

# Psychological Needs and Motivational Outcomes in a High School Orchestra Program

Journal of Research in Music Education

2019, Vol. 67(1) 83–105

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DOI: 10.1177/0022429418812769

jrme.sagepub.com



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## Abstract

Motivation has formed a core strand of research in music education, reflecting its importance in educational psychology and other skill-based performance domains. Understanding motivation is crucial for explaining students' achievement, performance, well-being, and intentions to continue participation in (or drop out of) music learning throughout school and into adulthood. In the present study, we addressed the need to better understand motivation in music education by examining the impact of psychological needs satisfaction and frustration in a high school orchestra program. Psychological needs—a core component of self-determination theory—have considerable explanatory power in other life domains and educational settings and are the focus of recent attention in music education. Participants ( $N = 704$ ) were surveyed in orchestra programs in three schools in the midwestern United States. Structural equation modeling was used to examine the effects of psychological needs satisfaction and frustration. The model explained substantial variance on three key outcomes: practice time (22%), intentions to continue participating in the orchestra program (45%), and global-self esteem (34%). The results point to psychological needs satisfaction and frustration as key elements of music education in which teachers might intervene to improve these outcomes as well as students' learning, engagement, and psychological well-being more broadly.

## Keywords

self-determination theory, motivation, practice, self-esteem, orchestra

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Music education has several features that make it an interesting domain in which to study motivation. Music performance is a domain that requires frequent and regular practice to gradually increase ability, and it is often studied by expertise researchers. School education usually begins with music as a regular part of the curriculum, but by high school, it becomes a choice among other competing opportunities. Music educators see attrition at this juncture as a problem, which has spawned a focus in music education research literature on dropout. Music is a deeply personal activity, closely intertwined with social identity and sense of self, and researchers have therefore focused on some of the broader psychosocial outcomes of music and music education.

In this study, we examined predictors of three important outcomes in music education related to these motivational issues: practice time, intentions to continue with learning music, and self-esteem. Specifically, we examine the role of psychological needs as a predictor of these outcomes. Psychological needs form the core of self-determination theory (SDT): a theory of motivation, behavior, and wellness. We proceed by explaining SDT and reviewing literature related to SDT in music education before outlining the nature and importance of the three outcomes examined by the study—practice time, intentions to continue with music, and self-esteem.

## **Self-Determination Theory**

SDT (Ryan & Deci, 2017) provides the conceptual framework in the present study for understanding the social environment—in this case, a high school orchestra program—and how it is able to satisfy or frustrate students' psychological needs. SDT emerged out of studies of intrinsic motivation (behavior that is undertaken because of its own enjoyment) and extrinsic motivation (behavior that is undertaken for some other reason; e.g., Deci, 1971). Since then, research in educational settings has consistently indicated that extrinsic motivation undermines intrinsic motivation (e.g., Deci, Koestner, & Ryan, 2001). SDT research spawned several mini-theories concerning the relationship between extrinsic and intrinsic motivation, as well as the extent to which extrinsic motivation can be internalized, the problems associated with pursuing extrinsic goals, and the benefits associated with prosocial behavior in relationships (for a comprehensive review, see Ryan & Deci, 2017).

One of SDT's mini-theories is basic psychological needs theory (BPNT), which explains why intrinsic motivation is associated with better well-being (Deci & Ryan, 2000). BPNT posits that human well-being and thriving depend on the satisfaction of fundamental needs. When people are in social environments that satisfy these important needs, they are more likely to experience intrinsic, rather than extrinsic, motivation. They also experience growth, wellness, vitality, and the attainment of their potential. But when people are in social environments that frustrate their needs, they are more likely to experience negative psychosocial outcomes and psychopathology (Chen et al., 2015; Milyavskaya & Koestner, 2011; Ryan & Deci, 2017). In educational settings, when psychological needs are fulfilled, students learn more, enjoy learning more, participate more in class by asking questions and providing feedback to the teacher, and have greater focus and attention on their work (Jang, Kim, & Reeve,

2012; Jang, Reeve, & Deci, 2010; Reeve & Lee, 2014). For these reasons, we adopted BPNT as the approach for the present study in understanding and explaining the outcomes of practice, intentions to continue, and self-esteem.

Through an extended program of empirical research, three psychological needs have been identified: competence, relatedness, and autonomy. Deci and Ryan (2000) describe the needs as follows. *Competence* refers to feeling effective in one's actions and pursuits. It is satisfied when people are able to learn, master new skills, and express their talents and abilities, but it is frustrated when people feel helpless or ineffective. *Relatedness* refers to the need to feel close and connected to others—a sense of belongingness, without which people feel isolated and lonely. *Autonomy* refers to people's need to feel that the things they are doing are aligned with their interests and emanate from their sense of self; it is frustrated when people feel controlled by other people or social conditions, rather than by themselves. Other candidate needs are occasionally suggested, such as a sense of purpose or self-esteem (Sheldon, Elliot, Kim, & Kasser, 2001) and, more recently, the need to be benevolent (Martela & Ryan, 2016). As yet, however, none has met the strict theoretical and empirical justification required to be considered a fundamental psychological need (Ryan & Deci, 2017).

### *SDT Research in Music Education*

As a conceptual framework of human motivation, SDT has been applied to many of life's domains (e.g., sports, creative activity, work, education, personal relationships; Ryan & Deci, 2017), including music education (Evans, 2015b). Music educators are particularly interested in motivation because of the motivational resources required for success in music—the difficulty of sustaining hours of practice, which is usually done in isolation; the commitment to choosing music in the face of other competing activities; and the creativity and aesthetic dimensions that connect music with the sense of self. Another major focus of motivation research in music education has been on dropout—preventing attrition from music education programs (Hallam, 1998; Klinedinst, 1991; Zdzinski, 1996).

Much of music education's SDT research is on university students. Psychological needs support has been associated with not only more practice but better-quality practice among university students (Bonneville-Roussy & Bouffard, 2015; Evans & Bonneville-Roussy, 2016). In studies of passion—an inclination to find an activity important and relevant to one's identity—students who had passion that was autonomous and self-determined (*harmonious* passion) practiced more and had better achievement than students who had passion that was controlled and compulsive (*obsessive* passion; Bonneville-Roussy, Lavigne, & Vallerand, 2011). In a study of gender, stress, and coping, music students who experienced more autonomy in the context of their studio practice had better ability to cope with the stress of their performance examinations and performed much better in those examinations as a result (Bonneville-Roussy, Evans, Verner-Filion, Vallerand, & Bouffard, 2017). Perceived competence and autonomy have been linked with university music students' experiences of *flow*—a term used to describe deep immersion and involvement in a task with high levels of intrinsic motivation (Valenzuela, Codina, & Pestana, 2017).

Some research has also applied SDT to music education in childhood and adolescence. An illustrative case study (Renwick & McPherson, 2002) showed a child whose practice behavior varied considerably based on her satisfaction of autonomy. Her practice when she was working on a piece selected by her teacher was unsystematic, but her practice when working on a self-selected piece—a more autonomous activity—was strategic, thoughtful, structured, and more enjoyable. In a high school band program, Legutki (2010) found that autonomy support led to more interest, enjoyment, and intentions to continue participation. In a retrospective survey of young adults in Australia, Evans, McPherson, and Davidson (2013) found that when students were most engaged in music in their childhood and adolescence, they felt more competence, relatedness, and autonomy than around the time when they were deciding to cease music learning activities. Furthermore, the reasons that these students cited for ceasing music learning were closely associated with needs frustration—feelings that there was some aspect of their social environment that precluded them from seeking out needs satisfaction (Chen et al., 2015). Although not explicitly SDT research, studies on motivation with other theoretical approaches have produced results that overlap conceptually with SDT constructs. For example, students with poor musical self-concept were found to be less likely to pursue elective music instruction in junior high school, and their perceptions of competence were related to “objective” measures of their ability (Demorest, Kelley, & Pfordresher, 2017), aligning with SDT’s competence need.

It is also worth noting some research that has applied SDT to music outside of educational contexts. In a broad sample of adults (respondents to a survey of musicians, some of whom were in formal learning and others who were not), positive effects of SDT’s internal regulations (e.g., intrinsic, identified) were more strongly associated with outcomes such as desire to continue playing, motivational intensity, willingness to play music, and global self-esteem than external regulations (e.g., external, introjected; MacIntyre, Schnare, & Ross, 2017). In a study comparing pianists with guitarists, MacIntyre and Potter (2013) found mean differences in SDT motivation regulations and other motivation constructs (though not in consistent directions), and the structural relationships between the motivation constructs may have differed between the guitarists and the pianists.

In summary, it is clear that SDT has received support from music education research as a conceptual framework for understanding important motivational outcomes (Evans, 2015b) and that this empirical support has come from beginning musicians in childhood and adolescence (Evans et al., 2013; Freer & Evans, 2017; Legutki, 2010; Renwick & McPherson, 2002) to older and more advanced music students (Bonneville-Roussy et al., 2011; Bonneville-Roussy et al., 2017; Bonneville-Roussy & Bouffard, 2015; Evans & Bonneville-Roussy, 2016) and adult musicians (MacIntyre et al., 2017; MacIntyre & Potter, 2013), in general agreement with conceptually similar research. On one hand, it is not surprising that the robust SDT research conducted in countless other life domains is replicated in music education. On the other, music education has extended SDT’s reach by testing its motivational validity in a relatively uncharted context—where high levels of performance demand immense motivation to do the practice that is required, where choosing to continue makes behavioral intentions an

important factor, and where psychosocial outcomes are of relevance. Further research continues to be needed to more fully understand the nature of motivation for music learning, as well as to extend the research on the conceptual framework of SDT by studying its phenomena in this unique domain.

### *Music Education Outcomes*

We examined the impact of psychological needs satisfaction and frustration on three outcomes important to music educators: practice time, intentions to continue studying music, and global self-esteem.

*Practice time.* Progression in music is strongly dependent on the amount of time spent practicing. The most systematic line of research supporting this arose from the work of Ericsson and others (Ericsson & Charness, 1994; Ericsson, Krampe, & Tesch-Römer, 1993), including empirical studies of musicians and experts in other performance domains such as chess and sports. Ericsson et al. claimed that the most proximal cause of ability in music is the activity of practice that is structured, effortful, and designed to improve performance, which they termed *deliberate practice*. The amount of deliberate practice that can be undertaken was said to be limited by resource, motivational, and effort constraints. Many studies have since supported the claim of a correlation between practice and performance, mainly through measures of moderate to high correlations between practice time and performance measures (see Ericsson, Hoffman, Kozbelt, & Williams, 2018).

One of the central claims of deliberate practice research—that it is the main cause of variance in performance—has recently been challenged. Macnamara, Hambrick, and Oswald (2014) examined research studies claiming to measure the relationship between deliberate practice and performance in various domains; the result for music was that deliberate practice explained only 21% of variance in performance. Another estimate put this value at 29.9% (Hambrick et al., 2014). For these authors, this means that the deliberate practice premise is not a major causal factor of improved performance because it does not explain a majority of variance and that the influence of other factors, particularly genetics, may be undervalued. They suggest the reason why the expertise approach has attracted widespread interest: the appealing political and social corollaries of the “practice makes perfect” message (Hambrick, Macnamara, Campitelli, Ullén, & Mosing, 2016). The meta-analysis was refuted by Platz, Kopiez, Lehmann, and Wolf (2014), who claimed that the criteria for including studies in the meta-analysis were too generous, extending to studies where the measure of performance was not matched to the practice activity. Their more conservative approach yielded a higher estimate of the relationship between practice and performance.

Nevertheless, the deliberate practice framework informed our focus on practice time as an outcome in the research. Although recent research suggests that the size of the relationship between practice and performance may have been overstated, there is no doubt that practice is the primary activity for improving one’s performance. Notwithstanding the need to consider additional dimensions of practice (e.g., the

degree to which practice is mindless vs. engaged) and even other contributors to ability beyond practice, behavioral engagement in the form of time spent practicing is an important consideration for music education.

*Intentions to continue in orchestra.* The degree to which students want to continue in a music program is a major indicator for teachers concerned with retention and attrition. Music programs are usually voluntary and have to compete with other activities that students might find more enjoyable or useful to their schooling and future careers. When making decisions about whether to continue in orchestra or not, students choose from a constellation of information to make the decision, most centrally concerned with the values they associate with the activity (Eccles & Wigfield, 2002; McPherson & O'Neill, 2010). In a study of young adults recollecting their high school experiences, Evans et al. (2013) found that the time when students make the decisions to cease music learning was associated with psychological needs being less satisfied and more frustrated. Freer and Evans (2017) found that in a high school music program in Sydney, Australia, 65% of variance in students' intentions to continue learning music was explained by psychological needs satisfaction and the internalization of values for music education. Thus, the present study extends this research to the high school orchestra context, studying students' intentions to continue participating in orchestra as an important cognitive outcome. The prediction of intentions by psychological needs satisfaction is supported by previous research in a broad-based academic music classroom setting (Freer & Evans, 2017) and in other educational settings (Reeve, 2012) but not yet in a performance-based ensemble program.

*Self-esteem.* Self-esteem is one of the most prominent constructs to be examined in psychology. It is defined broadly as positive beliefs in relation to self-worth (Harter, 1993). One reason for the prominence of self-esteem in the field of psychology is that it is associated with important life outcomes, such as general happiness (Diener & Diener, 2009) and school achievement (Di Giunta et al., 2013). Some authors are concerned that positive impacts of self-esteem can be overstated, noting that high self-esteem can be an indication of maladaptive narcissism and can result in defensive and violent retaliation when threatened (Baumeister, Campbell, Krueger, & Vohs, 2003) and that very low self-esteem can still be associated with high performance as a result of a defensive pessimism about self-worth (Pullmann & Allik, 2008). Notwithstanding these potential cautions around very high or very low extremes and their causes, self-esteem was assumed in the present study to be a generally favorable motivational outcome.

Some studies suggested that self-esteem can be boosted merely by participating in music education (Costa-Giomi, 2004; Zapata & Hargreaves, 2018), but other studies concluded either that this effect is not special to music and could be obtained from any arts-based activity (Rickard et al., 2013) or that the effect may be limited to focused, systemic, and individualized instruction rather than general classroom music education (Rickard, Bambrick, & Gill, 2012). Here, we examined self-esteem not as an

outcome of music education itself but as a result of the degree to which students' music programs support their psychological needs. Autonomy support bolsters self-esteem in a physical education setting (Hein & Hagger, 2007), and we expect self-esteem to be predicted by needs satisfaction (positively) and needs frustration (negatively) in the present study.

## *Aims*

In this study, we aimed to investigate the satisfaction and frustration of psychological needs in the context of a high school orchestra program and how they affect important music-related and psychosocial outcomes. We examined three important outcomes: practice time, intentions to continue participating in the orchestra program, and self-esteem. We expected each of these to be positively predicted by psychological needs fulfillment and negatively by psychological needs frustration.

## **Method**

### *Participants*

We recruited students in string programs from all three high schools in one district in the midwestern United States. The school district is composed of 30,000 K–12 students and has an ethnic distribution of White (50%–60%), Asian (15%–25%), Black (5%–15%), Hispanic (5%–15%), multiracial (<10%), and Native American (<1%; figures are rounded to prevent identification of the school district). Approximately 20% of students in the district were enrolled in a free or reduced-price lunch program. Approximately 30% of the students at each school participated in a music program. The string programs at each school were well established and received regular state and national recognitions.

There were 704 participants in the study. On the day on which the survey was undertaken, there was no systematic pattern of absences from school (the usual absence rate for schools in this district is approximately 4%). Only two students declined to participate, yielding a response rate of 99.7% based on students who were in attendance on the day the survey was completed. There were 288 participants from school 1, 239 from school 2, and 179 from school 3. There were 267 boys (38%) and 430 girls (61%). Further data were unavailable on the representativeness of the orchestra students to the broader school and district populations. The procedures used in the study were approved by Boston University's institutional review board.

### *Procedure*

Students completed the survey in a booklet during their regular orchestra rehearsal time. No identifying information about the students was gathered. Permission to conduct the district-wide study in each high school was granted by orchestra directors, school principals, and the district's superintendent. An information statement was sent to students'

parents prior to the study. Students consented to participation in the study by reading the information sheet and checking a box at the top of the survey. The survey took around 10 minutes to complete.

## Measures

The following measures were used in the analysis. With the description of each measure, the Cronbach's alpha statistic ( $\alpha$ )—conventionally used as an indicator of reliability—is reported for completeness, but we did not adopt a threshold for “acceptable” reliability based on Cronbach's alpha due to the likelihood of the statistic being underestimated as a result of a small number of items on each scale (Schmitt, 1996) and a violation of the assumption of tau equivalence (i.e., equal factor loadings; McNeish, 2017) which was addressed by using structural equation modeling (see Analysis).

**Practice time.** Students responded to two items: how many days per week they practiced and how many minutes per session ( $\alpha = .648$ ).

**Intentions to continue.** Three items ( $\alpha = .687$ ) assessed students' intentions to continue with participating in an orchestra program: how long they intended to participate (1 = “until the end of the year,” 7 = “for the rest of my life”; see Evans & McPherson, 2015; McPherson, 2001), the extent to which they think about quitting their orchestra program (1 = “never,” 7 = “all the time”), and how likely they are to continue with orchestra next year (1 = “not likely,” 7 = “highly likely”).

**Self-esteem.** Four positive items from the Rosenberg (1965) Self-Esteem Scale (e.g., “On the whole, I am satisfied with myself”) were used ( $\alpha = .890$ ).

**Psychological needs.** Sheldon and Hilpert's (2012) Balanced Measure of Psychological Needs was adapted for the study. Adaptations were based on contextualizing the items to the orchestra context (e.g., “I feel pressured *in orchestra*”) rather than modifying the item stem, as the items were randomized with items from other measures in the survey. There are six lower-order needs factors (competence satisfaction, competence frustration, autonomy satisfaction, etc.) loading onto two higher-order factors (psychological needs satisfaction and psychological needs frustration). In the structural model (detailed later), item parcels comprising each of the lower-order factors were used as indicators for the needs satisfaction ( $\alpha = .758$ ) and needs frustration ( $\alpha = .632$ ) factors. Item parcels were used to overcome multicollinearity concerns (linear dependency among the lower-order constructs). Some cautions and limitations regarding the use this measure and item parcels are described in the Discussion.

**Gender.** Students were asked to indicate their gender by circling either male (coded as 0) or female (coded as 1).

**Prior experience.** Students were asked to indicate how many years they had received formal music lessons.



## *Analytical Approach*

Structural equation modeling was used to address the research aims. Structural equation modeling is a statistical modeling technique that allows modeling of latent factors via indicators (with confirmatory factor analysis) and the structural relations among them (with regression), with estimates of how well the model fits the data (Byrne, 2012). The hypothesized model in this study consisted of three dependent latent factors (practice, intentions, and self-esteem) and two predictor latent factors (needs satisfaction and needs frustration). The needs satisfaction and needs frustration factors were indicated by item parcels for each psychological need. Each dependent factor was hypothesized to be predicted by each independent factor. MPlus version 8 (Muthén & Muthén, 2017) was used to perform the analysis. The nesting of students within schools was taken into account by using the “cluster” command in MPlus (Muthén & Muthén, 2017). A  $p$  value cutoff of .01 was adopted for significance testing. Model fit was examined with root mean square error of approximation (with values  $<.08$  indicating good fit; Byrne, 2012) and comparative fit index (CFI; with values  $>.90$  indicating good fit; Byrne, 2012). The chi-square ( $\chi^2$ ) statistic is reported for completeness for each model but not used for evaluating model fit because of its sensitivity to large sample sizes (Byrne, 2012) and because chi-square values are incomparable between models that use the “cluster” command in MPlus.

Invariance testing was carried out to examine potential gender differences and differences by level of experience. Invariance testing followed the procedure outlined by Byrne (2012): A configural model was established where all parameters were free to vary between groups, then subsequent, more restrictive models were evaluated against the configural model. Negligible declines in model fit were taken to indicate invariance between groups.

## **Results**

### *Descriptive Statistics*

Of the 704 responses, multivariate outliers were identified as cases where the standardized Mahalanobis distance was  $>3$ . There were 12 such cases, which we removed from the data set before proceeding, leaving 692 cases. For descriptive statistics, see Table 1. Skew and kurtosis statistics were within a range of  $-1$  and  $1$ , so the data were assumed to be normally distributed, with the exception of weekly practice; as such, maximum likelihood with robustness to nonnormality was used as the estimator in MPlus to account for any potential violations of normality assumptions (Muthén & Muthén, 2017). Tables 2 shows correlations between latent variables, all of which were significant at the  $p < .01$  level.

### *Structural Equation Modeling*

The hypothesized model was tested in MPlus. The model, shown in Figure 1, fit the data well,  $\chi^2 = 290.227$ ,  $df = 77$ ; root mean square error of approximation = .063,

**Table 1.** Descriptive Statistics.

	<i>M</i>	<i>SD</i>	Skew	Kurtosis
Weekly practice, min	131.565	108.807	1.442	2.569
Intentions	4.777	1.532	-0.544	-0.486
Self-esteem	5.571	1.266	-0.985	0.541
Needs satisfaction	5.121	0.997	-0.428	-0.110
Autonomy satisfaction	5.013	1.246	-0.436	-0.191
Relatedness satisfaction	5.063	1.359	-0.490	-0.379
Competence satisfaction	5.287	1.018	-0.529	0.358
Needs frustration	2.744	0.922	0.571	-0.017
Autonomy frustration	3.227	1.241	0.422	-0.139
Relatedness frustration	2.196	1.067	0.895	0.373
Competence frustration	2.808	1.323	0.695	-0.040

Note. Descriptive statistics for latent variables are on a 1–7 scale and were estimated with the mean of their indicators, except for weekly practice, which was computed by multiplying days per week by minutes per day.

90% CI [.056, .071], CFI = .934. All hypothesized paths were supported by the model, with two exceptions: The path from needs frustration to intentions was nonsignificant, and the path from needs frustration to practice was in the opposite direction to what was hypothesized for a small effect ( $\beta = .100, p < .001$ ). The model estimated 22% of variance in practice, 45% of variance in intentions, and 34% of variance in self-esteem.

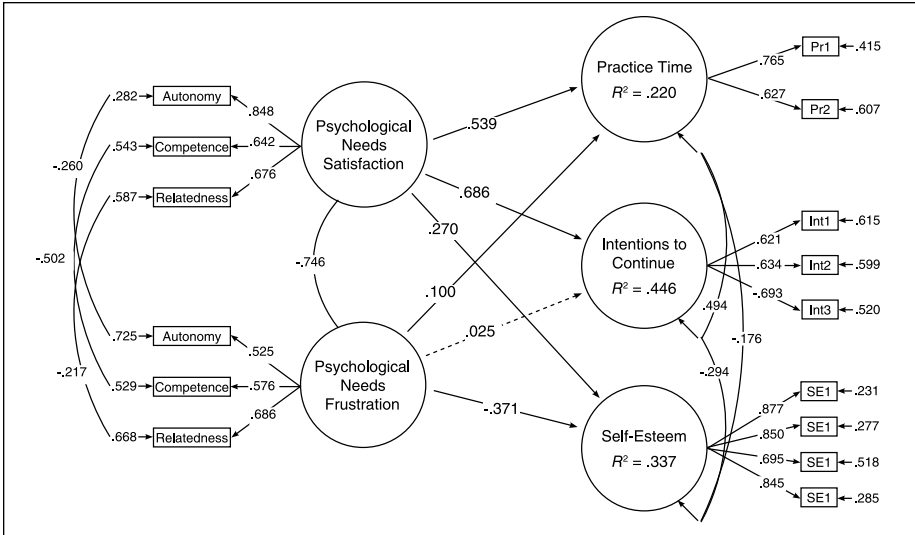
*Invariance testing for gender.* Multiple-group analysis tested whether the model was equivalent between boys and girls. A nested model approach was used by increasingly restricting parameters to be equal between boys and girls and examining model fit at each stage. We tested for configural invariance (all parameters free), metric invariance (factor loadings constrained), scalar invariance (intercepts also constrained), full measurement invariance (residual variances also constrained), and finally, structural invariance (correlations and structural paths also constrained). Each model fit the data well (see Table 3). There was no substantial decline in model fit; thus, the model was deemed to be fully gender invariant.

*Invariance testing for prior experience.* The sample was divided into two groups: Students who reported 2 or more years of formal experience learning an instrument and students who had less than 2 years, resulting in two approximately equal groups. The same invariance approach was used for prior experience invariance testing as for gender invariance testing. When we reached the scalar invariance stage and constrained intercepts to be equal between less and more experienced students, the model fit declined considerably (CFI = from .939 to .924). We thus freed intercepts for the indicators for factors, one by one, informed by modification indices and verified

**Table 2.** Correlations Between Factors.

	1	2	3	4	5	6	7	8	9	10
1. Practice time	—									
2. Intentions to continue	.400									
3. Self-esteem	.101	.129								
4. Needs satisfaction	.294	.455	.469							
5. Autonomy satisfaction	.267	.470	.368	.876						
6. Relatedness satisfaction	.193	.257	.416	.846	.620					
7. Competence satisfaction	.279	.419	.370	.736	.521	.392				
8. Needs frustration	-.164	-.271	-.426	-.568	-.542	-.446	-.410			
9. Autonomy frustration	-.103	-.181	-.179	-.347	-.416	-.211	-.229	.786		
10. Relatedness frustration	-.130	-.224	-.391	-.615	-.525	-.638	-.312	.697	.354	
11. Competence frustration	-.141	-.216	-.405	-.365	-.319	-.220	-.390	.790	.420	.319

Note. Correlations between latent variables were estimated with the mean of their indicators, except for weekly practice, which was computed by multiplying days per week by minutes per day. All correlations were significant at  $p < .01$ .



**Figure 1.** Final structural model.

Note. Path labels are standardized coefficients. Dashed line indicates nonsignificant path.

**Table 3.** Invariance Tests for Gender and Prior Experience.

Invariance Test (Constraints)	$\chi^2$	df	RMSEA [90% CI]	CFI
Invariance between girls and boys				
1. Configural	415.514	154	.070 [.062, .079]	.926
2. Metric (factor loadings)	406.649	164	.066 [.058, .074]	.931
3. Scalar (intercepts)	435.428	179	.065 [.057, .072]	.927
4. Full measurement (residuals)	449.688	194	.062 [.055, .069]	.927
5. Structural (correlations and betas)	467.033	203	.062 [.054, .069]	.925
Invariance between less and more experienced students				
1. Configural	384.366	154	.066 [.058, .074]	.940
2. Metric (factor loadings)	397.927	164	.064 [.059, .072]	.939
3. Scalar (intercepts) <sup>a</sup>	468.826	179	.068 [.061, .076]	.924
4. Full measurement (residuals)	426.816	188	.061 [.053, .068]	.938
5. Structural (correlations and betas)	450.236	197	.061 [.054, .068]	.934

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation.

<sup>a</sup>Scalar invariance was not fully retained for subsequent models (see Results).

against existing theory and research. Model fit was restored when the intercepts for practice, intentions, and competence satisfaction were freed to vary, so these constraints were not retained for subsequent models. Thus, the structural and measurement models were deemed to be invariant between less and more experienced students,

except for the mean levels of practice, intentions, and competence, which were all higher for more experienced students. These results are elaborated in the Discussion section.

## Discussion

In this study, we examined the influence of psychological needs satisfaction and frustration on three important outcomes of a high school orchestra program: time spent practicing, intentions to continue participation, and self-esteem. Psychological needs satisfaction predicted all three outcomes significantly and with noteworthy effect sizes. Psychological needs frustration, in contrast, showed mixed results. It predicted self-esteem negatively, as expected. But the prediction for intentions to continue was nonsignificant, and the prediction for practice time was small but positive—opposite to what was hypothesized. The model explained 22% of variance in practice time, 45% of variance in intentions to continue, and 34% of variance in self-esteem. Psychological needs satisfaction and, to a degree, frustration therefore appear to play a considerable role in these important music education outcomes.

### *Role of Psychological Needs Satisfaction*

There are many reasons why psychological needs satisfaction would lead to the outcomes measured here. Practice is a behavior that can be difficult and lonely (Ericsson et al., 1993; Evans, 2015a), and effective practice requires immense cognitive and motivational resources. Feeling a sense of autonomy leads students to internalize the values in their social environments (Ryan & Deci, 2017), so in the context of music learning, it should help students to internalize the belief that practice is an activity that improves performance and, because of this, the improved performance ability will lead to drawing greater enjoyment from music. Positive perceptions of competence also lead students to think about the effectiveness of their efforts (Legault, 2017), so in the context of music, competence satisfaction can help students connect practice efforts with improved performance outcomes. Students with low perceptions of their competence might feel helpless or find it difficult to see the connection. Students who have a higher sense of relatedness may be more likely to undertake solitary practice because although the activity is done by themselves, they know that it will help them to engage more fully and skillfully in the relatedness-supporting activity later on. The study lends evidence to the relationship between needs fulfillment and the amount of practice students undertake.

For students' intentions to continue participation, psychological needs satisfaction played a major role. In one sense, it seems almost too obvious that feeling a sense of autonomy, competence, and relatedness in an activity would lead a person to want to continue that activity (Deci & Ryan, 2000); indeed, this is supported in the present study by the large standardized path coefficient (.686) from needs satisfaction to intentions. As noted in the introduction, previous music education researchers also found

this connection (Bonneville-Roussy et al., 2017; Evans et al., 2013; Freer & Evans, 2017). The present study has therefore extended this line of research, with a range of measures in different contexts, showing that psychological needs satisfaction is an important factor when considering whether students want to continue with music. It should therefore be a major focus when dealing with issues of retention, recruitment, and dropout.

As expected, there was also a positive prediction of psychological needs satisfaction to self-esteem. Although self-esteem is a global motivation measure, it makes sense that there should at least be a distal relationship (evidenced by a relatively small correlation) between context-relevant psychological needs satisfaction and global self-characteristics such as self-esteem (Vallerand, 2000). While previous research attempted to make a case that learning music improves self-esteem (Costa-Giomi, 2004; Rickard et al., 2012; Rickard et al., 2013), it may well be that the mixed or null results among those studies occur because it is not the music itself that improves self-esteem but rather the social and motivational climate in which the music learning takes place. This would explain why Rickard and colleagues' (2012) positive finding of the impact of self-esteem also generalized to a similar arts-based activity (juggling). It may also explain why Costa-Giomi (2004) found a positive effect of music on self-esteem in an individual studio setting and why Zapata and Hargreaves (2018) found a positive effect in an otherwise socioeconomically vulnerable and displaced population, although Rickard et al. (2013) found no such effect in a classroom setting. Future research focused on self-esteem and music participation may therefore need to disentangle the source of the effect, distinguishing whether the effect is due to the music program itself or to the motivational climate in which the activity takes place.

### ***Role of Psychological Needs Frustration***

Psychological needs frustration, hypothesized to have negative associations with all three outcomes, delivered interesting results. Practice time was predicted by needs frustration in the direction opposite to what was hypothesized, albeit with a relatively small effect. However, a plausible explanation may be that controlling extrinsic motivation is well known to be effective in influencing the amount but not the quality of behavior (Ryan & Deci, 2017), whereas in this study, only the amount of behavior (time spent practicing) was measured, not the quality of the behavior (e.g., cognitive engagement in practicing). This phenomenon is instantiated in research on classroom motivation and engagement in which engagement is measured in behavioral, cognitive, and affective dimensions (Reeve, 2012). Students who feel controlled motivation via psychological needs frustration are therefore still likely to practice more, but the quality of that practice may be compromised. Future researchers may adopt measures of not just behavioral engagement, as in the present study, but also cognitive engagement and affective engagement in practice to examine more fully the dimensions of the quantity and quality of motivation and behavior.

Needs frustration was not significantly predictive of students' intentions to continue, despite the sample size granting adequate power to find small effects and despite

a zero-order correlation coefficient of  $-.271$ . This means that when psychological needs satisfaction is taken into account, needs frustration may not be influential on students' intentions. Students in this context may have their intentions influenced by the rewarding aspects of psychological needs fulfillment but be resilient enough to ignore the negative aspects of needs frustration. It may also be that in all three schools sampled, the incidence of psychological needs frustration was relatively low, so it was unable to influence students' intentions negatively. In contexts where psychological needs frustration is higher, it might be able to exert more of an effect. Although previous research in music education has considered the effects of needs satisfaction, none has looked at needs frustration, so it is difficult to contextualize the current findings. Given the extensive evidence of negative effects of needs frustration on well-being and psychological functioning in other disciplines (Ryan & Deci, 2017), the conclusion that it has no effect on students' intentions to continue with music may be untenable, and the result should be interpreted with caution. Nonetheless, a tentative conclusion may be that increasing needs support is critical for influencing the outcomes studied here, while simply reducing needs frustration is not enough (an interpretation consistent with educational research; Jang et al., 2010).

Self-esteem was negatively predicted by psychological needs frustration. The effect for this was moderately large as well, especially considering the contextual-level measure of psychological needs and the more distal global nature of self-esteem. Indeed, self-esteem has been proposed as a psychological need in its own right (Sheldon et al., 2001), and given that psychological needs are by their nature highly correlated, the result is to be expected. It may also be that the result is artificially higher because of the methodology of the study (i.e., completing the measures of needs frustration and self-esteem in close proximity within the same survey).

### *Role of Prior Experience in Music Learning*

One likely explanation for why children might want to continue and persist with music learning is their prior experience. Through many years of individualized instruction, students may rely more on their extensive knowledge and be more likely to choose to continue. With more prior knowledge, students are more likely to know more about what to expect from ongoing music learning and can derive more enjoyment from a higher level of participation. They might also be more able to sustain longer hours of practice. Indeed, the present study supported these ideas. The analysis could not establish full invariance between less and more experienced students at the scalar level, meaning that the mean levels of practice time, intentions, and competence satisfaction were higher for more experienced students, as would be expected. However, crucially, the model was invariant at the structural level, meaning that less experienced students appeared to derive just as much benefit from psychological needs satisfaction as more experienced students, even though the amount of practice, the intentions to continue, and the level of competence satisfaction were all actually higher. Future research could take a closer substantive look at the role of experience in a developmental way, looking at how the motivation dynamics may change over time.

## *Gender Invariance*

Although self-esteem is known to be higher among males (Kling, Hyde, Showers, & Buswell, 1999), any mean difference in the present study was not enough to compromise the fit of the model in comparison with a model that did not take gender into account. Mean gender differences have also been observed in psychological needs satisfaction (females higher in relatedness satisfaction; males higher in competence satisfaction; Chen et al., 2015). Structurally, there is some evidence that low autonomy support affects females more than males (Bonneville-Roussy et al., 2017). However, none of these effects were evident in the present study, as gender differences did not have a considerable impact on model fit. Future research that takes a closer, more substantive look at the role of gender may uncover different results.

## *Limitations and Implications for Future Research*

Several limitations of the present study should lead to caution in interpreting the present results and be addressed by future research. The self-report methodology uses response scales to indicate latent factors that are otherwise difficult to directly measure. Structural equation modeling removes some measurement error, and measures such as the basic psychological needs scale and self-esteem are well known to be reliable and valid. However, practice time is reported according to the students' own estimates, and it is not well known whether high school students are able to report accurately on the amount of practice that they have undertaken. A diary method might lend some more accuracy. Also, intentions to continue was limited to assessing students' perceived likelihood of staying in the orchestra program. When asked about their intentions in this way, they reported that they wanted to continue with the activity. But students face a range of school subject choices and can make only a limited number of selections, so when the time comes to make such a decision, students might consider other subjects more attractive. Future research might present students with a range of activities and ask them to rank-order them; better yet, researchers might use actual enrollment data as a more objective measure of the choices that students make about subjects.

A further problem with the practice time measure is that it measures the behavior of practice, rather than other dimensions. SDT is particularly concerned that motivation is less about the amount of behavior undertaken and more about the quality of behavior (Ryan & Deci, 2017). Reeve and colleagues (Reeve & Lee, 2014; Reeve & Tseng, 2011) have used a framework for examining the quality of behavior in terms of cognitive, affective, behavioral, and agentic dimensions to great success in their research on school classrooms. This approach may be useful in a music practice context.

We examined only the higher-order psychological needs factors of satisfaction and frustration. Further research might look more closely at the particular influence of each psychological need. This was not possible in the present study due to the very high correlations between the needs causing multicollinearity issues, but a more recently developed psychological needs measure (Chen et al., 2015) may not exhibit



this problem. Nevertheless, correlations are shown in Table 2, and they do suggest a more important role for some lower-order factors than others. It is worth further noting that caution should be used when interpreting results from models that have used item parcels. Marsh, Lüdtke, Nagengast, Morin, and Von Davier (2013) noted that item parcels are “almost never appropriate” (p. 257), but Little, Cunningham, Shahar, and Widaman (2002) noted that when the emphasis of the model is on the structural relations, as in the present study, parceling may be an acceptable pragmatic solution that minimally biases the parameters that are the focus of interpretation. We therefore recommend that future research review the use of the Chen et al. (2015) scale as a potentially superior measure that can overcome this problem.

The study reported here was cross-sectional. This could artificially increase the relationships between factors by virtue of them all being answered in the same survey. Longitudinal survey research could address this issue by accounting for prior variance and increasing the conclusiveness of the findings. In addition to the important aspect of accounting for prior variance, fully cross-lagged longitudinal modeling is able to test for relationships in the direction opposite to the subject of this study. That is, psychological needs fulfillment may lead to better practice, intentions to continue, and self-esteem, but these in turn may subsequently predict the fulfillment of psychological needs.

The sample recruited for the study drew from a single, fairly homogeneous school district. The analysis took into account students grouped within the three schools. But a broader study might examine a sample with greater variance in socioeconomic and regions and other music education activities, such as bands, choirs, classroom programs, or community ensembles.

Finally, the present study used an entirely quantitative survey approach. Research would benefit from a greater methodological breadth of approaches to the issue of understanding motivation in music education. Of particular relevance would be case study approaches of students based on interviews, observations, and other qualitative data that glean a fuller understanding of what causes psychological needs fulfillment and frustration in the music context. Experimental research may also examine the impact of targeted interventions (e.g., training teachers to be autonomy supportive) on the experiences of students in a music program (see Su & Reeve, 2010).

### *Implications for Educators*

Notwithstanding the limitations described so far, the study, combined with previous theoretical (e.g., Evans, 2015b) and empirical (e.g., Evans & Bonneville-Roussy, 2016; Freer & Evans, 2017; MacIntyre & Potter, 2013; Valenzuela et al., 2017) findings, may have several implications for orchestra directors and music teachers more generally. Before we embark on a speculation of what some of these implications might be, it is important to note that the results from any single study, no matter how it is conducted, have limits on generalizability. Thus, we preface this explanation of implications for educators by noting that these results should be interpreted with research on SDT in other music education contexts, as well as the larger body of

research on SDT in school settings more broadly (e.g., Bonneville-Roussy, Vallerand, & Bouffard, 2013; Niemiec & Ryan, 2009; Reeve, 2013; Reeve & Lee, 2014; Taylor et al., 2014) and with a view to awaiting an accumulation of findings in relevant contexts. Given that educators have a view to targeting outcomes (in this case, practice behavior, intentions to continue, and self-esteem), we discuss each outcome in turn and ways in which psychological needs may be addressed to attain improvements in each outcome.

To increase practice behavior while supporting needs fulfillment, a teacher may wish to develop as many creative ways as possible for students to tackle difficult situations. A classroom environment that highlights and acknowledges shared experiences in practicing among students—such as loneliness, struggles, frustration, discomfort, failure, joy, surprises, and improvement—may fulfil a sense of students' relatedness by demonstrating that students belong to a community of people who share the same difficulties and rewards while they practice. Another way to address relatedness is to realize that practicing does not need to be always an individual task, so students could practice in miniature chamber music ensembles ("pods") or practice with a buddy with the same instrument. Autonomy can be supported by assisting students to develop a practice schedule that aligns with their own priorities, rather than dictating and mandating a prescribed amount of practice per day or per week. Competence can be supported by providing accurate feedback and helping students to see the benefits of their practice in relation to improved performance ability.

Intentions to continue with music learning can also be bolstered by fulfilling psychological needs. Relatedness support, to this end, might take the form of helping students to point out that one of the rewards of studying music is the sense of belonging derived from the cooperation and teamwork involved in a music ensemble. Autonomy can be supported by helping students to see the benefits of choosing to remain in an ensemble and pointing out the utility value of music so that they may identify intrinsic interest in the activity. Competence can be supported by giving students opportunities to work with other students at higher levels so that they have a sense of what kinds of competencies and abilities can be gained by sustaining their involvement in music learning.

Self-esteem may also be increased by supporting psychological needs. Relatedness support in music could improve self-esteem by demonstrating that students' contributions to an ensemble are valued and appreciated. Autonomy support in music can be provided by communicating to students that because they have volition and choice in the activity, the pride and satisfaction derived from the ensemble are genuine, and their self-esteem is not contingent on confirming to external incentives. Competence support can improve self-esteem by helping students to make connections between their efforts and their abilities, thus highlighting that successes in music can contribute to positive self-esteem but also that difficulties should not mean that students should feel like a failure.

Professional development programs for music teachers might focus on ways that teachers can support needs satisfaction, as research has shown that teachers can

reliably learn how to provide needs support and that their strategies make a long-term difference to student learning and well-being (Su & Reeve, 2010). However, such programs need a rigorous research base and should be validated in such a way that the interventions target needs support in a precise and accurate way and does not inadvertently extend into other teaching strategies under the guise of an SDT intervention. Although interventions exist in educational settings (Cheon, Reeve, Lee, & Lee, 2018), music-specific interventions are yet to be developed and tested through research.

In summary, psychological factors play a significant role in many issues that are salient to music education. Incorporating the psychological need constructs outlined by SDT, the current study examined predictors of three motivational phenomena in music education: practice time, intentions to continue with learning music, and self-esteem. Findings of the current study provide a substantial explanation of the psychological underpinning of these outcomes, which could allow music educators to more effectively motivate their students.

### Authors' Note

The study reported in this article was based on the second author's doctoral dissertation.


### Declaration of Conflicting Interests

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

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Submitted August 22, 2017; accepted July 2, 2018.