The Development of a Measure of Self-Regulated Practice Behavior for Beginning and Intermediate Instrumental Music Students

Peter Miksza¹

Abstract
The purpose of this study was to develop and test the construct validity and reliability of a self-report measure of self-regulated practice behaviors for beginning and intermediate instrumentalists. A questionnaire was designed to assess the motive, method, behavior, time management, and social influences dimensions of the theoretical model of self-regulation proposed by McPherson and Zimmerman. The questionnaire’s construct validity was tested using confirmatory factor analysis, and a preliminary assessment of predictive validity was estimated by correlating the measure with self-reported practice habits. The measure’s reliability in regard to internal consistency and consistency over time was assessed as well. The sample consisted of middle school band students in grades 6 to 8 (N = 302). Confirmatory factor analyses indicated that a model including factors representing the dimensions self-efficacy, method/behavior combined, time management, and social influences was the best fit. Cronbach’s alpha and test–retest reliability results indicated good to excellent consistency across all self-regulation subscales, with coefficients ranging from .76 to .90. Significant correlations (p < .001) between the self-regulation subscales and self-reported practice habits (i.e., time spent practicing, average daily practice efficiency, percentage of time spent on formal practice) provided preliminary evidence of predictive validity of the measure.

Keywords
practice, self-regulation, instrumental music

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Introduction and Theoretical Framework

Understanding the processes and methods by which students develop as self-sufficient music learners is an important endeavor for music education researchers and practitioners (Barry & Hallam, 2002). Instrumental music students, in particular, routinely spend great amounts of time practicing away from the direct influence of their teachers (Miksza, 2006; Sloboda, Davidson, Howe, & Moore, 1996). Such self-guided instruction is especially important for beginning and intermediate musicians because early phases of learning are crucial to the development of fundamental skills and proficiencies that may guide future music success. Music success at the beginning and intermediate levels also is critical given the high degree of program attrition often found among middle school or junior high school instrumental students (Boyle, DeCarbo, & Jordan, 1995; Warnock, 2005). One way to conceptualize the development of musicians as self-sufficient learners is through the theoretical framework of self-regulation (Zimmerman, 1986).

The theoretical model of self-regulation explored in the current study is rooted in Bandura’s social cognitive theory. Consequently, the model takes into consideration how an individual’s perceptions, environment, and behavior interact to influence the learning process. Self-regulated learning is somewhat distinct from other theoretical models of learning because it describes learning activities from the student’s perspective and draws heavily from an individual’s self-image as a learner. The definition of self-regulation employed in the current study—“self-generated thoughts, feelings, and actions for attaining academic goals” (Zimmerman, 1998, p. 73)—is based on conceptions developed in both general education (Zimmerman, 1998) and music education (McPherson & Zimmerman, 2002). Zimmerman and Martinez-Pons (1988) went further and described self-regulated learners as “metacognitively, motivationally, and behaviorally active participants in their own learning process” (p. 284). Zimmerman and Martinez-Pons (1986) also described self-regulated learning strategies as “actions directed at acquiring information or skill that involve agency, purpose, and instrumentality self-perceptions of the learner” (p. 615). Studies in general education have found students’ self-regulated behavior to be predictive of homework completion, academic achievement, teachers’ ratings of self-regulated behavior, and help-seeking behavior (Zimmerman & Martinez-Pons, 1988, 1990).

McPherson and Zimmerman (2002) highlighted six dimensions of self-regulation relevant to music learning: (a) motive, (b) method, (c) time management, (d) behavior, (e) physical environment, and (f) social factors. The motive dimension refers to a student’s self-beliefs and how they may or may not affect learning. Of the various motivational dispositions discussed, self-efficacy seems to be the most salient, given evidence suggesting direct or indirect relationships with goal setting, effort expenditure, and persistence in general education (Zimmerman, Bandura, & Martinez-Pons, 1992) as well as in music education (McPherson & McCormick, 2006). Method entails task-oriented learning strategies, mental strategies, and other general approaches to self-instruction,
whereas behavior encompasses orientations toward reflective thinking, metacognition, and learners’ abilities to self-evaluate or monitor their own learning processes. Time management encompasses students’ abilities to concentrate, focus on tasks, and plan the use of their time. Although frequently beyond the learner’s control, environment refers to the physical structure in which learning takes place. Lastly, social factors refers to a learner’s tendency to engage others through help-seeking behaviors (e.g., teachers, parents, peers, siblings). Although McPherson and Zimmerman’s discussion of each dimension suggested at least some degree of overlap, they did not explicitly hypothesize relationships among the dimensions.

**Literature Review**

Music education research examining processes related to self-regulated learning has come most commonly in the form of research on individual practicing. For example, many researchers have investigated (a) developmental changes in practice approaches among musicians of varying competence (e.g., Hallam, 2001a; Howe & Sloboda, 1991; Manturzewska, 1990; McPherson & Renwick, 2001; Pitts, Davidson, & McPherson, 2000a, 2000b), (b) relations between motivational orientations and practice (e.g., Hamann, Lucas, McAllister, & Teachout, 1998; McPherson & McCormick, 2006; Miksza, 2011), (c) practice strategies (e.g., Barry, 1991; Duke, Simmons, & Cash, 2009; Gruson, 1988; Miksza, 2007; Rohwer & Polk, 2006), (d) metacognitive elements of practicing specifically (e.g., Hallam, 2001b; McPherson, 1997; McPherson & McCormick, 1999; Nielsen, 2004), and (e) time use and practicing (e.g., Ericsson, Krampe, & Tesch-Romer, 1993; Madsen & Geringer, 1981; Williamson & Valentine, 2000). Generalizations from this literature base suggest that strategic, purposive, and reflective approaches to practicing are (a) likely to develop over a long time, (b) motivated primarily via intrinsic sources, and (c) more likely to yield performance competence.

The tendency for musicians to become more self-regulated over time has been identified across several studies of music development. For example, although parents have been found to play a pivotal role in the practicing of beginning-level musicians, this scaffolding is replaced gradually by personal intrinsic desires and students’ abilities to choose appropriate strategies (MacNamara, Holmes, & Collins, 2006; Manturzewska, 1979, 1990; Sosniak, 1985). McPherson (1997) found that beginning instrumentalists reported practice strategies of increasing sophistication (playing by ear, improvising, mental rehearsal) across a 3-year study, and those reporting more sophisticated strategies also had greater performance achievement scores.

Studies of motivation orientations toward practicing have found that students generally are driven to practice in order to satisfy personal needs (Hamann et al., 1998; Schmidt, 2005, 2007), meet personal challenges (Ciabattari, 2004; Miksza, 2006), and/or master tasks (Miksza, 2009; Schmidt, 2005, 2007). However, the self-efficacy construct is of particular note given that researchers have found it to be a theoretical precursor to intrinsic motives such as goal setting, managing effort, and persisting at
tasks. Self-efficacy has been found to be related significantly to instrumentalists’ time spent on formal practice, degree of practice regulation, and performance achievement (McCormick & McPherson, 2003; McPherson & McCormick, 2006).

Measures of performance competence also have been found to be related to practice behaviors suggestive of self-regulated behavior. Gruson (1988) and Miksza (2007, 2009) reported relationships between instrumentalists’ performance achievement and greater frequencies of their strategic behaviors such as repetition of large sections of music material, slowing, whole-part-whole practicing, chaining music sections together, skipping to critical sections of études, marking music, and using a metronome. Similarly, Duke et al. (2009) found that the most accomplished pianists in their sample exhibited greater frequencies of locating errors, varied tempo when practicing, and persistence until errors were corrected. When comparing novice and professional musicians, Hallam (1997a, 1997b, 2001b) found that professionals were more likely to report metacognitive activity, sophisticated memorization strategies, and cognitive approaches for dealing with performance anxiety. In addition, although those who achieve music expertise have been found to accumulate greater amounts of practice time than those who do not (e.g., Ericsson et al., 1993; Sloboda et al., 1996), generally speaking, quality, rather than quantity, of strategic practice seems to be more closely related to performance achievement outcomes (e.g., Williamon & Valentine, 2000). Although all of the studies referenced above incorporated elements of practicing reminiscent of self-regulation, relatively few researchers have drawn from a specific self-regulatory theory to frame their research problems and methods.

Studies that have incorporated a specific self-regulation theoretical framework most commonly have employed case study and/or quantitative self-report or questionnaire methodology with beginning or intermediate instrumental musicians. McPherson and Renwick (2001) found, across a 3-year study, that participants tended to play straight through music material without recognizing errors and exhibited a great degree of distracted behavior. In addition, Renwick and McPherson (2002) found that students tended to avoid practicing music that requires a self-regulated approach to attain mastery. Similarly, Pitts et al. (2000a, 2000b) found that participants who dropped instrumental music study tended to have lower levels of motivation, were more distracted when practicing, and became frustrated during practice. In contrast, Austin and Berg (2006) found evidence of help-seeking behaviors and strategic behavior (e.g., slowing, additive/chaining) among intermediate instrumental students.

The majority of quantitative studies of self-regulatory practice behaviors have incorporated an adaptation of the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and colleagues in the 1990s (Pintrich & DeGroot, 1990; Pintrich, Smith, Garcia, & McKeachie, 1993). However, self-regulation has been defined clearly as a set of context-specific processes rather than a fixed student characteristic (e.g., Zimmerman, 1998). This may have impacted the reliability and validity of self-report measures adapted for music education research. Reliability results for music-specific approaches to self-report measures of self-regulation have been similar to those reported by the original MSLQ developers with coefficients rarely above .80 and most
in the .60 to .70 range (Austin & Berg, 2006; Miksza, 2006a; Nielsen, 2004). This could be the result of any number of issues such as changes in wording for music-specific applications, a general lack of items per subscale (i.e., as few as 2 items have been used as subscales), type of response mode employed, and samples ranging widely in development (i.e., ages 9 to 18 in some studies).

Exploratory factor analyses of adaptations of the MSLQ have suggested different underlying theoretical structures across many of the previous studies (see Austin & Berg, 2006; McPherson & McCormick, 1999, 2000; Miksza, 2006). The potential discrepancies in the construct validity of the scales employed across studies could result in what psychologists have described as a “jingle jangle” fallacy (Kelley, 1927) and hinder the interpretability of findings emerging from this body of work. Although the discrepancies may be due to differences in factor analysis procedures, sample characteristics, and the actual items used in each study, the fact remains that no confirmatory approaches have examined empirically the goodness of fit between the theoretical model of self-regulation and measurement approaches used in music education. There is a clear need for testing a music education–specific measure, given changes in wordings, population discrepancies (i.e., academic vs. music students), and inherent differences between music and academic tasks. Moreover, although most measures have been based in some part on reviews of literature (e.g., Austin & Berg, 2006; Miksza, 2006), measures that take advantage of the recent explosion in practice research could be beneficial to the research community.

Limitations aside, several compelling generalizations have begun to emerge from the research employing a quantitative or questionnaire methodology to study self-regulated music learning. Self-reports of self-regulation strategies have been shown to be predictive of performance achievement (McPherson & McCormick, 2000). Students who possess greater competence have been found to be more likely to scan music for problems, use mental strategies, and exhibit a sense of organization in their practicing (Hallam, 2001b; McPherson, 2005). Positive relationships have been reported between self-regulation and time spent practicing (Austin & Berg, 2006) as well as time spent on formal practice specifically (McPherson & McCormick, 1999, 2006; Miksza, 2006). Lastly, positive relations have been found between reports of self-efficacy and general self-regulation reports (McPherson & McCormick, 2006) as well as cognitive, metacognitive, and resource practice strategies (Nielsen, 2004).

**Purpose**

A need exists for a valid and reliable measure of self-regulated learning that is informed by a robust psychological theory as well as the most current research in music practice. Such a contribution could advance significantly our understanding of how individuals develop into competent musicians. The purpose of this study was to test the construct validity and reliability of a self-report measure of self-regulated practice behaviors for beginning and intermediate instrumentalists. A questionnaire was designed to assess the motive, method, behavior, time management, and social influences dimensions of
the theoretical model of self-regulation proposed by McPherson and Zimmerman (2002). The physical environment dimension was not included in the measure for three reasons: (a) many children have little or no control over this variable, (b) the psychometric properties of a scale intending to measure whether there was a quiet or distraction-free environment available likely would be limited, and (c) environmental elements have been found to be extremely weak (Zimmerman & Martinez-Pons, 1986) or non-significant (Zimmerman & Martinez-Pons, 1988) predictors of learning outcomes in previous research. The construct validity of the questionnaire was tested using confirmatory factor analysis. The reliability of the measure was assessed via test–retest and internal consistency. A preliminary assessment of predictive validity was estimated by correlating the measure with self-reported practice habits.

Method

Middle school band students in grades 5 to 8 served as participants in this study (N = 302). Volunteers were drawn from 10 suburban middle schools and 2 middle school summer music camps in the southwestern United States. Instrumental music instruction typically begins in fifth grade in this region of the country. The 10 middle schools were identified based on directors’ willingness to participate as well as an effort on my part to try to diversify the sample across teaching contexts and demographic characteristics. For example, the middle schools were from rural, suburban, and urban communities varying widely in socioeconomic status (4% to 55.8% free and reduced-priced lunch). Both music camps are nonauditioned organizations, one organized by a large university and the other a community-based program in an urban location. Only participants who completed an informed assent form approved by the university institutional review board and the local school district as well as a parental consent form participated in this study. The participants were male (50.2%) and female (49.8%) woodwind (49.6%), brass (38.8%), and percussion (11.5%) students in grades 5 (11.4%), 6 (33.8%), 7 (30.0%), and 8 (24.7%). The average age of the sample was 12.8 (SD =1.08) years.

The questionnaire designed for this study went through several phases of development. I began with a thorough review of the literature on self-regulated music learning and individual practice. This included gathering and comparing the available items, subscales, and factor analysis results of self-report measures of self-regulation used in previous research (Austin & Berg, 2006; McCormick & McPherson, 2003; McPherson & McCormick, 1999, 2000, 2006; Miksza, 2006; Nielsen, 2004). I then created an initial questionnaire composed of items from the previously used measures as well as newly created items on practicing suggested by other researchers. I created hypothesized subscales for the following dimensions of the theoretical model of self-regulated learning: motive, method, behavior, time management, and social influences.

Schmidt’s (2007) 10-item measure of music self-efficacy was incorporated as the motive dimension, given self-efficacy’s prominence in the theoretical model as well as
the scale’s sound psychometric properties (e.g., $\alpha = .92$ in Schmidt, 2007). Schmidt’s scale is an adaptation of a measure of group efficacy developed by Guzzo, Yost, Campbell, and Shea (1993). Participants responded to items regarding their personal beliefs of music competence (i.e., “I am confident I can improve on my instrument”), using a 5-point, Likert-type scale ranging from *strongly disagree* to *strongly agree*.

Items designed to measure the method, behavior, time management, and social influences dimensions of self-regulated learning were written as statements of practice tendencies or habits (e.g., “Practice at least a little bit every day,” “I am easily distracted when practicing”). Participants responded to these items by indicating the frequency with which they engage in the behavior or experience the tendency, using a 5-point, Likert-type scale with the following options: 1 (*never*), 2 (*rarely*), 3 (*sometimes*), 4 (*often*), and 5 (*always*).

The method subscale was constructed primarily with items drawn from Austin and Berg’s (2006) study of intermediate instrumental musicians’ practicing. I adapted or created 14 items to assess participants’ goal setting, preparation, practice routines, and mental organization (e.g., “Mark trouble spots in music while practicing”). The behavior subscale comprised 7 items that were drawn from measures presented by Austin and Berg (2006) and Miksza (2006). The behavior subscale assessed students’ perceptions of their abilities to adjust their practicing to learning outcomes, monitor their progress, identify when they are being inefficient, and think about practicing metacognitively (e.g., “When I’m practicing I stop playing and try to think about the best way to work out a problem”).

The time management subscale included 6 items drawn from Miksza’s (2006) study of intermediate band students’ practicing. These items examined participants’ abilities to maintain concentration and avoid distraction while practicing (e.g., “It is easy for me to remain focused on my music when practicing alone”). Lastly, the social influences subscale consisted of 10 items that referred to participants’ help-seeking behaviors, likelihood of seeking out information, and utilization of their band teachers’ advice (e.g., “Ask for feedback from band teacher”). I either adapted these items from Austin and Berg’s (2006) measure or created them myself.

Items designed to assess practice habits also were included on the questionnaire. Participants reported their average number of minutes spent practicing per day and average number of practice sessions per day. They also were asked to estimate what percentages of time they spent on formal or informal practicing, defined as practicing with a specific music or technical goal in mind or not, respectively. Lastly, participants provided a global assessment of their average daily practice efficiency, using a 10-point, Likert-type scale ranging from 1 (*extremely inefficient*) to 10 (*extremely efficient*).

The initial questionnaire was presented to a panel of 3 experienced instrumental music teachers who made suggestions for changes in wording to reduce bias and suggestions for item deletions. A subsequent revision of the questionnaire was presented to 158 instrumental music students in grades 5 to 12 as a preliminary check for reliability. This resulted in a final questionnaire consisting of 47 items and 5 hypothesized subscales: (a) self-efficacy/motive (10 items); (b) method (14 items); (c) behavior (7 items);
(d) time management (6 items); and (e) social influences (10 items; see Appendix A, available at http://jrm.sagepub.com/supplemental, for the final questionnaire).

I distributed the final version of the questionnaire to the participants and collected them when completed, or they were distributed by the participants’ band teachers, who subsequently mailed them back me. All participants completed the questionnaires anonymously.

Results

Preliminary Reliability and Correlational Analyses

Exploratory interitem and item-total analyses were conducted for each of the 5 hypothesized self-regulation subscales. The results suggested that deleting 1 item from the self-efficacy subscale and 1 item from the social influences subscale would increase internal consistency. Following the deletions, analyses revealed that all interitem correlations were significant ($p < .01$) and that all item-total correlations were $r = .30$ or greater. Reliability coefficients and descriptive analyses for each subscale are presented in Table 1. The range of Cronbach’s alpha reliability coefficients across the hypothesized subscales was good ($\alpha = .76$ to .85). Consistency of the subscales over time was assessed by readministering the measure to a subsample of 63 participants 1 week following the original administration. The range retest reliability coefficients

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>$\alpha$</th>
<th>Retest$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy (9 items)</td>
<td>3.80</td>
<td>0.55</td>
<td>−0.48</td>
<td>1.81</td>
<td>.83</td>
<td>.83</td>
</tr>
<tr>
<td>Method (14 items)</td>
<td>3.44</td>
<td>0.67</td>
<td>−0.91</td>
<td>1.71</td>
<td>.85</td>
<td>.85</td>
</tr>
<tr>
<td>Behavior (7 items)</td>
<td>3.47</td>
<td>0.76</td>
<td>−0.60</td>
<td>0.39</td>
<td>.78</td>
<td>.75</td>
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<tr>
<td>Time management (6 items)</td>
<td>3.33</td>
<td>0.86</td>
<td>−0.33</td>
<td>−0.60</td>
<td>.80</td>
<td>.91</td>
</tr>
<tr>
<td>Social influences (9 items)</td>
<td>3.07</td>
<td>0.70</td>
<td>−0.91</td>
<td>0.42</td>
<td>.76</td>
<td>.80</td>
</tr>
<tr>
<td>Method/behavior (21 items)</td>
<td>3.45</td>
<td>0.66</td>
<td>−0.88</td>
<td>1.54</td>
<td>.90</td>
<td>.82</td>
</tr>
<tr>
<td>Method/behavior/social influences (30 items)</td>
<td>3.34</td>
<td>0.68</td>
<td>−0.87</td>
<td>1.76</td>
<td>.91</td>
<td>.86</td>
</tr>
<tr>
<td>Time per day</td>
<td>23.59</td>
<td>19.06</td>
<td>1.53</td>
<td>4.39</td>
<td>NA</td>
<td>.84</td>
</tr>
<tr>
<td>Sessions per day</td>
<td>1.14</td>
<td>0.79</td>
<td>1.44</td>
<td>4.40</td>
<td>NA</td>
<td>.79</td>
</tr>
<tr>
<td>Informal practice$^b$</td>
<td>31.18</td>
<td>27.41</td>
<td>0.77</td>
<td>−0.34</td>
<td>NA</td>
<td>.90</td>
</tr>
<tr>
<td>Formal practice$^b$</td>
<td>57.43</td>
<td>31.58</td>
<td>−0.43</td>
<td>−0.99</td>
<td>NA</td>
<td>.80</td>
</tr>
<tr>
<td>Practice efficiency$^c$</td>
<td>6.21</td>
<td>2.27</td>
<td>−0.82</td>
<td>−0.01</td>
<td>NA</td>
<td>.85</td>
</tr>
</tbody>
</table>

Note: Method/behavior is a composite variable of all method and behavior items; method/behavior/social influences is a composite variable of all method, behavior, and social influence items.

$^a$Re-test assessments are Pearson correlations between responses from a subsample ($n = 63$) across 1 week.

$^b$Figures are based on reported percentages.

$^c$Range for this item was 1 (extremely inefficient) to 10 (extremely efficient).
(Pearson) across hypothesized subscales also was good \( (r = .75 \text{ to } .91) \). Descriptive analyses of the subscales indicated relatively normal distributions for all variables with the exceptions of self-efficacy and method having slightly peaked distributions (e.g., kurtosis > 1.00).

Pearson correlations computed among the five hypothesized self-regulation subscales reached statistical significance \( (p < .01) \) among all possible pairings but ranged widely in magnitude \( (r = .19 \text{ to } .78; \text{ see Table 2}) \). The strongest relationships were detected between method and the behavior \( (r = .78) \) and social influences \( (r = .70) \) subscales. The weakest correlations were found between time management and all other subscales \( (r = .19 \text{ to } .30) \). MANOVA analyses revealed no significant differences among subscale means as a function of grade level, instrument type, or gender, and no significant interactions.

**Construct Validity and Confirmatory Factor Analyses**

In contrast to exploratory factor analysis, confirmatory factor analysis is used to verify the number of underlying dimensions of a questionnaire when the design of the measure is informed strongly by theory and/or previous research (Brown, 2006; Thompson, 2004). Four nested models were tested in this study in accordance with guidelines presented by Thompson (2004), who suggested comparing rival models based on empirical findings and theoretical assertions. The models were (a) a five-factor model that included factors for each of the primary elements of McPherson and Zimmerman’s (2002) model of self-regulated music learning examined in this study (i.e., self-efficacy, method, behavior, time management, social influences); (b) a four-factor model that included factors for the self-efficacy, time management, and social influences dimensions of McPherson and Zimmerman’s model but considered the method and behavior dimensions as a combined single factor due to the high degree of correlation between the scales \( (r = .78) \); (c) a three-factor model that included factors for the self-efficacy and time management dimensions of McPherson and Zimmerman’s model but considered the method, behavior, and social influences dimensions as a combined single factor due to the high degree of correlation among the hypothesized subscales \( (r = .65 \text{ to } .78) \); and (d) a two-factor model based on Austin and Berg’s (2006) exploratory factor analysis results, which suggested two global constructs, practice regulation and practice motivation. LISREL 8.80 (Jöreskog & Sörbom, 2006) was used to estimate the models. Maximum likelihood estimation was used to determine the models.

Path diagrams of all models with standardized coefficients are presented in Appendix B (see http://jrm.sagepub.com/supplemental). Goodness-of-fit statistics for the models estimated are presented in Table 3. The minimum fit function chi-square was significant for each model \( (p < .001) \), suggesting that no model was a perfect replication of the covariance matrix generated from the observed data. However, this test is extremely sensitive to sample size and will lead to rejection even when only minute differences exist between the model and the observed data. Consequently, researchers rely more commonly on additional absolute fit indices such as the root mean square error of
Table 2. Pearson Correlations Among Hypothesized Self-Regulation Subscales, Scales Suggested by Factor Analyses, and Practice Habit Items

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</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>1.00</td>
<td>.45</td>
<td>.40</td>
<td>.30</td>
<td>.34</td>
<td>.46</td>
<td>.45</td>
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<tr>
<td>Method</td>
<td>.100</td>
<td>.78</td>
<td>.28</td>
<td>.70</td>
<td>.97</td>
<td>.95</td>
<td>.95</td>
</tr>
<tr>
<td>Behavior</td>
<td>.100</td>
<td>.19</td>
<td>.65</td>
<td>.91</td>
<td>.88</td>
<td>.26</td>
<td>.25</td>
</tr>
<tr>
<td>Time management</td>
<td>.100</td>
<td>.16</td>
<td>.26</td>
<td>.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social influence</td>
<td>.100</td>
<td>.72</td>
<td>.86</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Time per day</td>
<td>.12</td>
<td>.43</td>
<td>.30</td>
<td>.13</td>
<td>.29</td>
<td>.40</td>
<td>.39</td>
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<tr>
<td>Sessions per day</td>
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<td>.39</td>
<td>.33</td>
<td>.10</td>
<td>.28</td>
<td>.39</td>
<td>.38</td>
</tr>
<tr>
<td>Formal practice</td>
<td>.08</td>
<td>.34</td>
<td>.26</td>
<td>.08</td>
<td>.24</td>
<td>.33</td>
<td>.32</td>
</tr>
<tr>
<td>Practice efficiency</td>
<td>.43</td>
<td>.60</td>
<td>.48</td>
<td>.31</td>
<td>.40</td>
<td>.58</td>
<td>.56</td>
</tr>
</tbody>
</table>

Note: Coefficients > .15 are significant at p < .01; coefficients > .19 are significant at p < .001.

*Figures are based on reported percentages.

*Range for this item was 1 (extremely inefficient) to 10 (extremely efficient).
approximation (RMSEA) and standardized root mean square residual (SRMR) as well as incremental fit indices such as the comparative fit index (CFI; see Brown, 2006; Hu & Bentler, 1999; Kaplan, 2000).

The two-factor model yielded both absolute and incremental fit statistics that suggested a poor to marginal fit to the data. Fit statistics for the three-factor model were incrementally better, with an RMSEA value indicating a fair fit and SRMR and CFI values suggesting an adequate fit. The four-factor model yielded an RMSEA value demonstrating a close fit (i.e., RMSEA ≤ .05) and identical SRMR and CFI values to the three-factor model. The five-factor model resulted in fit statistics that indicated a slightly better fit than the four-factor model with identical RMSEA and SRMR values and a slightly greater CFI (.95). All coefficients for all models were statistically significant (p < .05) with the exception of the coefficient describing the correlation between the latent variables time management and social influences (.12, p > .05) in the four- and five-factor models. However, the degree of correlation estimated between the latent variables method, behavior, and social influences is extremely high and in some cases nearly perfect (coefficients .86 to .98) and therefore suggests poor discriminant validity.

The four nested models were compared empirically by evaluating the difference between the chi-square value (i.e., $\Delta \chi^2$) obtained from the five-factor model and those obtained from the other models. The results suggest that the five-factor model represented a significant improvement in fit when compared with the two-factor and three-factor models. The difference in chi-square values between the five-factor model and the four-factor model was nonsignificant ($\Delta \chi^2 = 6.62, df = 4, p > .05$). In addition, the four-factor model represented a better fit than the three-factor ($\Delta \chi^2 = 47.10, df = 3, p < .05$) and two-factor ($\Delta \chi^2 = 445.54, df = 5, p < .05$) models. Upon examining the sum of empirical evidence, the goodness-of-fit indices, estimated coefficients, and model comparisons indicate that the four-factor model is the best fit to the data. In addition, the theoretical implications of combining the latent variables method and behavior are feasible given the emphasis of learner activity directed at thoughtful and strategic practice in each set of items.

Table 3. Goodness-of-Fit Statistics for All Models Estimated

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>RMSEA</th>
<th>$p$ Close</th>
<th>SRMR</th>
<th>CFI</th>
<th>$\Delta \chi^2$</th>
<th>$\Delta df$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five-factor model</td>
<td>1,875.27</td>
<td>935</td>
<td>&lt;.001</td>
<td>.05</td>
<td>&lt;.001</td>
<td>.07</td>
<td>.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four-factor model</td>
<td>1,881.89</td>
<td>939</td>
<td>&lt;.001</td>
<td>.05</td>
<td>&lt;.001</td>
<td>.07</td>
<td>.94</td>
<td>6.62</td>
<td>4</td>
</tr>
<tr>
<td>Three-factor model</td>
<td>1,928.99</td>
<td>942</td>
<td>&lt;.001</td>
<td>.06</td>
<td>&lt;.001</td>
<td>.07</td>
<td>.94</td>
<td>53.72</td>
<td>7</td>
</tr>
<tr>
<td>Two-factor model</td>
<td>2,327.43</td>
<td>944</td>
<td>&lt;.001</td>
<td>.08</td>
<td>&lt;.001</td>
<td>.08</td>
<td>.92</td>
<td>452.16</td>
<td>9</td>
</tr>
</tbody>
</table>

Note: $\chi^2$ = minimum fit function chi-square; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index; $\Delta \chi^2$ = difference between five-factor chi-square value and each comparative model; five-factor model = self-efficacy, method, behavior, time management, and social influence; four-factor model = self-efficacy, method/behavior, time management, and social influence; three-factor model = self-efficacy, method/behavior/social influences, and time management; two-factor model = practice motivation (i.e., self-efficacy) and practice regulation.
Preliminary Predictive Validity Analyses

Results of the descriptive analyses of the practice habit items are presented in Table 1. Retest reliability coefficients for the practice habit items were attained using the same procedure for the hypothesized self-regulation subscales, described above. The coefficients ranged from good to excellent ($r = .79$ to .90). On average, the participants reported practicing for approximately 23 minutes per day in 1 session, with more time generally spent on formal practice (57.43%; i.e., with a specific music or technical goal in mind) than informal practice (31.18%). They rated themselves as somewhat efficient in their practicing, with a mean score of 6.21 out of 10. The variability among responses for each of these items was quite large.

Reliability analyses of the composite self-regulation subscale method/behavior suggested by the best-fitting four-factor model indicated excellent internal consistency ($\alpha = .90$) and good retest reliability ($r = .82$). Pearson correlations between the self-regulation subscales suggested by the four-factor model and practice habit items revealed many statistically significant, positive relationships (see Table 2). However, the magnitude of the relationships was quite varied. Significant relationships ($p < .001$) indicating at least 10% shared variance between variable pairings included (a) self-efficacy and practice efficiency ($r = .43, r^2 = 18\%$); (b) time management and practice efficiency ($r = .31, r^2 = 10\%$); (c) social influences and practice efficiency ($r = .40, r^2 = 16\%$); and (d) the composite subscale method/behavior and time spent practicing per day ($r = .40, r^2 = 16\%$), number of sessions practicing per day ($r = .39, r^2 = 15\%$), percentage of time spent on formal practice ($r = .33, r^2 = 11\%$), and practice efficiency ($r = .58, r^2 = 34\%$).

Discussion

The self-report measure of instrumentalists’ practice behaviors examined in this study was conceived originally to capture five dimensions of self-regulated learning outlined by McPherson and Zimmerman (2002; i.e., motive/self-efficacy, method, behavior, time management, and social influences). The construct validity of the measure was assessed by comparing four competing models that hypothesized different underlying factor structures (see Table 3). Results suggested that the four-factor model—self-efficacy, method and behavior combined, time management, and social influences—was the best overall fit to the data. Although the five-factor structure as originally conceived was not a poor fit to the data, the five-factor model did not demonstrate empirically a better fit than the four-factor model. In addition, the combination of the method and behavior dimensions is logically plausible given that both sets of items deal with relatively specific and individually enacted practice strategies. Furthermore, the two dimensions perhaps may be considered as parallel processes in the sense that method deals with actions in the moment, whereas behavior deals with attention and/or action directed by reflective and metacognitive approaches. As such, the four-factor solution may represent a somewhat more refined and parsimonious theoretical model. Overall, the construct validation of the four-factor model supports McPherson and Zimmerman’s (2002) assertions regarding the utility and suitability of self-regulation theory for music education research.
Reliability estimates for the four subscales that resulted from the confirmatory factor analyses also were assessed. The internal consistency (Cronbach’s $\alpha$) and consistency over time (test–retest) of the final versions of the subscales yielded coefficients indicating good to excellent reliability. These results suggest equivalent or improved consistency when compared with the subscale reliability results from previous research in the context of instrumental music (Austin & Berg, 2006; Miksza, 2006; Nielsen, 2004). In addition, two indices of reliability rarely have been reported in research regarding self-regulated music learning, and in some cases no reliability figures have been reported.

This study also aimed to provide preliminary evidence of predictive validity for the questionnaire. Several significant correlations were detected among the four subscales and various reports of practice habits. Positive relationships of meaningful magnitude (e.g., greater than 10% variance shared) were found between all subscales and at least one of the practice habit items. All subscales were predictive of participants’ reports of average practice efficiency, suggesting that those who reported greater degrees of practice efficiency also tended to report more self-regulated learning tendencies. In addition, the method/behavior combined subscale was predictive of the amount of time participants spent practicing per day as well as the percentage of time participants spent practicing with a particular music or technical goal in mind (i.e., formal practice). These relationships suggest that those participants who reported using self-regulated strategies more frequently also tended to practice for longer amounts of time and considered their practicing to be more formal in nature. The relationships between reports of self-regulated behavior and practice habits in the current study are consistent with those in previous research that demonstrated links between reported (e.g., Hallam, 2001b; McPherson, 1997; McPherson & McCormick, 2006) and observed behaviors (e.g., Duke et al., 2009; Gruson, 1988; Miksza, 2011) indicative of relatively strategic practicing and positive music learning outcomes.

The findings of the current study suggest many potentially productive directions for future research. Replications of this study with different populations of musicians (e.g., developmental level, strings, vocalists) would be beneficial. The fit of the theoretical model may vary as a function of developmental level, in that beginner and advanced (e.g., high school, college) instrumentalists may perceive self-regulated learning with different levels of sophistication. Consequently, results from samples varying in developmental level may yield still different underlying factor structures. It would be beneficial to examine patterns of development in self-regulated learning over time through longitudinal designs. The preliminary predictive validity evidence accrued in this study also could be augmented with observational designs that examine potential relationships between self-reports of self-regulated behavior and actual observed behaviors. The reliability of each subscale explored in this study could be examined further. It may be that adding items or investigating alternative response options would increase the variability of the measures and consequently improve reliability.
Researchers may consider approaches for using the measure developed in this study in conjunction with experimental interventions. For example, experiments could be designed that examine the differential effects of interventions for participants who vary according to self-regulated learning tendencies. Researchers also could examine alternative approaches to operationally defining the dimensions in McPherson and Zimmerman’s (2002) model. For example, approaches to measuring the effect of environment could be explored as well as alternative motivation orientations (achievement goal motivation, attributions for success and failure, etc.). Lastly, the relationships modeled among most latent variables in the four-factor model may suggest a higher order factor structure. Investigations of potential higher order constructs could be important for theoretical advances.

The results of this study have practical implications for music education. The preliminary predictive validity evidence suggests that the questionnaire may be useful for teachers who wish to identify students who are in need of instruction in how to practice. Music teachers could use the questionnaire at the item or subscale level to help identify particular weaknesses in their students’ practice approaches. Teachers interested in investigating the impact of instruction aimed at developing self-regulated learning tendencies could use the measure as a formative assessment. Music teachers could consider the theoretical model proposed by McPherson and Zimmerman (2002) when designing rehearsal plans. For example, rehearsal experiences that focus on key constructs from the theoretical framework in a sequential manner could be particularly useful for encouraging self-regulated behavior among students. Lessons could be designed that create opportunities for students to experience self-regulated activity and make the goal-directed application of strategic practice behaviors explicit. Teachers could design rehearsal approaches that emphasize planning, concentration, and the use of resources suggestive of self-regulated learning.

The results of this study provide evidence for the validity and reliability of a measure of self-regulated practice behavior suitable for applications to research and teaching in the context of instrumental music education. The findings suggest that McPherson and Zimmerman’s (2002) model of self-regulated music learning is a viable theoretical framework for exploring how instrumental musicians become self-sufficient learners. The measure developed in this study could be beneficial to researchers interested in investigating approaches to self-regulated music learning as well as practitioners concerned with helping young musicians develop into independent artists.

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References


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