improves the knowledge of the piece and its memorization, or aids performance preparation (Driskell, Coppper, & Moran, 1994). The cognitive or motivational function of imagery (e.g., regulation of agitation level, skill rehearsal) has an impact on the final outcome (Gregg & Clark, 2007). This is important as "imagery affects performance through both cognitive and motivational functions. The cognitive function includes strategy and specific skill rehearsal, whereas the motivational function consists of being successful, controlling emotions and overcoming adversity" (Gregg & Clark, 2007, p. 296). MP can also help identify and reconsider technical problems and difficult passages and, finally, enhance performance.

Research studies on mental practice in music were undertaken more than 90 years ago. The first representative of this particular cognitive practice technique was Karl Leimer (Leimer & Giesecking, 1988). In his view, a piece of music could be prepared in a very short time before its performance by means of mental practice techniques only. Since Karl Leimer's first publication, mental rehearsal has been applied in instrumental pedagogy and music psychology.

First studies on conceptual mental practice for musicians were conducted in the 1940s by Rubin-Rabson. A study conducted in 1941, covering adult piano musicians, revealed that students with prior mental practice achieved better results in memorizing musical text. The imagery comprised auditory, visual, and kinesthetic representations, such as a visualization of both hands' movements.

Some studies were carried out in the 1980s and in 1990s, including Ross (1985), Wapnik et al. (1982), Coffman (1990), or Kopiez (1990). All these experimental studies proved that the musicians who had previously practiced the music piece mentally gave a better performance compared to those who had not used mental practice. The research in question covered mostly trumpeters, guitarists, and pianists. The studies also revealed that the combination of MP and PP appeared to be effective in the field of music (e.g. Ross, 1985).

Some studies (e.g. Lim & Lippman, 1991; Highben & Palmer, 2004; Cahn, 2007; Bernardi, Schories, Jabusch, Colombo, & Altenmüller, 2009) investigated the effectiveness of MP. The outcomes of this research, conducted on pianists revealed that mental practice was an important part of physical practice. For example, according to Bernardi and colleagues (2009), "proper combination of MP and PP led to unnoticeable differences in performance, compared to the equal amount of PP alone" (p. 25). Cahn (2007) confirmed the effectiveness of the combination of both (physical and mental) practice techniques. In the study by Highben and Palmer (2004), physical practice condition (in which auditory and/or motor feedback were present) led to better performance than conditions with mental practice. Similarly, Lim and Lipman reported that physical practice proved to be superior to other mental conditions (MP or MP with listening to the auditory model). Overall, results revealed that mental practice was better than no practice but not as effective as physical practice (Lim & Lippman, 1991; Highben & Palmer, 2004). Also the most recent studies discussing mental practice (e.g., Bernardi, DeBuglio, Trimarchi, Chielli, & Bricolo, 2013; Mosing, Madison, Pedersen, Kuja-Halkola, & Ullén, 2014; Macnamara, Hambrick, & Oswald, 2014) confirm the observation that mental practice promotes motor anticipation.

There are also differences between expert and less experienced musicians in the application and effectiveness of MP. An experiment involving pianists at

various levels (amateur vs. professional musicians) conducted by von Stephani and Hemming (2009) confirmed that pianists with high levels of expertise (professional musicians) achieved better results in tasks related to mental exercise; they practiced mentally more frequently and performed better in terms of all assessment criteria (musical expression, accuracy and precision, rhythmic accuracy, and overall evaluation of music performance). The most experienced musicians tended to memorize a piece with the help of mental practice (cf. Kopiez, 1990, p. 50).

Aim of the Study

To the best of my knowledge, there has been no systematic study of the actual use of MP by children or adolescents; this kind of a study might answer some important questions, such as: Which practice strategies are the most commonly used? For which purposes are they employed? The author therefore endeavored to explore the topic.

The aim of the study was to analyze the way in which young instrumentalists from Poland and Germany describe their mental practice. The study investigated differences between self-reported mental practice behaviors among adolescents from both countries. Both groups underwent an identical research procedure.

The condition for participation in the survey was being a student in a music school or music academy (special study programs for young people). Polish musically talented adolescents have different opportunities to learn music compared to their peers in Germany (Kaczmarek, 2019). In Poland there are numerous music schools for children and adolescents that are unpaid and offer music lessons on two levels: the first level lasts four to six years and the second level lasts six years and ends with the completion of high school. Classes are offered by day and evening music schools. Young German musicians, on the other hand, have to pay for their music education, which is most frequently provided by extracurricular/evening music schools, or they take part in special music programs such as those offered by the Music Academy in Hanover, Detmold, or Cologne. These special study programs (DHZ, IFF, PCC) were designed for “musically highly gifted” adolescents aged 10 to 18. Basically, students of Polish music schools concentrate on their solo careers, in contrast to German music students, who concentrate more on making music. Both groups focus on the highest level of musical performance.

Since the music education systems between the two countries differ completely, the author attempted to find answers to the following questions:

1. How do young musicians describe their MP?
2. Are there any differences in the way of describing MP between young Polish and German instrumentalists?

METHOD

Measures

In order to examine the differences in mental practice between Polish and German students, the author applied a questionnaire study. The measurement instrument (*Fragebogen zur Praxis des Übens, Instrumental Practice Questionnaire*; Kaczmarek, 2012) was developed by the research group working on this project at the Institut für Begabungsforschung in der Musik (Institute for Research on Musical Ability) in Paderborn. The process of adapting the questionnaire involved its translation into Polish and methodological consultation with experts from a secondary music school in Lodz. The questionnaire consists of both open-ended and close-ended questions and is divided into three parts: the first part covers questions on practice time and practice behaviors, the second section deals with the most frequently applied practice strategies, and the third one involved four questions about mental practice as well as the Mental Practice Scale (MPS). This article will mainly present the results of the third part of the applied measure of MP, along with data on practice time from the first part of the questionnaire.

Open-ended item about MP. All study participants had to respond to the open-ended item: “Describe your way of mental practice.”

Other questions about MP. The students answered questions about whether mental practice was part of their instrumental practice (on a yes/no scale) and how often they used mental practice. They had to choose one of the following answers: *never, once in half a year, once a month, once a week, once a day*.

The Mental Practice Scale (MPS). The MPS consists of those items of the questionnaire (i.e., 95–103) that describe the nature and content of mental practice/representation and the required concentration. It consists of nine items ($\alpha = .75$), such as “I have the feeling for music,” “My images are clear,” or “My mental images appear quickly and are very detailed” (all items are listed in Table 2). Responses to the items were based on a Likert scale ranging from 1 – *not true* to 4 – *true*.

Practice time. The subjects were asked about the number of physical practice days during the week (1–7) and the average length of practice time during the day (daily practice time: less than 30 minutes, 1–2 hours, 2–3 hours, 3–4 hours, 4–5 hours, more than 5 hours). Additionally, they were asked about the length of practice time (in years) on their first and second instruments. Demographic data concerned the respondents' age, sex, and origin.

Procedure

The prerequisites for participation in the study were age (between 10 and 18) and attending regular instrument performance lessons in a music school. The study was conducted between 2010 and 2013. It was a cross-sectional study. The time assigned for the completion of the questionnaire was approximately one hour. After contacting the heads of music schools and of respective degree programs for young students at the colleges in Detmold, Hanover, and Cologne, a common date for the questionnaire survey was established. Students were surveyed as a group, at the same time. Every student completed the questionnaire independently.

In order to analyze the data collected from the two open questions, the author used the method of qualitative text analysis (Mayring, 2009). As regards the optional description of the process of MP, it was coded whether participants did or did not provide it. The respondents' answers were classified into seven categories of mental practice: visual, acoustic, kinesthetic, musical-analytical, emotional, motivational, and general mental representations. The percentage and frequency of each category were calculated. Furthermore, results on practice time and mental practice were compared with the *t*-test for both groups or the χ^2 test. All these data were analysed using the statistical SPSS software (version 21).

Participants

The participants ($n = 300$) came from two countries: Poland (60%, $n = 180$) and Germany (40%, $n = 120$). The German participants were young students of German conservatories ($n = 80$), such as Detmolder Hochbegabten Zentrum (DHZ), Institut zur Früh-Förderung musikalisch Hochbegabter in Hannover (IFF), and Pre-College-Cologne (PCC Köln), as well as local music school students from Paderborn ($n = 40$). The group from Poland consisted of students from a secondary music school in Lodz, Poland.

Each of the 300 subjects completed each questionnaire. The average age in the sample was 15.28 ($SD = 1.75$). The average age of German instrumentalists was 15.33 ($SD = 1.98$), while the average age of young Polish musicians was 15.24 ($SD = 1.64$). The age difference between the groups was statistically insignificant, $t = 0.422$, $df = 300$, $p = .673$. There were 121 boys (40.1%) and 179 girls (59.9%) in the sample, and gender equivalence was $\chi^2(1, N = 300) = 1.142$, $p = .171$.

The largest number of students played string instruments (37.3%, 112 subjects); fairly numerous subjects played keyboard instruments (23%, 69 subjects), woodwind instruments (16%, 48 subjects), and brass instruments (7.3%, 22 subjects). The remaining members of both groups were composers and singers (3%, 9 subjects), guitarists (5.5%, 16 subjects), drummers (4%, 12 subjects), and other instrumentalists (eurythmics, 4%). Differences between the two groups in terms of the instrument played were significant, $\chi^2(7, N = 300) = 40.11$, $p < .001$. The Polish group more often played string instruments, while the German group was more involved in playing keyboard instruments and singing.

RESULTS

Length of Practice Time

The difference between the two groups in the length of time they played their instrument was substantial. On average, the group of young students from Germany spent more years playing the main instrument ($M = 8.0$, $SD = 3.03$) than the Polish group ($M = 7.3$, $SD = 2.90$), $t = 2.00$, $df = 297$, $p = .046$. There was also a discrepancy between the two groups in the length of time spent practicing the second instrument, $t = -2.58$, $df = 219$, $p = .011$. On average, music students from Germany spent one year less playing their second instrument ($M = 4.72$, $SD = 3.40$) than students from Poland ($M = 5.70$, $SD = 2.50$). The author found significant differences, $\chi^2(5, N = 300) = 46.30$, $p < .001$, in daily practice time between German ($M = 2.30$, $SD = 1.26$) and Polish students ($M = 2.04$, $SD = 0.85$), but not in the number of practice days per week, which was, on average, five days a week (German: $M = 5.83$, $SD = 1.45$; Polish: $M = 5.65$, $SD = 1.38$). The largest number of respondents practiced 1–2 hours a day ($n = 114$, 38%), less than one hour daily ($n = 91$, 30.3%), or more than two hours a day ($n = 64$, 21.3%). The minority of the students practiced more than three ($n = 23$, 7.7%), four ($n = 6$, 2%), or five hours a day ($n = 2$, 0.7%). Polish students practiced 1–2

hours a day more often than German ones. All participants had no less than one hour per week of regular individual lessons in instrument performance. Detailed information concerning the length of practice time and general practice on the first/second instrument in both groups is presented in Table 1.

Table 1. *Length of Practice Time*

Items	German group		Polish group		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
First instrument	8.00	3.03	7.03	2.90	2.00	297	.046
Second instrument	4.63	3.51	5.70	2.50	-2.59	219	.011
Daily practice time	2.31	1.26	2.04	0.85	2.15	298	.032

Use of Mental Practice

As a result of the analyses, it turned out that 43% of the total sample (131 students) claimed that mental practice was an integral part of their instrumental practice. There was a group difference, with more Polish participants (72 students) than German ones (59 students) reporting the use of MP, $\chi^2(1, N = 131) = 4.35, p = .005$. There were significant differences in the frequency of mental practice, $\chi^2(4, N = 131) = 49.44, p < .001$. One third of the music students answered that they used MP techniques while practicing once per week ($n = 48, 36.6\%$). A quarter of the students used MP very rarely or never ($n = 34, 25\%$), and one third used MP once a month ($n = 23, 17.5\%$) or once a day ($n = 26, 19.8\%$). Next, the students were asked to present—optionally—their knowledge on the process of mental practice. The group comparison showed that only 59 German students (49%) and 61 Polish students (36%) described this process. The chi-square test showed no significant difference between the groups in terms of the number of descriptions provided, $\chi^2(1, N = 298) = 2.54, p = .122$.

Mental Practice Characteristics

There was a significant difference between German and Polish adolescents in the score on the Mental Practice Scale, $t(292) = 4.23, p = .001$. German adolescents scored higher ($M = 2.96, SD = 0.39$) than their Polish peers ($M = 2.70, SD = 0.57$). Young musicians from Germany showed the ability to develop a “feel” for music and to hear the piece internally; they were able to visualize the score better than Polish students, too (see Table 2). Their mental images were clearer and more detailed. Maybe the mental process worked more quickly and more effortlessly in their case.

Table 2. Means, Standard Deviations, and Independent Samples *t*-Test Results for the Nature and Quality of Mental Practice in German and Polish Groups

Items	German group		Polish group		<i>t</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
I have the “feeling” for music	3.36	0.69	2.96	0.88	4.14**	288
My images are clear	3.16	0.65	2.75	0.83	4.46**	288
Mental practice works fast and effortlessly	2.84	0.68	2.86	0.89	ns	289
I see the notes/musical picture in front of my eyes	2.82	0.99	2.63	1.10	ns	290
I focus on details	2.69	0.88	2.39	0.80	3.03*	289
Mental representation covers the whole piece	2.90	0.83	2.71	0.96	ns	287
I hear the piece in my inner ear	3.55	0.70	2.91	1.07	5.69**	290
I imagine the movement I have to make to play the piece	2.64	1.11	2.56	1.15	ns	289
Mental practice requires a lot of concentration	2.72	0.92	2.61	0.92	ns	289

Note. * $p < .01$, ** $p < .001$, ns—not significant.

The students had an opportunity to describe their strategies and the process associated with mental practice when responding to the open-ended item: “Describe your way of mental practice.” All answers were analyzed (in terms of the content) and categorized, and then the frequencies were quantitatively calculated. Based on the answers, seven categories were distinguished (see Table 3 for examples of all types of mental representation).

Some young musicians produced a visual representation of notes/scores. The most common comment regarding visual ideas are: “I imagine the score in front of me” or “I try to imagine and memorize every trouble spot in my piece” (16-year-old girl, German flutist).

The acoustic type of mental representation refers to auditory imagery and to the way in which a music piece should sound when performed. Examples of acoustic representations are: “I imagine how the final version of the piece should sound” or “I hum tunes from the piece.” The idea of imagining the sound is often associated with the visualization of movement , for example: “I look out for a difficult passage and imagine the sounds and my body posture beforehand” (16-year-old girl, German violinist).

Table 3. *Types of Mental Practice Representation With Examples*

Mental idea	Examples and comments
Visual	“I imagine notes”; “I see notes”; “I can see the score in my mind”
Acoustic	“I try to imagine a general tone of the piece first”; “I try to imagine how this piece should sound”; “I imagine how the final version of the piece should sound”
Emotional	“I try to imagine as accurately as possible how it feels when I play a certain piece“; “Mental practice helps me with imagination”
Kinesthetic	“I imagine playing the cello, with sound, fingering and/or bowing”; “I prepare my hands and the body position as if I had the instrument in my hands”
Musical (analytical)	“I analyze a piece of music very slowly”; “Perfect imagery of music (with dynamics and tempo)”
Motivational	“I imagine that I play the piece in concert perfectly”; “Motivation, concentration, and perfect imagining of the situation”
General	“I imagine the piece in my mind”; “I imagine myself playing the instrument”

The emotional representation of a piece is connected with the content of mental practice responsible for feelings, emotions, interpretation, and the comprehension of the composer’s intention. Mental rehearsal can also be used to imagine emotions and feelings connected with the performed piece, for example: “I imagine the story told by the composer in a piece or emotions and feelings connected with its creation” (16-year-old girl, German pianist).

Kinesthetic representation refers to the imagery of the body position, proper blowing, fingering, hand movements, grips, or playing the instrument without the use of hands. The kinesthetic approach also accounts for practicing trouble spots or overcoming technical difficulties. Young instrumentalists often give the following descriptions: “I usually imagine the guitar fretboard and move my fingers in my head” (12-year-old girl, Polish guitarist); “I imagine playing the cello—with sound, fingering, bowing” (16-year-old boy, German cellist), or “I often close my eyes and position my hands very precisely as I go through the score in my mind” (17-year-old boy, German oboist) (cf. Kaczmarek, 2019, p. 331). The last comment is an example of combined kinesthetic and visual representations

The category of motivational representation comprises comments on a psychological approach to mental practice. This group involved all the comments connected with “a psychological aspect of practice, with preparation for performance, inner strength or with satisfaction from a well-performed piece played confidently and flawlessly on stage” (Kaczmarek, 2019, p. 333). An example of motivational representation is the following response: “I imagine step by step what I would like my concert or rehearsal to be like” (18-year-old boy, Polish cellist) or “I imagine that I play the piece in concert perfectly” (15-year-old boy, German violinist).

Musical-analytical representation involves basic musical elements of the piece, namely rhythm, melody, dynamics, phrasing, and harmony, articulation, or tempo. This category describes a strategic and analytical approach, focusing on basic elements of music. The comments belonging to this category involve those about learning the piece by heart, or attempts to memorize a difficult fragment. The examples of comments from this category are: “I analyze the piece in detail,” or “I analyze the piece very slowly” (15-year-old girl, Polish flutist).

The last category is general representation which refers to unspecified representations, i.e. having the imagery of playing an instrument. This category describes the types of mental practice that do not fit in with any other type of representation. The general representation is best reflected in the following commentary: “I lie in my bed and think about the piece” (15-year-old boy, Polish trumpeter), “I imagine myself playing the instrument” or “I imagine the piece of music in my mind” (17-year-old girl, Polish pianist).

The 120 answers (comments) were assigned to seven categories (see Figure 1). The most common category comprises kinesthetic ideas (47 comments), the notion of fingering, finger exercises, grips, movement, or bow strokes. In most cases, it is a kinesthetic representation of music that is applied in music imagery/mental practice. The second significant group is related to auditory

(43 comments) and musical-analytical (30 comments) representation. The idea of the overall tone of the piece, melody, and the development of perfect sound in one's mind—these are common depictions of an acoustic performance, often coupled with kinesthetic images. General imagery of performed music (28 comments) forms another group of mental rehearsal ideas. The next category consists of emotional and motivational imagery of the music played. In emotional representations (only 14 comments), students think about the feelings they want to convey in the piece; it is a relatively emotional idea of sound. Motivational representations (15 comments) relate to psychological aspects of practicing and performing, or to boosting motivation for physical practice. The last group (13 comments) encompasses visual representations, described by the subjects as “seeing the notes being played.”

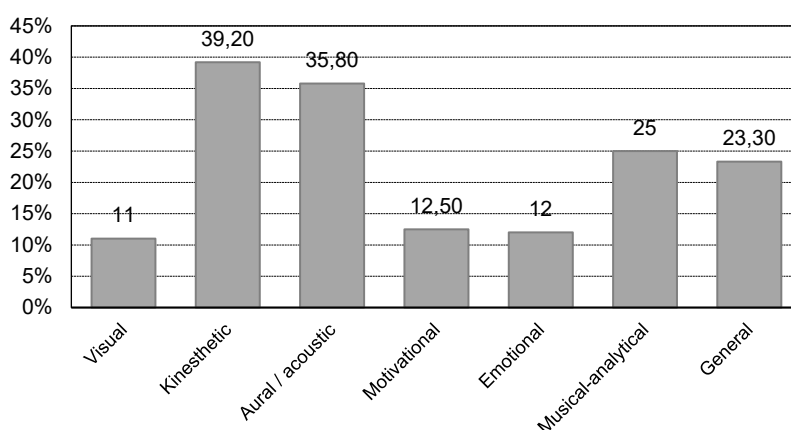


Figure 1. Frequency of mental representation strategies (in percentages).

In the next step, all comments were coded into categories of mental representations, separately for the two national groups (Figure 2). The number of comments from both countries was compared by means of a chi-square test. Significant differences were found only in one type of mental practice representation: musical-analytical representation, $\chi^2(6, N = 120) = 5.89, p = .013$. Young students from Germany used the musical-analytical approach to mental practice more frequently than their Polish peers. All the other differences listed below are not statistically significant. The general and visual attitudes to mental practice were more often represented by young German musicians, whereas Polish stu-

dents more often used emotional, motivational, acoustic, and kinesthetic contents for mental training.

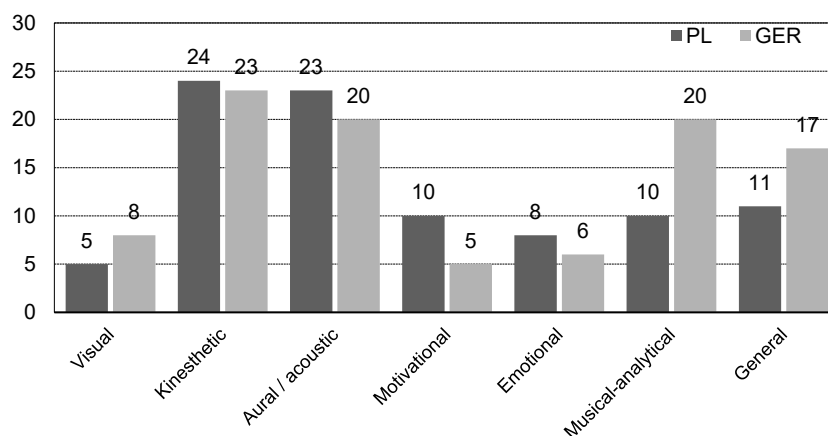


Figure 2. Frequency of mental practice strategies in German versus Polish students.

To sum up, the nature of representation may be aural, visual, or kinesthetic. The representation can also include emotional, motivating or musical elements of the music piece. Mental practice depends on the selected instrument and can be seen as a “kind of confrontation with the music piece” (Kaczmarek, 2019, p. 334).

DISCUSSION

The present study was designed to explore, how young musicians from Poland and Germany described their MP. It is impossible to compare our results with those of past research due to a different character and setting of our study. Many of the previously presented studies were experiments with quantitative data, while this study is mainly qualitative.

The survey showed that less than half of the students undertook the description of their method of mental exercise. Only 43% of the participants in the sample indicated that they (theoretically) use mental practice as an integral part of instrumental practice. This may suggest that many students did not use MP or had no knowledge of this type of practice.

The descriptions of the way young instrumentalists from both countries practice mentally has been classified into seven categories. The most common category describing young musicians' mental practice is kinesthetic representations. The auditory and musical-analytical representations of the music piece rank second and third, respectively. The general imagery forms another group of mental rehearsal ideas. Further categories are emotional and motivational imagery. The last group of comments contain visual representations.

In the current study, the findings indicate that Polish and German music students use mental representations in almost the same ways. The author found significant differences in the use of mental rehearsal strategies in one category—namely, in musical-analytical representation. Both groups make equal use of mental strategies (or types of representation) to cope with similar elements of a piece, such as fingering, finger exercises, or sound. Most frequently, they imagine body movements and finger or hand movements connected with sound production, or they use acoustic representations. Students from both groups use mental practice to analyze the score, to imagine general components of a piece, or to develop a strategy to learn the piece by heart. It means that our participants reveal a tendency to produce a general content of the imagery.

With regard to differences in the frequency of using MP between two nationality groups, more German than Polish students answered "Yes" to the question about whether MP was an integral part of their usual instrumental practice. The findings also indicate that the participants in the study sample described the frequency of using MP in various ways. Our results are similar to Hallam's (1995), who claims that some musicians practice mentally very often (almost every day) while others do it only occasionally. This result is comparable to that reported by Stephani and Hemming (2009) or Gruson (1988). The participants in the present study were not experienced players yet, and not all of them used mental practice or endeavor to memorize the piece by means of mental practice.

The German scored higher in the MPS, possibly thanks to the quality of music education they had received (a special music study program). The reason for the German students' higher scores on this scale may be associated with their having more practice experience. This is indicated both by the differences in the length of time spent playing the main instrument and by the differences in the amount of daily practice.

To sum up, the obtained data suggests that the participants use various mental rehearsal strategies/categories in a similar way. In terms of the frequency and content of applied mental practice, the results of the surveyed students are also similar. It has not been established how many minutes per day/week young in-

strumentalists from both countries dedicate to mental practice. This research also revealed differences between the groups in the frequency of MP as an integral part of instrumental learning, in the use of the musical-analytical strategy, and in the quality of MP measured with the MPS.

Imagery is a skill that can be practiced and improved over time (Gregg & Clark, 2007). Less experienced music students can imagine a technically difficult spot in the piece, but not the entire work (Hallam, 1995). It seems that the ability to develop a mental image goes hand in hand with expertise, musical knowledge, and experience. The ability to visualize an entire piece of music requires not only experience in mental techniques but also plenty of concentration. This confirms the hypothesis that mental practice skills require time to develop to be used effectively.

There are some limitations of this study. The most important limitation of this study is the lack of measurement invariance analysis. This analysis gives us information about whether a measure (e.g., a scale) has the same properties when used with different groups of participants (e.g., differing in terms of age, culture, or type of research procedure; Lubiewska & Głogowska, 2018). In this study, the collected information was based on the subjects' self-assessment, with no reference to the actual level of their musical skills. At this point, therefore, the author cannot prove that there is a link or correlation between the use of practice strategies and the development of musical abilities.

Past research showed that a proper combination of MP and PP led to improvements in performance, compared to the same amount of PP alone. Unfortunately, in this study the author did not analyze whether the amount and content of MP had an impact on music performance quality, the level of expertise, and quality of practice.

What also limits the study is the fact that the role of teachers and parents in the process of mental practice was not taken into account. It was important to examine the current knowledge and use of mental practice strategies during home practice, unsupervised by a teacher. Future research could investigate the relationship between instrument learning time, the quality and quantity of instrumental practice, and the use of MP.

CONCLUSIONS

Mental practice enables musicians to develop internal representations of the music to be played and the emotional representation carried by music. Addition-

ally, mental practice makes it possible to reach a specific level of performance without “moving a finger.” What is also important, MP permits to practice anywhere, at any time, without putting physical burden on the body. It therefore seems that mental practice should become part of formal physical practice on the instrument.

The results of this study show the importance of teaching appropriate mental rehearsal strategies to students during music lessons. Haddon writes: “Although musical imagery has considerable value for instrumental and vocal training, it seems to be neglected in many learning methods” (Haddon, 2007, p. 1). In other words, imagery training should become a formal or obligatory part of music education.

Future studies should present a detailed analysis of the use of mental practice strategies by musically talented adolescents. It could be research exploring the use of mental practice strategies through observation in reference to more diverse samples of young musicians. It could also be interesting to examine the age differences in the use of mental practice.

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