

# Measuring self-regulated practice behaviours in highly skilled musicians

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## Abstract

The aim of this study was to explore self-regulated practice behaviours in advanced musicians. An online questionnaire was designed to assess self-regulated practice based on behaviours identified in the literature regarding expert music performance. The questionnaire was completed by 212 musicians. Factor analysis was applied in order to explore the underlying structure of the scale, and reliability and correlation tests showed that the scale was reliable. Descriptive and inferential analyses were used to describe the sample in relationship to self-regulated practice behaviours. Results obtained through factor analysis suggested three self-regulated behaviours in the advanced musicians, namely Practice Organization, Personal Resources and External Resources. In the advanced musicians, Self-Regulation through Personal Resources was most predominant in practice approaches, and Self-Regulation through External Resources decreased with experience. Additionally, Practice Time was negatively related to age and positively related to Practice Organization and Self-Regulation through External Resources, suggesting that the younger the musician, the more reliance is placed on time, organization and external resources. Implications regarding the use of the scale for formal assessment of self-regulated practice behaviours in musicians are discussed.

## Keywords

*advanced musicians, factor analysis, music practice, practice behaviours, self-regulation*

To succeed in a music performance career, a high level of physical and psychological skills are necessary (Williamon, 2004). Indeed, the mastery of a musical instrument at a professional level is a particularly challenging activity, requiring years of dedicated practice and study (Altenmüller, Wiesendanger, & Kesselring, 2006; Ericsson, Krampe, & Tesch-Romer, 1993; McCaskie, Kenny, & Sandeep, 2011). A considerable amount of literature has addressed how much practice time is appropriate to develop musical expertise (Ericsson et al., 1993; Sloboda, Davidson, Howe, & Moore, 1996), as well as how effective practice behaviours in musicians

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differ according to different levels of expertise (Chaffin & Imreh, 2001; Hallam, 1995, 2001, 2010; Williamon, 2004; Williamon & Valentine, 2002). Currently, there is strong evidence that the quality of practice plays an important role in the improvement of performance, and, once a high level of proficiency is achieved, that practice needs to be continued in order to sustain the necessary skills (Krampe & Ericsson, 1996).

Empirical studies have highlighted the characteristics of effective practice among advanced musicians. Music practice is deliberate when musicians set specific goals that lie somewhat beyond their current level of performance, and try to attain those goals during bouts of intense concentration (Ericsson et al., 1993). In this kind of practice, there are explicit goals and the possibility of feedback (Lehmann, Sloboda, & Woody, 2007). In other words, the approach to practice is deliberate when musicians: 1) have a well-defined task representing a personal challenge to overcome; 2) are concentrating as much as possible during the undertaking of the task to be accomplished; 3) have the persistence to repeat sections and correct errors; and 4) find alternative strategies to try to accomplish difficult elements within the task. Another perspective is to consider effective practice as an activity that achieves a desired end product in as short a time as possible without interfering with long-term goals (Hallam, 1997), with a prominent role for metacognition (i.e., knowledge about strategies and personal resources), a crucial element in music practice processes (Hallam, 2001). Indeed, advanced musicians often adopt reflexive/metacognitive strategies during practice asking questions such as 'in what way should I play this passage?' or 'what strategy should I use to tackle this musical task?' (Nielsen, 2001), and evaluate executed tasks. Practice strategies are used flexibly, and expert musicians also have their own artistic conceptualizations of pieces to be studied (Chaffin & Lemieux, 2004).

Music practice effectiveness has also been viewed in terms of the self-regulated learning paradigm (Miksza, 2011a). From this perspective, music learning occurs through the interaction of social, cognitive, affective and motivational processes (McPherson & Zimmerman, 2011). Musicians self-regulate to improve their performance through managing and planning their own practising, choosing, modifying and adapting their own strategies. Phases of self-regulation include planning, performance and evaluation. Common self-regulated behaviours of advanced musicians include: self-setting goals, including goals' properties, orientations and goal efficacy; metacognitive thinking; planning and time management; environment control; self-evaluation; active search for resources; help-seeking; and internal causal attributions.

The characteristics of effective practice outlined above present a wide range of deliberate, efficient and self-regulated behaviours, which may be used frequently by advanced musicians. This article defines advanced musicians as those adult musicians who have more than 10 years of practice experience with their main instruments (Ericsson et al., 1993), but also as those engaged in higher education music performance courses, as they are learning musical skills and strategies for professional engagement (i.e., pre-professionals). From the perspective of skill acquisition, advanced musicians are autonomous, highly skilled individuals when engaged with musical activities, including practising (Papageorgi et al., 2010). Accordingly, the term 'music practice' in this study is understood as carrying out activities directed towards the acquisition or maintenance of related musical performance skills (Lehmann et al., 2007). It can include activities from the acquisition and development of motor skills to the final stages of performance preparation.

This study also relies on goal-setting theory (Locke & Latham, 2013), where a goal is defined as 'the object or purpose of an action, and [it] may be, in the context of work, a level of performance to be achieved' (Locke & Latham, 2013, p. 28). One of the main attributes of a goal is its content, which refers to the outcome to be achieved (e.g., being able to play a quick musical section without changing the tempo), having as its main attributes specificity and difficulty.

Thus, in the context of music practice, a goal can be regarded as a level of proficiency to be achieved in any aspect of music learning. Advanced musicians, like anyone undertaking music practice, can set goals for different levels of abstraction in the learning process, ranging from the simple and immediate completion of goals (e.g., sight-reading a musical phrase) to more complex goals (e.g., be able to play a particular piece of music from memory).

Many music psychology studies have aimed to provide empirical support for anecdotal evidence from teachers and musicians, presenting and categorizing the behaviours of advanced and aspiring musicians. The multifaceted nature of music practice has allowed for the development of theoretical models that attempt to explain it as a whole, presenting the different aspects addressed in these investigations. However, few studies have attempted to measure advanced and efficient practice behaviours through questionnaires. Most of the studies that have incorporated quantitative measures of practice behaviours have adapted and/or supplemented measures by authors from other fields. For example, the most widely used questionnaire for this purpose is the Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich and colleagues in the 1990s (Pintrich, Smith, Garcia, & McKeachie, 1993), which is frequently adapted and used for measuring music learning strategies (see Nielsen, 2011). One exception is the study conducted by Miksza (2011b), who developed a measure for self-regulated musical behaviours based on specific literature about students' approaches to practice.

In light of this theoretical gap, the general aim of this study was to explore the self-regulated practice behaviours of advanced musicians through the development of a self-report measure. The sub-aims of this study were: 1) to explore and to test the psychometric structure of the questionnaire, testing its reliability and preliminary validity; and 2) to characterize the participants according to the expert practice behaviours measured by the questionnaire, answering the following questions:

- (i) Can self-regulated practice behaviours be measured by a self-report questionnaire for advanced musicians?
- (ii) To what extent does a sample of advanced musicians self-regulate, and what are the self-regulated practice behaviours they use most?
- (iii) Is self-regulated practice predicted by age, gender, musical instruments and time spent practising?

The overall aim of investigating advanced musicians' behaviours was to develop understanding of the factors that might influence variability in music practice behaviours, and of the nature of musical expertise.

## Method

### Materials

The present study addressed self-regulated practice behaviours of advanced musicians from the Western classical music tradition. Based on (i) the general literature on social cognitive and educational psychology (Locke & Latham, 2013; Zimmerman, 1998) and (ii) music psychology research focusing on deliberate music practice (Ericsson et al., 1993) and effective practice (Hallam, 1997; Hallam & Barry, 2002; Williamon, 2004), a questionnaire for measuring self-regulated practice behaviours in advanced musicians was developed.

The main section of the questionnaire included 22 items (Table 4) related to different aspects of practice gathered from the relevant literature, including management/evaluation of distinct

goals for practice (e.g., 'I set specific goals for my practice sessions'), planning of time and physical environment (e.g., 'I plan the time of my practice sessions'), knowledge/regulation of strategies (e.g., 'I am aware of the strategies that I use during practice'), general self-efficacy for goal achievement (e.g., 'I am able to achieve my practice goals satisfactorily'), external causal attributions (e.g., 'I cannot reach my practice goals without the support of some external factors [peers, teachers, materials, environment]'), help-seeking (e.g., 'I request help from others [teachers, peers, composers, musicologists and specialists]') and use of resources (e.g., 'I seek information from several sources [books, CDs, videos, internet, biographies, arts, etc.] to support my study'). The self-regulated practice behaviours were rated on a 5-point Likert-type scale related to frequency of behaviours (1-never to 5-always) and levels of agreement (1-completely disagree to 5-completely agree). In addition to its main section, the questionnaire included a demographic section in which participants recorded information regarding their age, gender, nationality, musical instrument, practice time and performance experience, the latter being measured by years of playing from their first public concert onwards.

## Participants

A text invitation to participate in the survey was distributed via email to faculty colleagues from higher education institutions in Europe and America, and also released in online social networks (e.g., Facebook) and digital forums for dissemination of music research events (e.g., Performance Studies Network). The invitation included information regarding the research purposes and hyperlinks for direct access to the web platform for questionnaire response. The higher education context was deemed appropriate for searching participants for this study because a) it includes full-time adult students training for professional engagement with music; b) it includes teachers who are also engaged in professional careers as performers; and c) there is a predominant focus on the written repertoire from the Western classical music tradition in these institutions, involving the practice of similar musical genres.

A total of 335 questionnaires were returned, but only questionnaires that had responses for all items in the main section were considered. The resulting convenience sample included higher education performance students and professional performers (singers and instrumentalists) who make their living by performing and/or teaching music in higher education. It comprised 212 classically-trained instrumentalists (male = 52.4%; female = 47.6%) from several nationalities (Table 1). The high number of Brazilian and Portuguese participants in the survey was due to the fact that the author knew more possible interested participants and institutions from both countries at the time of the study. Participants and institutions from these countries were able to distribute the questionnaire to their students and colleagues. The present research assumes that cultural differences do not affect eventual differences in practice habits; studies investigating efficient practice behaviours in the context of the Western classical music tradition have found consistent results across different countries (Hallam, 1997; Miksza, 2011a), suggesting that efficient music practice is not significantly affected by cultural differences.

Participants' ages ranged from 18 to 58 years ( $M = 25.36$ ,  $SD = 7.87$ ), but most participants were between 21 and 40 years old (Table 2). Musicians engaged in higher education music performance study courses accounted for 50.5% of the sample, while the remainder were professional musicians.

Calculating from the date of each participant's first public concert, their practice experience ranged from 3 to 56 years ( $M = 19.96$ ,  $SD = 11.92$ ), with the majority having more than 10 years of experience (82.8%). All participants having less than 10 years of experience were

**Table 1.** Participants' nationalities.

Country	Frequency	Percentage
Brazil	91	42.9
Portugal	36	17.0
UK	25	11.8
USA	11	5.2
Canada	10	4.7
Italy	6	2.8
Greece	5	2.4
Germany	5	2.4
Australia	7	3.3
Other countries	16	7.5
Total	212	100.0

**Table 2.** Number of participants per age group.

Age group	Frequency	Percentage
< 20	22	10.4
21–30	79	37.3
31–40	58	27.3
41–50	29	13.8
> 50	24	11.2
Total	212	100.0

enrolled in higher education courses. A performance course in the context of higher education is usually focused on educating and training musicians to the highest professional standards. Because of that, this research included participants with less than 10 years of experience who were studying performance in higher education.

When participants were asked what instrument they played, the most frequent response was keyboard instruments (25.9%,  $n = 55$ ), followed by plucked strings<sup>1</sup> (24.5%,  $n = 52$ ), bowed strings (14.6%,  $n = 31$ ), woodwinds (16.0%,  $n = 34$ ), voice (10.4%,  $n = 21$ ), brass (4.2%,  $n = 9$ ) and percussion (3.8%,  $n = 8$ ). Two participants did not register their musical instruments and gender (0.6%,  $n = 2$ ). Daily practice durations reported by participants varied considerably, and are shown in Table 3.

## Procedures

Respondents completed the questionnaire online on a web platform<sup>2</sup> created for this research. The participants voluntarily answered the online questionnaire from 15 October 2013 to 28 February 2014. Because the participants were volunteers, they were not required to provide their names or any other data related to their identity. Thus, ethical considerations were only related to assuring the participants of the confidentiality of their responses.

The statistical analysis was run with the software IBM SPSS 20 statistics. For the data analysis, two main statistical procedures were undertaken. Firstly, the questionnaire structure was tested for robustness through exploratory inter-item and item-total correlational analyses, and reliability tests. Additionally, exploratory factor analysis (EFA) was used in order to test

**Table 3.** Duration of daily practice.

Hours	Frequency	Percentage
< 1	49	22.6
1–2	65	30.7
2–3	43	20.3
3–4	35	16.5
> 4	20	9.4
Total	212	100.0

hypothesized underlying dimensions within the instrument and to provide preliminary validity. Secondly, descriptive and inferential statistical tests were used for the characterization of the sample according to their self-regulated practice behaviours.

## Results

### Questionnaire structure

**Internal reliability.** The questionnaire items are displayed in Table 4. Exploratory inter-item and item-total correlational analyses (Pearson) were conducted to verify the internal structure of the questionnaire as a whole. After inspection of the correlational matrix table, the variable 'self 22' ('I practice in order to achieve high ratings (e.g., grades) and positive feedback') did not achieve any correlation where  $r \geq 0.3$ . Cronbach's alpha measure was used to test the measurement reliability. Across the full sample, a Cronbach's alpha score of .843 was achieved, which is above the acceptable level to indicate that the questionnaire is internally reliable (Marôco, 2011).

A reliability test also suggested that removing the 'self22' variable would increase the internal consistency to  $\alpha = .86$ . Thus, this variable was omitted from further analyses. Internal reliability tests showed that all items contributed to form a whole scale of self-regulated practice behaviours, with the exception of 'self19' 'I cannot reach my practice goals without the support of some external factors (peers, teachers, materials, environment)'. Although removing this item would have resulted in an increase of 0.01 in the reliability coefficient, the previous correlational analysis showed that this variable achieved four significant correlations ( $p < .005$ ), and therefore the item was not excluded.

**Preliminary validity.** In order to identify underlying factors among the remaining 21 items, exploratory factor analysis was carried out using the principal factor method and an orthogonal varimax (Kaiser off) rotation solution (Table 5). Factors were retained using the criteria of eigenvalues over 1, and of factor loadings above 0.4 (Guadagnoli & Velicer, 1988; Kaiser, 1960).

Three different aspects of music practice were derived from analysis of the whole self-regulation scale, which could be interpreted as (1) Practice Organization, (2) Personal Resources, and (3) External Resources. Factor 1 included ten practice behaviours related to the organization of practice, which were dependent on management/evaluation of distinct goals for practice, as well as planning of time and physical environment. Factor 2 clustered seven items related to different aspects of personal resources, knowledge/regulation of strategies and general self-efficacy for goal achievement in practice. Lastly, factor 3 included four items regarding the influence of external aspects that were related to practice efficiency (external causal attributions, help-seeking and use of resources). All these behaviours contributed to practice efficiency, which is characteristic of this sample of high-skilled musicians. The results showed



**Table 4.** Descriptive statistics of musicians' practice behaviours and reliability tests.

Factor	Practice behaviour	Mean	Mode	Median	SD	$\alpha$
Self-Regulation through Practice Organization	I use specific strategies related to my practice goals	4.14	4	4.00	.86	.83
	I understand that my goals are challenging	4.11	4	4.00 <sup>a</sup>	.85	.83
	I set goals for my practice sessions	3.95	4	4.00	.93	.83
	I set specific goals for my practice sessions	3.88	4	4.00	1.03	.83
	I evaluate the progress made towards my goals	3.80	4	4.00	1.01	.83
	I set long-term goals (weeks, months, years)	3.75	4	4.00	1.10	.83
	I organize the physical environment of my practice sessions	3.65	5	4.00	1.20	.84
	I set short-term goals (minutes, hours, days)	3.62	4	4.00	1.08	.84
	I plan the order of the activities of my practice sessions	3.61	3	4.00	1.05	.83
	I plan the time of my practice sessions	3.46	3	3.00	1.11	.83
Self-Regulation through Personal Resources	I understand the nature and demands of my musical activities	4.39	5	4.00	.68	.84
	I understand my strengths and weaknesses	4.31	4	4.00	.61	.84
	I am aware of the strategies that I use during practice	4.25	5	4.00	.83	.83
	I use strategies that have been effective in the past	4.22	5	4.00	.83	.84
	I know what I must do to in order to complete my musical activities satisfactorily	4.20	4	4.00	.77	.84
	I know when and in which contexts my strategies will be most effective	3.99	4	4.00	.81	.83
	I am able to achieve my practice goals satisfactorily	3.95	4	4.00	.72	.84
Self-Regulation through External Resources	I practice in order to improve my musical skills	4.50	5	5.00	.65	.84
	I seek information from several sources (books, CDs, videos, internet, biographies, arts, etc.) to support my study	3.83	5	4.00	1.07	.84
	I request help from others (teachers, peers, composers, musicologists and specialists)	3.39	3	3.00	1.12	.84
	I cannot reach my practice goals without the support of some external factors (peers, teachers, materials, environment)*	3.09	2	3.00	1.20	.85
	I practice in order to achieve high ratings (e.g., grades) and positive feedback**	2.93	3	3.00	1.28	.86

Note. SD = Standard Deviation;  $\alpha$  = Cronbach's Alpha reliability coefficient if item deleted; a. Multiple modes exist. The smallest values shown; \* Reversed score; \*\* Item removed.

**Table 5.** Rotated factor pattern matrix for final common factor analysis.

Item	Factor 1	Factor 2	Factor 3
I set goals for my practice sessions	.83		
I set short-term goals (minutes, hours, days)	.67		
I set long-term goals (weeks, months, years)	.48		
I set specific goals for my practice sessions	.79		
I understand that my goals are challenging	.49		
I use specific strategies related to my practice goals	.59		
I am aware of the strategies that I use during practice		.59	
I use strategies that have been effective in the past		.55	
I know when and in which contexts my strategies will be most effective		.77	
I understand the nature and demands of my musical activities		.79	
I know what I must do in order to complete my musical activities satisfactorily		.74	
I plan the order of the activities of my practice sessions	.69		
I plan the time of my practice sessions	.63		
I organize the physical environment of my practice sessions	.52		
I evaluate the progress made towards my goals	.46		
I seek information from several sources (books, CDs, videos, internet, biographies, arts, etc.) to support my study			.45
I request help from others (teachers, peers, composers, musicologists and specialists)			.67
I am able to achieve my practice goals satisfactorily		.49	
I cannot reach my practice goals without the support of some external factors (peers, teachers, materials, environment)			.43
I understand my strengths and weaknesses		.52	
I practice in order to improve my musical skills			.48

Note. Eigenvalues: Factor 1 = 6.476 / Factor 2 = 1.975 / Factor 3 = 1.077.

that this questionnaire could be used to explore different individual self-regulatory practice behaviours (i.e., items), and also to explore the three distinct aspects of music practice (i.e., self-regulated factors) in advanced musicians. Table 4 displays items ordered by mean within the three self-regulation factors.

### *Self-regulated practice behaviour in advanced musicians*

**Descriptive statistics.** Descriptive statistics were used to describe the sample according to their self-regulated practice behaviours (Table 4). Means for the self-regulated behaviours were moderately high, demonstrating that this sample of advanced musicians adopted the measured behaviours. Within the factor Practice Organization, items related to goals and strategy comprehension (i.e., 'I understand that my goals are challenging' and 'I use specific strategies related to my practice goals') obtained the highest scores. Personal Resources items, expressing metacognitive knowledge (i.e., 'I understand the nature and demands of my musical activities' and 'I understand my strengths and weaknesses') achieved the highest means. Moreover, the item 'I practice in order to improve my musical skills' obtained the highest score in the External Resources category. Lowest means were found for aspects of music practice related to support



from others and organization (i.e., planning). Although novice self-regulated learners rely on knowledgeable others and social resources when facing difficulties (Hallam, 2010; McPherson & Zimmerman, 2011), these behaviours did not score highly in this sample. Planning Of Time For Practice did not achieve as high mean and mode as the other behaviours (mean < 3.50, mode = 3). Support From External Factors ( $m = 3.09$ ;  $SD = 1.20$ ) and Help From Others ( $m = 3.39$ ;  $SD = 1.12$ ) also had low means when compared with the other measured self-regulated behaviours.

*Differences in self-regulation according to the participants' attributions.* Inferential statistical tests (ANOVAs,  $t$  tests) were performed in order to verify differences in the self-regulated factors by gender, age group, musical instrument groups and time practising. No statistically significant differences in the self-regulation factors by gender and musical instrument groups were found.

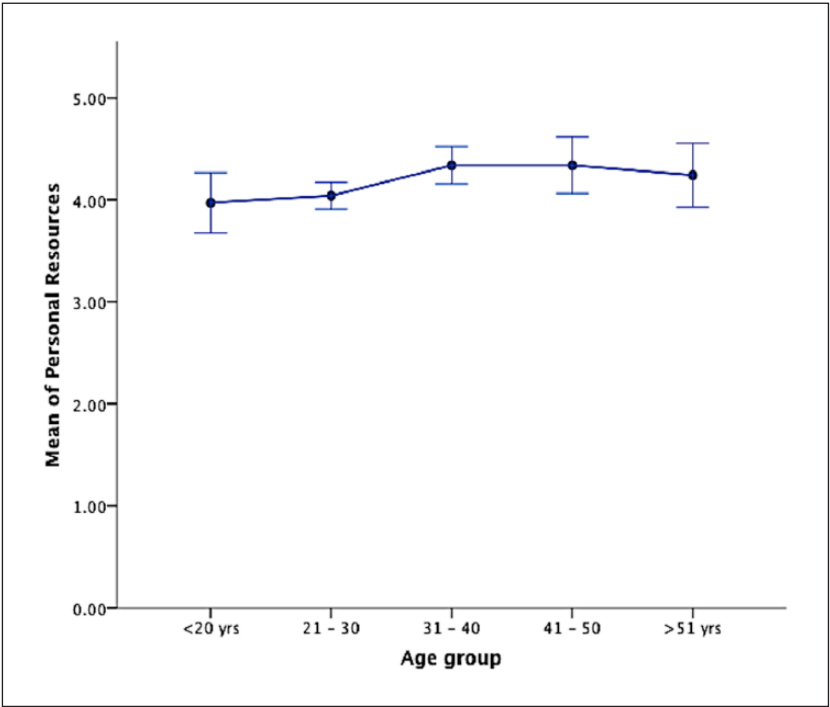
*Age and self-regulation.* A one-way ANOVA was conducted to determine if the three self-regulation factor scores were different for groups with different ages. Participants were divided into five age groups: < 20, 21–30, 31–40, 41–50, and > 50 (see Table 2 for number of participants in each age group). There were no outliers, as assessed by boxplots; data were normally distributed for each group, as assessed by Shapiro-Wilk's test ( $p > .05$ ), and there was homogeneity of variances, as assessed by Levene's test of homogeneity of variances ( $p > .05$ ).

Data are presented as mean  $\pm$  standard deviation. Self-Regulation through Personal Resources showed a statistically significant difference between different age groups,  $F(4, 207) = 2.730$ ,  $p < .005$ . Also, Self-Regulation through External Resources was significantly different between different age groups,  $F(4, 207) = 7.192$ ,  $p < .005$ . Tukey's post-hoc analysis revealed that the Self-Regulation through Personal Resources score increased from the < 20 years ( $3.9 \pm 0.6$ ) to 31–40 years ( $4.3 \pm 0.7$ ) groups with the scores being maintained until 50 years of age (Figure 1). The means of Self-Regulation through External Resources, however, decreased significantly after 50 years of age (Figure 2).

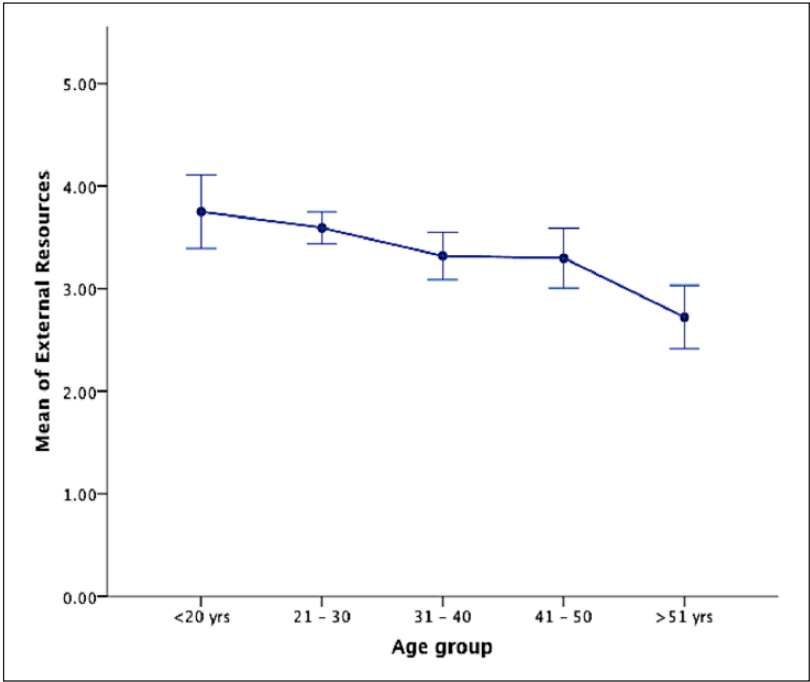
The data suggest that Self-Regulation through Personal Resources (knowledge and regulation of cognition, strategies, self-efficacy) increases with age. In contrast, Self-Regulation through External Resources (external causal attributions, help-seeking and use of resources) decreased with age, suggesting that advanced musicians are less dependent on external resources.

*Practice time and self-regulation.* A one-way ANOVA was conducted to test whether the three self-regulation factor scores differed for groups reporting different daily practice durations. Participants were classified into five practice duration groups: 'less than 1 hour,' '1h – 2h' '2h – 3h,' '3h – 4h,' and 'more than 4h' (see Table 3 for number of participants in each practice duration group). There were no outliers, as assessed by boxplots; data were normally distributed for each group, as assessed by Shapiro-Wilk's test ( $p > .05$ ); and there was homogeneity of variances, as assessed by Levene's test of homogeneity of variances ( $p > .05$ ). Data are presented as mean  $\pm$  standard deviation.

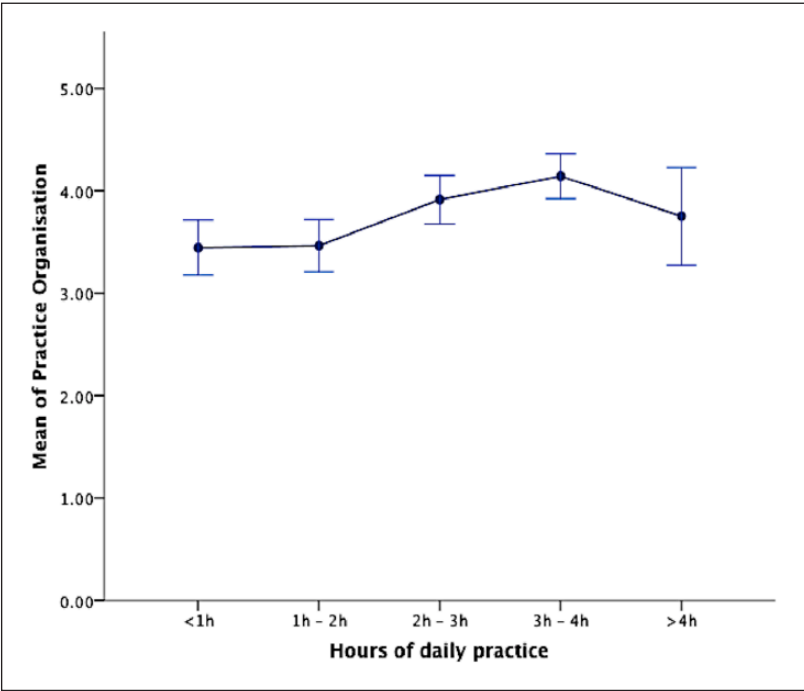
'Self-Regulation through Practice Organization' was statistically significantly different between different practice duration groups,  $F(4,207) = 4.846$ ,  $p < .005$ . There was a significant increase in the means from the 'less than 1h' group ( $3.4 \pm 0.9$ ) to the '3h–4h' group ( $4.1 \pm 0.6$ ) (Figure 3). Also, Self-Regulation through External Resources was significantly different between different practice duration groups,  $F(4,207) = 4.385$ ,  $p < .005$ , where means increased from the 'less than 1h' group ( $2.9 \pm 0.9$ ) to the '3h–4h' group ( $3.8 \pm 0.6$ ) (Figure 4). Tukey's post-hoc analysis revealed that the increases were significant.



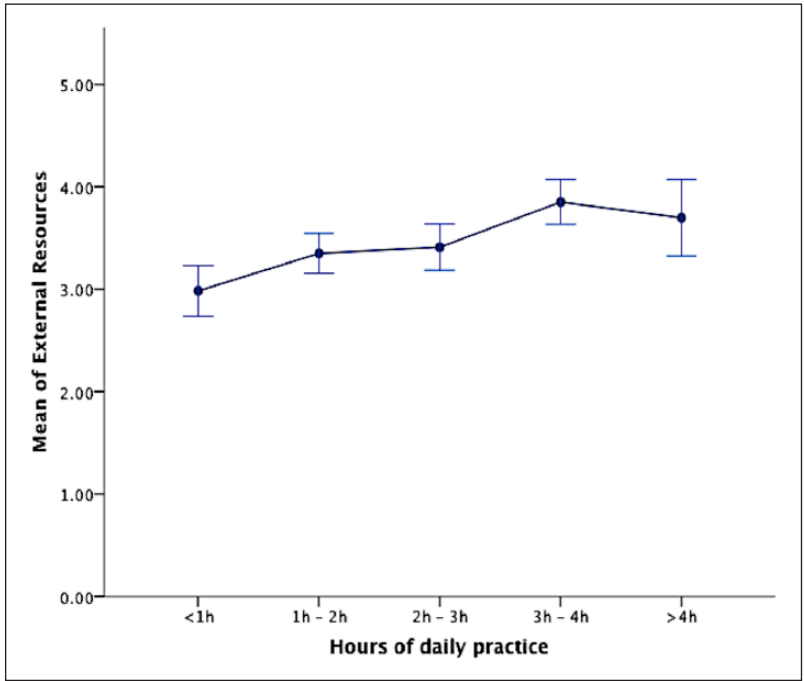
**Figure 1.** Increase in ANOVA means for the Self-Regulation through Personal Resources factor according to age group.



**Figure 2.** Decrease in ANOVA means for the Self-Regulation through External Resources factor according to age group.



**Figure 3.** Increase in ANOVA means for the Self-Regulation through Practice Organization factor according to duration of daily practice measured in hours.



**Figure 4.** Increase in ANOVA means for the Self-Regulation through External Resources factor according to duration of daily practice measured in hours

A correlational analysis was also employed to verify if time spent practising decreased with age. Practice duration was significantly related to age,  $r(212) = -.272, p < .01$ . It seems that the more experienced the musician, the more self-regulated his/her practice is, and the less time he/she needs to practise efficiently.

## Discussion

This study examined self-regulated practice behaviours in highly skilled classical musicians' practice. Drawing on the three previously established self-regulated practice factors, namely Self-Regulation through Practice Organization, Self-Regulation through Personal Resources, and Self-Regulation through External Resources, the present study found high scores for most of the self-regulated practice behaviours (Table 4), suggesting that advanced musicians rely heavily on self-regulation in their practice processes. However, some of the organizational aspects (i.e., planning of time and order of activities) received lower scores in this category (i.e., Practice Organization), contradicting findings that have stated that practice is most effective when organized in a sequential manner (see Hallam, 1997). It was expected that advanced musicians would be highly organized or methodical, but the standard deviations and modes found for these items ( $SD > 1$ ; mode = 3) suggest that organization is not a main aspect of their self-regulation. Notwithstanding, a possible explanation for this may be that experts from several fields normally adopt behavioural patterns (Ericsson, Charness, Feltovich, & Hoffman, 2006), which are constructed through several years of training. In other words, these advanced musicians may not need to focus as much on practice planning because they already know how to organize it efficiently. On the other hand, many studies have demonstrated high scores in these dimensions in self-regulated music students (McPherson & McCormick, 1999; McPherson & Zimmerman, 2011; Miksza, 2007; Miksza, 2011b), as they are learning and acquiring efficient practice routines.

Most notable were the low rates for Self-Regulation through External Resources. Self-regulated learning is a social learning theory, in which music practice occurs through the interaction of social, cognitive, affective and motivational processes (McPherson & Zimmerman, 2011). What is clear in the results of this study is that the advanced musicians reported relying more on personal resources (e.g., metacognition) instead of external ones (i.e., teachers, peers, composers, specialists, materials). This result is supported by previous studies on professional musicians' approaches to practice. For instance, Hallam (1995) found considerable use of metacognitive skills in professional musicians. Thus, a possible explanation is that musicians become more autonomous with experience and the development of expertise, relying less on support from knowledgeable others. In addition, Self-Regulation through External Resources significantly decreased with age (Figure 2), and, in contrast, there was an increase in the Self-Regulation through Personal Resources scores for musicians between 20 and 40 years old (Figure 1). Together, these results suggest that Self-Regulation through Personal Resources contributed to make the musicians' music practice processes more efficient and less time-consuming as their expertise increased. Thus, these musicians may simply need less time to achieve their practice goals, as expressed by the negative correlation between practice time and age. But there are other possible explanations for this. It is known that the nature of the practice task or familiarity with the repertoire can influence the time and the manner in which practice is undertaken. For example, Miklaszewski's study (1995) with professional pianists found that the participants spent less time practising a Romantic piece than a contemporary one. Nevertheless, it is important to note that, although self-regulated skills have predicted efficient use of practice time in studies with young musicians (Austin & Berg, 2006), studies have tended

not to address how specific self-regulatory behaviours can contribute to practice efficiency. The findings of this study suggest that Self-Regulation through Personal Resources may be the most relevant aspect of self-regulation for practice efficiency among advanced musicians.

Efficient practice may comprise self-regulated behaviours that expert musicians regularly use during their music practice processes. One advantage of using the self-regulated learning paradigm to assess more advanced musicians is the possibility of reflection on other factors that are normally absent in studies with professionals (e.g., social factors). However, music practice is primarily a solitary activity, and more advanced performers may be less inclined to share their learning processes with others. Indeed, compared to younger students, there are less observational studies of concert performers, which seem to suggest that these musicians may not be so open to share the 'mystique' of their artistry. For instance, in the analysis of the learning process of a piece of music by a professional pianist, the pianist expressed feelings of vulnerability in revealing her demanding practising process to others (Chaffin, Imreh, & Crawford, 2002). This can be considered as a limitation of this study, as reports on Self-Regulation through External Resources can be biased by this salient characteristic of professional performers.

The use of a self-report questionnaire technique and the volunteer sample are also limitations of this study. There is evidence that self-reported practice procedures and authentic practice may differ (Chaffin & Imreh, 2001). Because of this, future research using the questionnaire with observational (e.g., video-based research) or experimental (e.g., intervention) methods should be considered, to confirm or challenge the present findings.

In furthering our understanding of the practice behaviours of advanced musicians, several practical implications arise, for musicians, music teachers, and researchers alike. The reliability and preliminary validity of the measure suggest that the questionnaire can be used to assess musicians' self-regulated practice behaviours. As the questionnaire does not focus on particular instrumental techniques or methods of practice (e.g., use of metronome, body stretch, breath exercises, etc.), it can be applied to musicians playing any type of instrument. Depending on the score achieved, teachers and coaches could assess which self-regulated behaviours might be improved to make the practice processes of adult students and musicians more efficient, teaching them how to self-regulate their practice. In a longitudinal context, the questionnaire might also be used to assess improvements and changes in the musicians' behaviours throughout a music course. Musicians (i.e., instrumentalists and singers) can also use the present questionnaire for self-assessment. There are individual differences in the music practice processes, and thus musicians can fill in the questionnaire to assess what strategies could be adopted to improve their practice efficiency.

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## Notes

1. Plucked strings comprised only classical guitarists.
2. <http://questionarios.ua.pt/index.php/589964/lang-en>

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