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The Trans-Contextual Model of Autonomous Motivation in Education: Conceptual and Empirical Issues and Meta-Analysis

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The trans-contextual model outlines the processes by which autonomous motivation toward activities in a physical education context predicts autonomous motivation toward physical activity outside of school, and beliefs about, intentions toward, and actual engagement in, out-of-school physical activity. In the present article, we clarify the fundamental propositions of the model and resolve some outstanding conceptual issues, including its generalizability across multiple educational domains, criteria for its rejection or failed replication, the role of belief-based antecedents of intentions, and the causal ordering of its constructs. We also evaluate the consistency of model relationships in previous tests of the model using path-analytic meta-analysis. The analysis supported model hypotheses but identified substantial heterogeneity in the hypothesized relationships across studies unattributed to sampling and measurement error. Based on our meta-analysis, future research needs to provide further replications of the model in diverse educational settings beyond physical education and test model hypotheses using experimental methods.

Keywords: motivational transfer, self-determination theory, theoretical integration, autonomous motivation, theory of planned behavior, meta-analysis

An important question for any school educator is whether his or her instruction will affect students' learning and behavior outside the school environment. Educators are interested in whether students apply the knowledge and skills that they have learned in the classroom in everyday contexts. The same principle of transfer from classroom to out-of-school contexts can be applied to the fostering of important psychological attributes that enhance learning of, and persistence with, educational activities and lead to adaptive educational outcomes outside school. Good examples of such attributes are continuing motivation (Maehr,

1976) and self-determined or *autonomous* motivation (Deci & Ryan, 1985b, 2000). Continuing motivation is defined as motivation to continue to pursue educational activities in multiple contexts, in the absence of external pressure, and when alternatives are available (Fortus & Vedder-Weiss, 2014). Similarly, autonomous motivation is defined as engaging in activities out of a sense of personal agency, for the interest and satisfaction derived from the activity itself, or its concomitant outcomes, and in the absence of any externally referenced contingencies (e.g., deadlines, rewards, noncontingent praise, or criticism). Importantly, such motives are strongly associated with persistence on self-directed learning activities. Within educational contexts, there is considerable evidence that continuing motivation and autonomous motivation are related to adaptive outcomes such as persistence in the classroom and academic attainment (e.g., Boiche, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Fortus & Vedder-Weiss, 2014; Goldberg & Cornell, 1998; Grolnick & Ryan, 1987; Grolnick, Ryan, & Deci, 1991; Pintrich & Degroot, 1990; Vansteenkiste, Simons, Lens, & Sheldon, 2004).

In addition to promoting autonomous motivation within classroom contexts, fostering students' motivation to pursue activities outside the classroom that reinforce and enhance learning is a desirable outcome for educators. For example, teachers are interested not only in developing students' autonomous motivation to pursue techniques and skills learned within educational contexts such as physical education (PE) but also in fostering students' motivation to pursue these skills in contexts outside of the classroom such as home or leisure-time contexts (Maehr, 1976). By promoting autonomous motivation toward activities in the classroom, the teacher may be able to foster autonomous motivation toward similar activities outside of school. This link implies that autonomous motivation toward activities in an educational context like PE may *transfer* to motivation toward related activities in an out-of-school context like participation in leisure-time physical activity. This is consistent with the continuing motivation construct, which focuses on the pursuit of educational activities in multiple contexts (Anderman & Weber, 2009).

A decade ago we proposed a theoretical model that outlined the processes by which autonomous motivation toward in-class activities in a PE context would transfer to autonomous motivation toward, and future intentions to engage in, related activities in an out-of-school context, namely, leisure-time physical activity (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). The proposed *trans-contextual* model of autonomous motivation integrated tenets of self-determination theory (Deci & Ryan, 1985b, 2000), Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation, and the theory of planned behavior (Ajzen, 1985, 1991). The model has received considerable empirical support, particularly for the relationship between autonomous motivation in PE contexts and autonomous motivation for physical activities outside of school (e.g., Barkoukis, Hagger, Lambropoulos, & Torbatzoudis, 2010; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger et al., 2003; Hagger et al., 2009; Shen, McCaughtry, & Martin, 2008; Standage, Gillison, Ntoumanis, & Treasure, 2012). Although the initial theorizing and evidence supporting the propositions of the trans-contextual model have focused on PE and physical activity, the model may have a broader scope as a generalizable framework that explains the processes by which

motivation is transferred across educational and out-of-school contexts (Hagger & Chatzisarantis, 2012). This proposition is consistent with one of the key goals of education to foster motivation toward learning activities, such as homework and self-directed learning, beyond the classroom (Trautwein, Ludtke, Kastens, & Koller, 2006).

The purpose of the present article is to (a) review the key propositions and hypotheses of the trans-contextual model, (b) resolve some of the conceptual and empirical questions relating to the model, (c) synthesize the findings of empirical tests of the model in educational contexts, and (d) derive recommendations for future research using the model. Specifically, we will clarify the key processes proposed in the model: the transfer of forms of motivation from self-determination theory across PE and out-of-school contexts, and the relationship between autonomous motivation for physical activity in out-of-school contexts and the psychological antecedents of future outside-of-school physical activity participation. We will identify some criticisms levelled at the trans-contextual model and provide some potential solutions including the conditions that constitute a failed replication of the model, the conceptual rationale for relations between autonomous forms of motivation and the belief-based antecedents of future action in the model, and the causal ordering of the constructs in the model.

In addition, we aim to provide cumulative support for the model through a quantitative synthesis of empirical tests of model hypotheses. The analysis will seek to identify consistencies in the proposed pattern of effects across research that has adopted the model. Specifically, we will conduct a path analysis of the hypothesized model relationships using a matrix of meta-analytically derived correlations among the model constructs. We will contend that although the model has been predominantly developed and empirically tested in the PE and leisure-time physical activity contexts, its hypotheses will generalize to multiple domains consistent with the propositions of its component theories (Deci & Ryan, 2002; Fishbein & Ajzen, 2009; Vallerand, 1997). We will conclude our review by highlighting the importance of motivational transfer from educational to out-of-school contexts and how the trans-contextual model assists in identifying the underlying psychological processes. We will also identify the gaps in the evidence with respect to the model including the need for greater diversification to other educational domains to confirm the generalizability of the model beyond the PE context, the need for more longitudinal tests of the model, and the imperative for more experimental and intervention research.

Basic Tenets of the Trans-Contextual Model

The trans-contextual model is a multitheory approach to understanding the processes by which forms of motivation toward educational activities in a classroom context lead to motivation toward similar activities and behaviors in out-of-school contexts (Hagger & Chatzisarantis, 2012; Hagger et al., 2003). The model was originally developed and tested in the PE context and focused on the transfer of students' autonomous motivation toward activities in PE lessons to motivation to engage in related activities, namely, leisure-time physical activity, outside of school. However, we contend that the model represents a generalizable framework to test the processes underpinning the transfer of motivation for in-class

activities to motivation for related activities in contexts outside of school. Our generalizability proposition is consistent with the theories that underpin the model (Ajzen, 1985; Deci & Ryan, 1985b; Vallerand, 1997).

The model comprises three central propositions that inform a series of testable hypotheses. Each proposition represents a fundamental, defining aspect of the model and comprises hypotheses that must be empirically supported for the model to be accepted. Failure to replicate or support the hypotheses for each proposition in empirical tests constitutes a rejection of the model and a failed replication. We also present a set of peripheral hypotheses that, although integral to the model, are not essential to be confirmed for the overall model to be supported empirically. These propositions and their importance within the context of the model will be outlined in the following section. We begin with an overview of the component theories that have informed the model, followed by how each component theory serves as a precursor of the specific propositions of the model. To facilitate understanding, the hypothesized relationships in the model are illustrated in Figure 1. In addition, the hypotheses and the propositions to which they pertain are formally outlined in Table 1. Figure 1 and Table 1 should be used as guides to complement the explanations of the model propositions and hypotheses that follow.

Proposition 1: Perceived support for autonomous motivation predicts autonomous motivation within educational contexts.

The trans-contextual model draws heavily from self-determination theory (Deci & Ryan, 1985b, 2000) as a leading explanatory system for the effects of motivation on behavior. The defining characteristic of the theory is that it differentiates between *qualities* or types of motivation experienced by individuals toward the activities and behaviors in which they engage rather than the *quantity* of motivation alone. Central to the theory is the concept of autonomous motivation. This type of motivation reflects engaging in behavior for reasons of choice and volition and to obtain self-referenced outcomes such as feelings of satisfaction, competence, and personal effectance. Acting for autonomous reasons is considered adaptive. Individuals acting autonomously feel that they are the origin of their actions and experience their actions as entirely consistent with their authentic sense of self. Importantly, autonomously motivated individuals tend to experience their actions as separable from externally referenced pressures and contingencies.

Self-determination theory defines three forms of autonomous motivation. *Intrinsic motivation* is the prototypical form and reflects engaging in activities because doing so leads individuals to experience ownership over their actions and consistency between their behavior and their authentic sense of self. Intrinsically motivated activities are performed in the absence of any external contingency and for the inherent enjoyment, satisfaction, and interest derived from the activity itself. *Identified regulation* is an autonomous form of motivation and reflects engaging in activities because they service self-endorsed outcomes. Individuals acting for identified regulated reasons recognize the behavior as their own and its inherent value, but it is still performed instrumentally rather than as a source of satisfaction and enjoyment and for optimal psychological functioning.

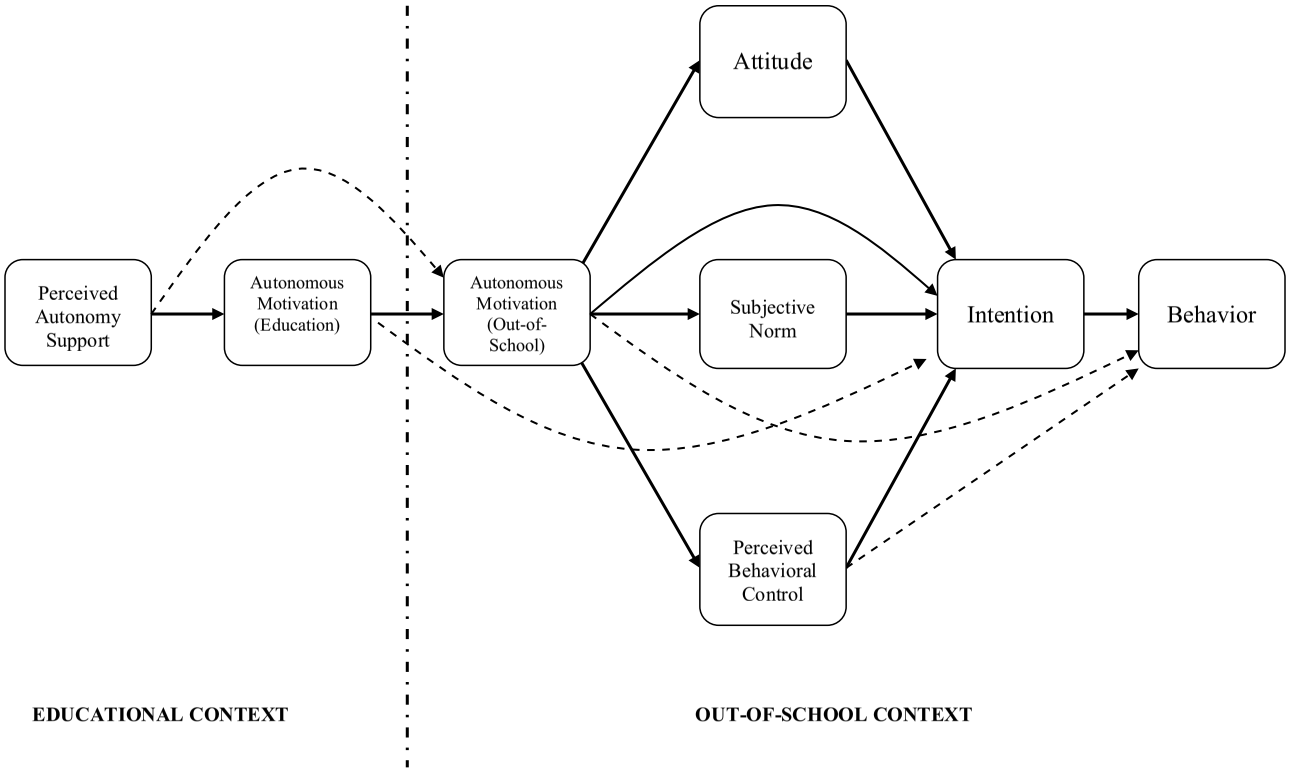

FIGURE 1. *The trans-contextual model.*

Note. Solid unidirectional arrowed paths represent the hypothesized relations among the model variables. Broken unidirectional arrowed paths represent direct, unmediated effects that are not hypothesized in the model. Empirical confirmation that the nonhypothesized direct effects are of a size that is relatively trivial, or not statistically significant, will provide further support for the hypothesized indirect effects.

TABLE 1

Fundamental and peripheral hypotheses of the trans-contextual model

Hypothesis (H)	Proposition	Status[a]
H1: Perceived autonomy support (educational context) → autonomous motivation (educational context)	1	F
H2: Autonomous motivation (educational context) → autonomous motivation (out-of-school context)	2	F
H3: Perceived autonomy support (educational context) → autonomous motivation (educational context) → autonomous motivation (out-of-school context)	2	F
H4: Autonomous motivation (out-of-school context) → intention[b]	3	F
H5: Autonomous motivation (out-of-school context) → behavior[c]	3	F
H6: Autonomous motivation (out-of-school context) → attitude	3	P
H7: Autonomous motivation (out-of-school context) → subjective norm	3	P
H8: Autonomous motivation (out-of-school context) → PBC	3	P
H9: Attitude → intention	3	P
H10: Subjective norm → intention	3	P
H11: PBC → intention	3	P
H12: Autonomous motivation (out-of-school context) → attitude → intention	3	P
H13: Autonomous motivation (out-of-school context)→subjective norm→intention	3	P
H14: Autonomous motivation (out-of-school context) → PBC → intention	3	P
H15: Intention → behavior	3	F
H16: PBC → behavior	3	P
H17: Attitude → intention → behavior	3	P
H18: Subjective norm → intention → behavior	3	P
H19: PBC → intention → behavior	3	P
H20: Perceived autonomy support → intention[d]	3	F
H21: Perceived autonomy support → behavior[e]	3	F
H22: Autonomous motivation (educational context) → intention[f]	3	F
H23: Autonomous motivation (educational context) → behavior[g]	3	F

Note. F = fundamental; P = peripheral; PBC = perceived behavioral control.

[a]Status of hypothesis within the trans-contextual model, rejection of a fundamental hypothesis will lead to a rejection of the model and a failed replication.

[b]This effect accounts for the total effect of the independent variable (autonomous motivation in out-of-school contexts) on intention comprising both direct and indirect effects via the antecedents of intention (attitude, subjective norm, perceived behavioral control).

[c]This effect accounts for the total effect of the independent variable (autonomous motivation in out-of-school contexts) on the behavior comprising both direct and indirect effects via the antecedents of intention (attitude, subjective norm, perceived behavioral control) and intention itself.

[d]This effect accounts for the total effect of the perceived autonomy support on intention that comprises both direct and indirect effects via the proposed motivational sequence in the model.

[e]This effect accounts for the total effect of the perceived autonomy support on behavior that comprises both direct and indirect effects via the proposed motivational sequence in the model.

[f]This effect accounts for the total effect of the independent variable (autonomous motivation in educational contexts) on intention that comprises both direct and indirect effects via the proposed motivational sequence.

[g]This effect accounts for the total effect of the independent variable (autonomous motivation in educational contexts) on behavior that comprises both direct and indirect effects via the proposed motivational sequence.

A third form of autonomous regulation, *integrated regulation*, reflects acting to attain an inherently valued and important goal or outcome, but the action is fully endorsed by the self (Ryan, 1995). Integrated regulated actions are perceived to be entirely consistent with self-endorsed values and identity. Integrated regulation is therefore considered a more autonomous form of motivation than identified regulation because the action is viewed as more closely aligned with the individuals' authentic sense of self, rather than merely instrumental in servicing self-referenced outcomes (Deci & Ryan, 2000; McLachlan, Spray, & Hagger, 2011).

Autonomous motivation is contrasted with controlled forms of motivation, which reflect behavioral engagement for reasons of obligation, reinforcement, or some other externally referenced contingency. Two forms of controlled motivation are proposed. *External regulation* is the prototypical form and reflects behavioral engagement reinforced by rewards or punishment. The reason for engaging in the behavior is perceived as located outside the individual and inconsistent with the individual's authentic sense of self. *Introjected regulation* reflects engaging in behaviors out of a sense of externally referenced obligation such as the avoidance of guilt or the promotion of contingent self-worth. Although introjected-regulated reasons for behavioral engagement emanate from within the individual, they are experienced as other-endorsed rather than self-endorsed. The different forms of autonomous and controlled motivation, known as behavioral regulations, are conceptualized as delineating a continuum, ranging from high to low autonomy, termed the *perceived locus of causality* (Ryan & Connell, 1989).

Autonomous forms of motivation are considered most adaptive because they are related to persistence with activities in the absence of externally referenced contingency or obligation and lead to salient outcomes (Deci, Koestner, & Ryan, 2001; Deci & Ryan, 2000). For example, teachers promoting students' autonomous motivation toward in-class learning will lead to better educational outcomes in the short and long terms (Reeve, 2002; Vansteenkiste et al., 2004). In the short term, fostering autonomous motivation will result in students taking ownership over their actions, deriving a sense of competence and satisfaction from engaging in the activities, which will, in turn, lead to self-regulated participation in, and persistence with, educational activities (Guay et al., 2010). In the longer term, it will lead to adaptive outcomes related to persistence, such as better grades, as well as an increased sense of harmony and optimal overall functioning (Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013). Acting for controlled motives is maladaptive as behavior will tend only to persist as long as the external contingency is present and will not lead to adaptive outcomes such as positive affect, perceived competence, and satisfaction. As a consequence, fostering autonomous motivation toward activities in educational contexts is important if self-regulated persistence is to be promoted.

The driving force behind motivation in self-determination theory is the concept of basic psychological needs and their satisfaction. According to basic needs theory, a subtheory of self-determination theory, individuals require the satisfaction of three psychological needs for optimal functioning and to gain a sense of fulfilment—autonomy, competence, and relatedness (Deci & Ryan, 2000). The most fundamental of the basic needs is the need for autonomy, which is the need to be the origin of one's own behavior and to experience actions as emanating from the self. Complementing the need for autonomy is the need for competence

(the need to feel effectance in one's actions) and the need for relatedness (the need to feel connected and supported by significant others). Research has identified these needs as generalized and universal across populations and cultural groups (Sheldon, Elliot, Kim, & Kasser, 2001; Taylor & Lonsdale, 2010).

The three needs are closely related, and it is the satisfaction of all three needs that leads to optimal functioning (Deci & Ryan, 2000; Deci, Ryan, & Williams, 1996). Furthermore, need satisfaction has typically been conceptualized as a global factor encompassing each of the needs. This has been supported empirically with strong, statistically significant correlations reported among measures of the psychological need satisfaction constructs (Sheldon & Elliot, 1999). Researchers have, therefore, collapsed the measures into a single composite need satisfaction construct or used a higher order factor indicated by three first-order need satisfaction factors (Hagger, Chatzisarantis, & Harris, 2006a; Sheldon & Elliot, 1999). The satisfaction of basic psychological needs is the process by which the experience of autonomous motivation leads to behavioral persistence and future participation in activities (Deci et al., 1996; Deci & Ryan, 2000). Behaviors perceived as autonomously motivated tend to be perceived as satisfying psychological needs.

Research in a number of contexts has demonstrated significant relations between perceiving actions as autonomously motivated and perceptions of satisfaction of psychological needs (Hagger et al., 2006a; Sebire, Jago, Fox, Edwards, & Thompson, 2013; Wilson, Rodgers, Blanchard, & Gessell, 2003). The mechanism underpinning these relations is that participation in autonomously motivated behaviors makes the adaptive need-satisfying elements of the activity salient. These elements include self-referenced outcomes such as positive affect, perceived competence, satisfaction, and personal effectance (Vallerand, 1997) and a greater sense of consistency between individuals' actions and their authentic sense of self (Deci & Ryan, 2000). Individuals will, therefore, be compelled to seek out and participate in the autonomously motivated behaviors that satisfy their basic needs (Hagger et al., 2006a). Through experience, individuals develop a repertoire of behaviors experienced as autonomous and need-satisfying and pursue them accordingly.

The theory also suggests that the repertoire of autonomous, need-satisfying behaviors can be augmented to include new behaviors through the process of *internalization*. Internalization is the process by which individuals assimilate behaviors previously experienced as controlled motivated and perceive them as autonomously motivated (Deci, Eghrari, Patrick, & Leone, 1994; Ryan & Connell, 1989). Activities that were once performed for externally referenced reasons can be taken in and experienced as self-endorsed and servicing self-referenced outcomes. Internalization demonstrates that behavioral regulations are not inflexible and fixed but are malleable and can be changed through supportive elements in the environment that make the need-supporting potential of the behavior salient (Ryan, 1995).

Autonomy support is an important means available to social agents to foster autonomous motivation. Social agents in educational contexts (e.g., teachers) can promote students' autonomous motivation toward class activities by structuring the learning environment accordingly (Reeve, 2002; Ryan & Deci, 2009). Research has revealed that teachers are able to foster higher levels of autonomous

motivation and greater behavioral persistence by providing instruction and feedback that focuses on self-directed learning and by giving students choice over, and a rationale for, their actions (Reeve, Bolt, & Cai, 1999; Reeve & Jang, 2006). Support for autonomy promotes autonomous motivation toward activities through the internalization processes. Research has shown that teachers' support for students' autonomy in the classroom is related to increases in students' perceived autonomy and a shift in locus of causality from external to internal (Deci et al., 1996; Su & Reeve, 2011).

The identification of the key behaviors and lesson content that fosters autonomous motivation is a priority (Hagger & Hardcastle, 2014), and researchers have begun to map the specific behaviors that teachers as social agents can employ to support autonomy in students (Cheon & Reeve, 2013; Cheon, Reeve, & Moon, 2012; McLachlan & Hagger, 2010b; Reeve & Jang, 2006). These behaviors are closely aligned with the defining features of autonomous motivation, such as providing choice and a meaningful rationale for activities, offering encouragement and positive feedback, avoiding controlling directives and commands, acknowledging students' perspectives, offering hints, and promoting an exploratory approach toward tasks. The links between autonomy support and the extent to which students perceive social agents in educational settings as supportive of their autonomy and autonomous motivation has received considerable empirical support (e.g., Black & Deci, 2000; Cheon et al., 2012; Cordova & Lepper, 1996; Koestner, Ryan, Bernieri, & Holt, 1984).

Students' perceptions of the extent to which their teacher supports their autonomous motivation in educational contexts forms the first proposition of the trans-contextual model and its first hypothesis (Hypothesis 1[H1]). The extent to which students perceive their teachers as providing support for their autonomous motivation in educational contexts is proposed to be associated with levels of autonomous motivation in the same context. Such perceptions illustrate the key role that the teacher and classroom environment has in fostering autonomous and self-directed learning. This proposed relationship has been confirmed in numerous studies in educational contexts (e.g., Pelletier, Fortier, Vallerand, & Briere, 2001; Reeve & Jang, 2006; Taylor & Ntoumanis, 2007). Perceived support for autonomy predicts students' autonomous motivation in class because students who view their teachers as autonomy supportive will tend to be those who have internalized the educational activities in class into their repertoire of behaviors that satisfy basic psychological needs. There is also evidence indicating that students' perceived autonomy support toward teachers correlates with the level of actual autonomy support offered by teachers in educational contexts (McLachlan & Hagger, 2010b; Reeve & Jang, 2006). Taken together, this evidence suggests that teachers displaying autonomy-supportive behaviors will foster perceived autonomy support and autonomous motivation in students and illustrates one of the key means by which classroom interventions can promote increased motivation in students.

Proposition 2: Autonomous motivation toward activities in an educational context predicts autonomous motivation toward similar activities in an out-of-school context.

Central to the trans-contextual model is the proposition that autonomous motivation in educational contexts is associated with autonomous motivation toward related educational activities in out-of-school contexts. There are two proposed mechanisms for the trans-contextual transfer of motivation. The first is related to Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation, which proposed that there will be reciprocal relations between autonomous forms of motivation across similar but distinct contexts. Specifically, Vallerand hypothesized that autonomous forms of motivation in one context would be linked, albeit imperfectly, to autonomous motivation in other similar contexts. The experience of a behavior or action as autonomous in a given context creates a script or schema containing the motivational representations and anticipated patterns of action in that context. The schema may subsequently serve as a useful template for motivation and action in closely related contexts, particularly when similar cues are presented and activate the schema.

The second mechanism is derived from self-determination theory and proposes that the adaptive outcomes derived from an autonomously motivated activity in one context may lead to an increased desire to experience autonomy toward similar activities irrespective of the context (Deci & Ryan, 1985b, 2000). The mechanism underpinning this transfer is through satisfaction of basic psychological needs and internalization. If a student experiences an activity as autonomous in the classroom, such as participating in physical activities in PE, the activity will be internalized as a candidate activity that fosters autonomous motivation and satisfies psychological needs in future (Deci et al., 1994; Ryan, 1995; Ryan & Connell, 1989). The student will tend to be attracted to these activities, and the concomitant outcomes such as feelings of satisfaction and enjoyment, in other contexts outside of school. Accordingly, the student may actively seek opportunities to participate in similar activities, such as leisure-time physical activity, in the other contexts. By seeking out autonomously motivated activities in out-of-school contexts, students will satisfy their psychological needs and experience accompanying adaptive outcomes (Deci et al., 1996). The fact that they have experienced need-satisfying behaviors toward educational activities in the past increases the likelihood they will seek out similar need-satisfying activities in out-of-school contexts. Psychological need satisfaction and internalization, therefore, are candidate mediators of this process, as specified in more recent theorizing on the model (Barkoukis et al., 2010; González-Cutre, Sicilia, Beas-Jiménez, & Hagger, 2014). Outside of empirical tests derived from the trans-contextual model, support for the transfer of autonomous motivation across contexts is scarce. The trans-contextual component is, therefore, an essential and unique component of the model.

In terms of the specific hypotheses related to Proposition 2, autonomous motivation in an educational context is hypothesized to predict autonomous motivation in an out-of-school context (H2). It is also important to note that Propositions 1 and 2 imply that perceived autonomy support in an education context will have an indirect effect on autonomous motivation in an out-of-school context mediated by autonomous motivation in an education context (H3).

Proposition 3: Autonomous motivation in an out-of-school context predicts future intention to engage in out-of-school activities and actual behavioral engagement.

The model posits that autonomous motivation toward education-related activities in out-of-school contexts will result in an individual seeking out similar behaviors in future. We propose that autonomous motivation will be an important impetus in the decision-making process that leads to future intended behavior. We employed the theory of planned behavior (Ajzen, 1985, 1991, 2014) to map the processes by which individuals form intentions to perform activities consistent with their autonomous motives. The theory is a belief-based social-cognitive model sharing a common approach to expectancy value models where the deliberation of beliefs determines a rational course of action (cf. Eccles & Wigfield, 2002; Fishbein, 1967). The theory proposes that engaging in a future behavior is a function of intentions, a motivational construct reflecting the extent to which individuals plan to engage in the behavior. Intention is proposed to mediate the effect of three sets of belief-based variables on future behavior: attitudes, which reflect an individual's beliefs that engaging in a future behavior will lead to desirable outcomes; subjective norms, reflecting beliefs that the behavior is consistent with the perceived desires of significant others; and perceived behavioral control, which reflects an individual's belief that he or she has the capacity and personal resources to successfully pursue the behavior.

Within the trans-contextual model, autonomous motivation is related to future behavior through the decision-making processes outlined in the theory of planned behavior. The two theories originate from different epistemological positions, namely, the organismic tradition for self-determination theory and the social-cognitive perspective for the theory of planned behavior. Despite these disparate origins, theorists have proposed that the two approaches are compatible and complementary (Hagger et al., 2006a, 2006b; Koestner, Bernieri, & Zuckerman, 1992; Motl, 2007; Vallerand, 1997), including Deci and Ryan (1985b, 2000). Specifically, theorists have proposed that motivational constructs identified in organismic theories are related to cognitive, affective, and behavioral outcomes. For example, Vallerand (1997) proposed that contextual-level behavioral regulations compel individuals to bring their systems of beliefs in line with their motives. Similarly, Deci and Ryan (1985b), in their original conceptualization of self-determination theory, proposed that autonomous motivation toward a given behavior or activity will lead to approach-oriented beliefs toward performing the behavior and the formation of intentions to engage in the behavior in future. For example, Deci and Ryan (2000) stated,

> Cognitive theories [such as the theory of planned behavior] begin their analysis with . . . a motive, which is a cognitive representation of some future desired state. What is missing, of course, is the consideration of the conditions of the organism that makes these future states desired. (p. 228)

The *conditions* to which Deci and Ryan (2000) refer are the motivational constructs that reflect the extent to which behaviors satisfy psychological needs and drive the formation of social-cognitive beliefs that precede future action. Furthermore, Koestner et al. (1992) demonstrated that individuals reporting high levels of autonomous regulation for their behavior had a high degree of consistency between social-cognitive beliefs, such as attitudes, and their behavior.

Research has also indicated that individuals can and do differentiate between beliefs that are autonomous in nature and beliefs that are more controlled (McLachlan & Hagger, 2011a, 2011b). Individuals, therefore, have a tendency to align their beliefs with their behavioral regulations. The process of alignment is adaptive and strategic because it allows individuals to form sets of beliefs and intentions with respect to future behavioral engagement that will be consistent with their motivational orientations. In summary, theory and research have provided bases for the links between constructs from self-determination theory and the theory of planned behavior.

The process that underpins the link between behavioral regulations from self-determination theory and belief-based constructs from the theory of planned behavior is derived from the processes of psychological need satisfaction and internalization (Deci et al., 1994; Ryan, 1995; Ryan & Connell, 1989). If a student has previously experienced an activity as autonomously motivated and has internalized it into a repertoire of behaviors that satisfies his or her psychological needs, he or she will tend to actively pursue future opportunities to engage in the activity to further experience need satisfaction and concomitant adaptive outcomes. The formation of beliefs aligned with motives is adaptive and strategic because doing so will facilitate the formation of intentions to pursue the need-satisfying activity in future (Hagger & Chatzisarantis, 2009b).

Furthermore, there are reasons why the content of specific sets of social-cognitive beliefs about future behavioral participation is related to autonomous behavioral regulations. Beliefs regarding the extent to which engaging in the activity will lead to personally relevant outcomes (attitudes) and beliefs regarding capacity to engage in the activity (perceived behavioral control) have been shown to be aligned with autonomous motivation (McLachlan & Hagger, 2010a, 2011a). This is because autonomous motivation reflects engaging in activities out of an authentic sense of self, consistent with personal beliefs about outcomes, and engaging in activities as an effective agent in the environment, consistent with beliefs about control. Theorists have suggested that subjective norms are less likely to be aligned with autonomous motivation because the construct is typically conceptualized as beliefs concerning social pressures to engage in the activity, and are therefore more consistent with controlled forms of motivation (Chatzisarantis & Biddle, 1998; Sheeran, Norman, & Orbell, 1999).

However, there is evidence that autonomous motivation is a significant, positive predictor of subjective norms (Chan, Fung, Xing, & Hagger, 2014; Hagger, Chatzisarantis, & Biddle, 2002a; Hamilton, Cox, & White, 2012; Pavey & Sparks, 2010). The reason for this positive relationship is that subjective norms may also reflect beliefs about participating in future actions at the behest of significant others because they have willfully and freely chosen to do so. Such beliefs arise because individuals respect and value the desires of significant others and view them as supporting their autonomy. Individuals may, therefore, form beliefs that they will participate in a future behavior in accordance with the perceived desires of significant others because they expect those others to support and endorse their autonomy.

Although the specific processes linking autonomous motivation with beliefs regarding future action were proposed by Deci and Ryan (1985b) in their original

conceptualization of the theory, and corroborated by other self-determination theory proponents (Koestner et al., 1992; Vallerand, 1997), no formal hypotheses were outlined. In the trans-contextual model, we propose that the process by which intentions are formed and affect behavioral engagement are represented by the processes outlined in the theory of planned behavior. In particular, we propose that constructs representing the behavioral, normative, and control-related beliefs from the theory of planned behavior mediate the effect of autonomous motivation on intentions to engage in future behavior.

We hypothesize that there will be a significant effect of autonomous motivation on intention to perform the target behavior in an out-of-school context (H4) and actual participation in the behavior in future (H5). These effects are expected to be mediated by the immediate belief-based determinants of intention to perform a specific out-of-school behavior, namely, attitudes, subjective norms, and perceived behavioral control. Consistent with these mediated effects, autonomous motivation in the out-of-school context will predict attitudes (H6), subjective norms (H7), and perceived behavioral control (H8). The belief-based variables of attitudes (H9), subjective norms (H10), and perceived behavioral control (H11) are proposed to affect intentions to engage in future behavior consistent with the theory of planned behavior. These hypotheses imply that there will be multiple indirect effects of autonomous motivation on intentions mediated by attitudes (H12), subjective norms (H13), and perceived behavioral control (H14).

The mechanisms behind these effects are derived from the original proposal in self-determination theory that individuals' beliefs toward specific behaviors tend to be consistent with their motivational orientation, and they will, therefore, align their motives with their beliefs (Deci & Ryan, 1985b). Such an alignment is adaptive as it paves the way for an individual to form intentions to perform need-satisfying behaviors in the future (Hagger et al., 2006a, 2006b). The motivational orientation acts as a source of information and drives the pursuit of intentional behavior consistent with their motives. The belief and intentional components are, therefore, important constructs in the model as they enable tests of the processes by which generalized motives are linked to future intentional action. For example, students who are autonomously motivated toward activities in school will also tend to be autonomously motivated to perform similar activities in an out-of-school context. In the context of previous tests of the model, this reflects the transfer of autonomous motivation toward activities in PE to autonomous motivation toward leisure-time physical activities out of school. Furthermore, students may form positive beliefs and intentions toward engaging in leisure-time physical activity consistent with their motives. Therefore, motivation at the contextual level may lead to students forming positive beliefs toward behaviors that are consistent with their contextual-level motives and satisfy their psychological needs.

The significant effect of autonomous motivation on actual behavior in the out-of-school context will be mediated by intentions as well as the belief-based factors from the theory of planned behavior (Hagger et al., 2003). This hypothesis is consistent with predictions of the theory of planned behavior in which intentions are the most proximal predictor of behavior (H15), along with a direct effect for perceived behavioral control to account for occasions where this variable equates

to a good proxy for actual control (H16; Ajzen, 1991). The effects of attitudes (H17), subjective norms (H18), and perceived behavioral control (H19) on behavior will, therefore, be indirect and mediated by intentions.

Finally, it is important to test the effects of distal variables in educational contexts on the key dependent variables of the model, namely, intentions to participate in educational activities outside of school and actual behavioral engagement. Such confirmation is important because it will provide support for the effectiveness of the proposed motivational sequence in accounting for links between motivation in education and actual behavior outside of school. It is hypothesized, therefore, that there will be significant indirect effects of perceived autonomy support on intentions (H20) and behavior (H21) and significant indirect effects of autonomous motivation in educational contexts on intentions (H22) and behavior (H23). In summary, the entire sequence of the model reflects the processes by which motivation toward educational activities that originates in the classroom is linked to motivation toward related educational activities outside the classroom and the sets of beliefs that drive intended engagement in such activities in future.

Empirical Support for the Trans-Contextual Model

There is growing support for the proposed pattern of relations among motivational constructs of the trans-contextual model. A number of prospective studies have tested and confirmed the premises of the model in school children aged 12 to 16 years from different ethnic and national groups including those endorsing independent (e.g, Barkoukis et al., 2010; Hagger et al., 2003; Hagger et al., 2009; Standage et al., 2012) and interdependent (Hagger et al., 2005; Lim & Wang, 2009) cultural norms. Specifically, the studies have found significant relationships between perceived autonomy support and autonomous motivation toward activities in an educational context (Proposition 1), between autonomous motivation in an educational context and autonomous motivation toward related activities in an out-of-school context (Proposition 2), between autonomous motivation in an out-of-school context and intentions to engage in future activities mediated by attitudes and perceived behavioral control (Proposition 3), and between intentions and future behavioral engagement (Proposition 3). It should be noted, however, that the majority of the empirical tests of the model to date have been conducted by our research group. Although there are a number of independent tests, interpretation of the weight of evidence in support of model hypotheses should be considered in light of the fact that the majority of the tests originate from a single group of researchers.

A further important caveat to the empirical support for the model is that the vast majority of tests have been in the context of motivation toward PE and out-of-school physical activity, although there have been some recent attempts to diversify to other educational contexts such as activities in math lessons and homework (Hagger, Sultan, Hardcastle, & Chatzisarantis, 2015). Recent proposals that the trans-contextual model can be generalized to other educational activities are based on the assumptions of the component theories on which the model is based (Hagger & Chatzisarantis, 2012). The component theories are proposed to reflect generalizable patterns of action that are invariant across contexts and populations (Bandura, 1989; Strack & Deutsch, 2004). This is because

the motivational and information-processing assumptions on which theories of motivation (e.g., self-determination theory) and theories of social cognition (e.g., theory of planned behavior) are based are assumed to be invariant across individuals and contexts (Deci & Ryan, 2002; Fishbein & Ajzen, 2009; Mata et al., 2009; Ryan & Deci, 2006; Vallerand, 1997). Provided the motivational, interpersonal, and environmental processes that determine motivation can be adequately captured, individuals' motivational outcomes and behavior should be eminently predictable across contexts.

The assumption of generalizability in the pattern of effects in the model notwithstanding, there is scope for variation in model effects due to extraneous moderating variables. However, such variations are likely to be manifested in the relative size or magnitude of the effect sizes across moderator groups rather than a change in the overall pattern of effects that would invalidate the model or lead to a rejection of its main hypotheses. Candidate moderators that should be tested in the model include educational domain, cultural orientation, age, gender, and socioeconomic status. Educational domain is a key moderator, and there is a need for research that broadens the application of the model to other domains (Hagger & Chatzisarantis, 2012). Variation in effects due to educational domain may be due to differences in the influence of the teacher across domains and the number of opportunities available for students to experience autonomous motivation in the school context and related activities outside of school.

Cultural orientation is also a potentially important moderator. Although individuals from groups that endorse different cultural norms (e.g., independent vs. interdependent values), including children, similarly experience events as autonomous or controlling (Sheldon et al., 2004; Taylor & Lonsdale, 2010), individuals from collectivist cultures may experience less autonomy or interpret normatively referenced contexts as autonomy-supportive (Bao & Lam, 2008; Chirkov, Ryan, Kim, & Kaplan, 2003; Hagger, Rentzelas, & Chatzisarantis, 2014; Iyengar & Lepper, 1999; Ryan et al., 1999). There is also evidence that individuals interpret the beliefs from the theory of planned behavior differently according to cultural orientation (Bagozzi, Lee, & Van Loo, 2001; Hagger, Chatzisarantis, Barkoukis, et al., 2007). An investigation of cultural norms as a moderator of trans-contextual model relations therefore appears relevant and valid.

Examination of age, gender, and socioeconomic status as moderators of the proposed model effects is also an important avenue for future investigation. Such analyses would provide a test of whether the proposed effects of the model reflect processes that are universal and generalizable. Previous research has identified age and gender differences in levels of autonomous motivation and in the effects of external contingencies that support autonomous motivation (e.g., provision of choice) on autonomous motivation (e.g., Lepper, Corpus, & Iyengar, 2005; Patall, Cooper, & Wynn, 2010). An assessment of these moderators would be important to confirm whether the proposed effects are invariant across these groups as stipulated by the generalizability hypothesis.

It is also important to consider the type of data available in the extant literature in order to effectively evaluate the extent of the empirical support for the trans-contextual model. Tests of the model have typically adopted a three-wave prospective design similar to that used in the original development article (Hagger

et al., 2003). The design requires participants to complete measures of perceived autonomy support and autonomous motivation in an educational context at an initial time point. Measures of autonomous motivation and constructs from the theory of planned behavior toward activities in an out-of-school context are then administered at a second point in time, 1 week later. Finally, actual behavioral engagement is measured at a subsequent time point, usually some weeks after the second time point. This design has advantages in that it enables testing of the prospective prediction of behavior, accounts for temporal changes in behavior provided past behavior is included, and minimizes the problem of common-method variance associated with use of similar means to measure model constructs. However, it is also important to acknowledge that these data also have disadvantages, including problems with the inference of causality and the static nature of the psychological and behavioral constructs measured.

Criticisms of the Model

A number of criticisms have been levelled at the trans-contextual model since its inception. They include whether the model can be rejected (i.e., what constitutes a null or failed replication), whether the inclusion of the beliefs from the theory of planned behavior is necessary to understand the pattern of relations among model constructs, and whether the proposed ordering of the constructs in the model is justified against other alternative models. In the next section, we provide theory- and evidence-based rebuttals to each of these criticisms to clarify the hypotheses and mechanisms in our proposed model.

Can the Trans-Contextual Model Be Rejected?

Ogden (2003, 2015) recognized that many articles reporting tests of social-cognitive theories and models claimed that their data were supportive of the theory or model. She raised an important and pertinent question: "Could data be collected that would lead to the model being rejected" (Ogden, 2003, p. 425)? Specifically, Ogden pointed out that social-cognitive theories were operationalized as a network of relationships among multiple constructs with a distinct nomological order, and researchers tended to evaluate the theories using omnibus tests (e.g., multiple regression or structural equation models). Although some of the individual effects, and therefore hypotheses, in the tests were not supported, the authors still claimed that their data supported the theory. Ogden challenged the scientific community to identify the exact conditions that would lead researchers to return a decision of reject or failure to replicate in their tests of theoretical models.

This criticism is relevant to the trans-contextual model as it falls into the same category of models and theories identified by Ogden. The model proposes multiple hypotheses that are typically tested simultaneously using analyses that test a network or pattern of relationships among multiple variables measured across multiple time points (e.g., path analysis, structural equation modelling). This analytic approach has often been referred to as nomological validity (Bagozzi, 1981; Bagozzi, Davis, & Warshaw, 1992; McLachlan et al., 2011). It is essential, therefore, to precisely delineate the conditions that would lead to the model being rejected such that any test of the model could be judged against an a priori set of

criteria consistent with a hypothesis-testing approach. Our view is that any test of the model should provide unequivocal support for the three model propositions and that a set of fundamental research hypotheses associated with the propositions must be accepted (i.e., the null hypothesis of zero effect should be rejected) in order for the model to be supported and held as a true replication of the pattern of effects in these data. This view is consistent with Sniehotta, Presseau, and Araújo-Soares' (2015) proposal that progress in theory development in psychology requires the specification of a theory core in which the explanatory concepts and their hypothesized relationships are clearly defined. Empirical support for these *fundamental* sets of hypotheses represents the minimum criterion for a successful replication.

Our taxonomy of trans-contextual model hypotheses in Table 1 outlines the status of each hypothesis as either fundamental or peripheral to supporting or rejecting the model. Fundamental hypotheses reflect a test of an effect that is central or core to the trans-contextual model and its defining characteristics. These include (a) the effect of perceived autonomy support on autonomous motivation in an education context (H1); (b) the effect of autonomous motivation in an education context on autonomous motivation in an out-of-school context (H2), and the indirect effect of perceived autonomy support on autonomous motivation outside of school mediated by in-school autonomous motivation (H3); (c) the effect of autonomous motivation in an out-of-school context on intentions (H4); (d) the effect of out-of-school autonomous motivation on actual behavioral engagement (H5); and (e) the effect of intentions on behavior (H15). It is important to note that the effects in (c) and (d) will be the total of the multiple indirect effects mediated by the belief-based (attitudes, subjective norms, and perceived behavioral control) variables. Support for Hypotheses 1 to 5 is fundamental for the test of model to be accepted and a null finding for any of these hypotheses in an overall test of the model will render it rejected as a failed replication. Peripheral hypotheses reflect tests of effects that contribute to the model and its processes but are not central to the three propositions. A failure to find support for these hypotheses in the model does not invalidate the core pathways of the model.

Why does a failure to support a particular fundamental hypothesis invalidate the model? To answer this question, we deal with each of the fundamental hypotheses in turn and explain their theoretical importance to model validation. A failure to replicate the effect of perceived autonomy support on autonomous motivation in education (H1) renders Proposition 1 invalid. This hypothesis is fundamental to the model as it identifies the salience of perceived support for autonomy by social agents as a source for autonomous motivation in educational contexts. Not only does it provide an indication of the origins of autonomous motivation but it also points to a potential route to promoting it through autonomy-supportive programs (e.g., Cheon et al., 2012). Failure to support the effect of autonomous motivation in an educational context on autonomous motivation in an out-of-school context (H2), and, by implication, the indirect effect of perceived autonomy support on out-of-school autonomous motivation mediated by in-school autonomous motivation (H3), means a failure to support Proposition 2, the trans-contextual effect that is fundamental in the model. Finding the trans-contextual effect to be redundant would render the model unfit for purpose in charting the process by which autono-

mous motivation in education is related to autonomous motivation in out-of-school contexts.

Finally, rejecting the effects of autonomous motivation in an out-of-school context on future intentions and behavior (H4, H5, and H15) would invalidate the proposal that autonomous motivation in an out-of-school context leads to intentions toward, and actual engagement in, future adaptive behaviors consistent with the motives. It is important to note that the component paths that comprise the indirect effect of autonomous motivation in an out-of-school context on intentions and behavior (e.g., H6–H8, H12–H15) do not all need to be supported for the indirect effect to be valid. The paths are, therefore, considered peripheral to decisions on whether to accept or reject the model. What is important for replication is that the overall effects of the motivational variables on intention and behavior are supported, regardless of whether they are mediated by one, two, or all three of the paths through attitudes, subjective norms, and perceived behavioral control. In other words, the effect of autonomous motivation on intentions may be mediated by attitudes, subjective norms, or perceived behavioral control alone and that is sufficient to support the model. Therefore, stringently specifying that all the pathways by which autonomous motivation predicts intention and behavior, through the belief-based constructs, should be accepted is not necessary to support the fundamental propositions of the model. Table 1 provides researchers with a set of guidelines that will enable them to evaluate whether any test of the model has been successful or represents a failed replication.

Are Beliefs Necessary in the Model?

A key mechanism in the trans-contextual model is the mediating effect of the belief-based social cognitive variables, namely, attitudes, subjective norms, and perceived behavioral control, on relations between autonomous motivation and intentions to perform the target behavior in an out-of-school educational context. An important question arising from this proposed mechanism is whether the beliefs are necessary to understand the proposed links. In other words, could the model be equally effective if the beliefs and associated mediation processes were omitted from the model? Specifically, would the model hold if autonomous motivation in an out-of-school context directly predicted intention and predicted behavior through the mediation of intention?

It is possible to develop an alternative well-fitting model that would provide a reasonable explanation of data that excluded the social-cognitive beliefs associated with the model. Furthermore, a failure to find indirect effects of autonomous motivation on intention mediated by the belief-based constructs would not invalidate the model. We propose that the employment of belief-based constructs serves a specific function in the model: to explain the process by which satisfaction of basic psychological needs is translated into future need-satisfying action. The theory of planned behavior was employed to provide a theoretical basis for hypotheses involving the belief-based constructs in the trans-contextual model because it is an established and clearly defined system for explaining the processes by which people's beliefs regarding future actions are related to intentions toward, and actual engagement in, future behavior. It permits testing of the mechanisms involved and indicates how and why autonomous

motivation may be implicated in decision-making processes and converted into actual future action.

Our inclusion of beliefs from a theory of social cognition alongside motives from a theory from the organismic tradition is based on previous evidence and theorizing that individuals align their beliefs with their organismic motives (Chatzisarantis, Hagger, & Smith, 2007; Chatzisarantis, Hagger, Smith, & Sage, 2006; Deci & Ryan, 1985b; Hagger et al., 2006a, 2006b; Vallerand, 1997). The process of alignment is strategic and adaptive because it enables individuals to deliberatively and actively engage in a decision-making process that will lead to further fulfilment of their psychological needs. By forming approach-oriented attitudes, subjective norms, perceived behavioral control, and intentions through the processes outlined in the theory of planned behavior, individuals will maximize their opportunities to satisfy their psychological needs in future. The alignment of beliefs is based on empirical evidence indicating that individuals actively make distinctions between beliefs that are autonomous and controlled in orientation (McLachlan & Hagger, 2011a, 2011b), and those beliefs significantly predict subsequent need-satisfying behavior (McLachlan & Hagger, 2011b).

A key limitation of the current literature is the dearth of experimental and intervention evidence showing that the motivational and belief-based constructs from the trans-contextual model can be independently manipulated. It is important that manipulations targeting behavioral regulations from self-determination theory (e.g., autonomy support) lead directly to changes in perceived autonomy support and measures of the regulations (e.g., autonomous motivation in class), and only affect concomitant changes in beliefs (e.g., attitudes) through the mediation of the regulations. Similarly, manipulations targeting beliefs should only have direct effects on the belief-based antecedents of intentions and behavior, as stipulated in the theory of planned behavior. Such evidence would provide effective support for the processes involved in the model and corroborate the pattern of effects.

In terms of design, a trans-contextual model intervention or experiment should adopt a factorial design including manipulations based on both self-determination theory (e.g., autonomy support) and the theory of planned behavior (e.g., persuasive communication) administered simultaneously in their appropriate context. The expectation is that manipulations of autonomy support would affect intentions and behavior through the mediation of autonomous motivation in both educational and out-of-school contexts and the theory of planned behavior variables. In contrast, persuasive communication manipulations would affect a change in the belief-based constructs (e.g., attitudes, perceived behavioral control), independent of the autonomy-support manipulation, and without any effects on autonomous motivation. The manipulations and their respective effects would provide a test of nomological validity of the motivational and belief-based constructs within the model, confirm that constructs are distinct, and provide support for different pathways by which they affect behavior. Testing the effects of autonomy support manipulations on model constructs would also present evidence that the model provides a flexible framework for intervention. Intervention designers could adopt intervention techniques that target different constructs in the model, and in different contexts (educational or out-of-school), to change future engagement in educational activities.

Ordering of Constructs in the Model

Another criticism that has been levelled at the trans-contextual model is whether the proposed pattern of relations among the constructs in the model represents the definitive causal ordering of the effects, or whether other theoretically plausible patterns exist. For example, can out-of-school autonomous motivation predict motivation within an educational context? The model is an a priori framework specifying a proposed network of relationships among its component constructs, the bases of which are rooted in theories of motivation and social cognition. However, the model has typically been tested using correlational data that does not provide sufficiently strong evidence to confirm the true causal ordering of the variables. In the face of a lack of such evidence, the causal order of the variables can only be inferred from the conceptual basis of the model alone.

One approach to resolving this issue would be to include premeasures of the out-of-school motivational and social cognitive constructs in the three-wave prospective design. The inclusion of premeasures would, in effect, lead to a panel design that would not only allow the researcher to model the covariance stability of the constructs in the model but also test the reciprocal effects of the in-school and out-of-school motivational constructs through the cross-lagged effects (Gollob & Reichardt, 1987; Hertzog & Nesselroade, 1987; Lindwall, Larsmann, & Hagger, 2011). The researcher could, therefore, be more confident in the directional nature of the proposed relations between the forms of motivation in school and the motivational and social cognitive constructs in the out-of-school context. Another analytic approach to resolve this issue would be the adoption of intervention and experimental designs that include manipulations to change the key components. Manipulating in-school variables such as autonomy support and observing the effects on the out-of-school motivational constructs may provide more robust evidence for the causal nature of the proposed relations among model constructs.

Research adopting the component theories of the trans-contextual model (Conner & Armitage, 1998; Vansteenkiste et al., 2004; Vansteenkiste, Lens, & Deci, 2006), and the trans-contextual model itself (Barkoukis et al., 2010), has extended them to test additional hypotheses. The trans-contextual model could, therefore, be considered a flexible framework for new models that broaden and deepen understanding of trans-contextual motivational effects. For example, an alternative model might include a set of hypotheses to account for the effect of autonomous motivation in out-of-school contexts on motivation in educational contexts. Hypotheses relating to such reciprocal effects of autonomous motivation across contexts could be based on the premises of Vallerand's (1997) hierarchical model, one of the models on which the trans-contextual model is based.

Vallerand (1997) proposed interplay among motivation, cognition, and emotional responses at the contextual level. Consistent with this proposal, autonomous forms of motivation in an out-of-school context may also contribute to the development of autonomous motivation toward activities in school. For example, autonomous motivation toward physical activities outside of school may not only be related to intentions toward, and actual engagement in, physical activities in future, as proposed in the trans-contextual model (Hagger et al., 2003), but also lead to increased autonomous motivation toward activities in PE lessons. The reciprocal pattern of effects may occur through the mechanism of matched

motivational schema across the PE and out-of-school contexts. We look to future research to explore possible extensions of the trans-contextual model to account for reciprocal relations across contexts, with panel designs as a potential means to test these effects.

The purpose of this section was to address some of the criticisms that have been levelled at the trans-contextual model in the past and provide theoretical and evidence-based responses. One of our key aims was to clarify what would constitute a null test or failed replication of the model through the rejection of the fundamental propositions and accompanying hypotheses of the model. Although a cursory glance of data from the current body of research on the trans-contextual model does not appear to have flagged any failed replications of the model, the research has not been subjected to a cumulative synthesis that accounts for methodological artifacts. We aimed to fill this void by conducting a meta-analysis of tests of the trans-contextual model, reported in the next section. In addition, we have provided a theoretical rationale in response to criticisms of the role of beliefs from the theory of planned behavior in the model and the causal ordering of the constructs in the model. In both cases, empirical support for these fundamental aspects of the model would be considerably strengthened with more intervention and experimental evidence, and we look to future research to augment the literature with such tests.

Synthesizing the Evidence: A Meta-Analysis

Given that the number of tests of the trans-contextual model is expanding, a cumulative synthesis of the results of these studies is a timely endeavor. There have been multiple tests of the model, the majority originating from our laboratories with a few independent tests conducted by other research groups. Based on conventional significance testing, these studies appear to corroborate the hypothesized pattern of relations among the model constructs across samples, some sample-specific variations notwithstanding. In fact, the latter variations may be attributable to methodological artifacts such as sampling and measurement error. Although the Method sections of these studies indicate that careful attention has been paid to precision in the development and administration of the measures of model to minimize measurement error and ensure adequate validity and reliability, the majority of tests have been conducted on relatively small samples that may lack representativeness and introduce systematic bias to the findings. We aimed, therefore, to conduct a quantitative synthesis of research adopting the trans-contextual model using meta-analytic techniques. The purpose of the analysis was to provide empirical support for the pattern of effects in the trans-contextual model across the literature while statistically controlling for sampling and measurement error. In addition to establishing the size and statistical significance of the effects among the model components across the literature, we aimed to conduct a path analysis to test the hypothesized pattern of relations among the trans-contextual model factors based on the meta-analytically derived correlation matrix (Hagger & Chatzisarantis, 2009b; Hagger, Chatzisarantis, & Biddle, 2002b; Viswesvaran & Ones, 1995).

Method

We conducted an electronic database (e.g., Medline, PsychINFO, ISI Web of Knowledge, Scopus) and manual literature search for articles from 2003, the year

of inception of the trans-contextual model, until January 31, 2014, that provided full or partial tests of the trans-contextual model. For the electronic databases, we used the following search strings to generate lists of potentially eligible articles that were then consolidated after removing duplicates: "trans-contextual," "trans-contextual," "theory of planned behavio*" with "self-determination theory," or "intrinsic motivation," "autonomy," or "autonomous motivation," and "self-determination theory" with "intention," or "attitude," or "social cogniti*." For the manual search, we examined the reference lists of all published articles on the trans-contextual model for any additional articles including unpublished manuscripts. In addition, we also made a concerted effort to track down and retrieve unpublished "fugitive" literature by contacting authors who have previously conducted research testing the model and requesting their unpublished data.

Studies were included if they provided a full empirical test of the trans-contextual model (i.e., included all the fundamental components of the model) or at least provided sufficient tests of the key trans-contextual aspect and component theories of the model. Although numerous studies that integrated components from self-determination theory and the theory of planned behavior were located (for further details, see Hagger & Chatzisarantis, 2009b), studies were eligible for the current analysis if they included a test of the fundamental trans-contextual effect proposed in the model. Studies must have included measures of autonomy support or autonomous motivation in an educational context and measures of autonomous motivation or variables from the theory of planned behavior toward activities in an out-of-school context as the minimum criteria for inclusion in the analysis. Studies also needed to contain sufficient statistical information such as zero-order correlation coefficients for correlational studies or cell means, standard deviations, *F* ratios, or effect size statistics (e.g., Cohen's *d*) for experimental or intervention studies to calculate an effect size. The literature search yielded 19 studies that met inclusion criteria. A flowchart of the search strategy and inclusion criteria is outlined in Figure S1 (available in the online journal) and the list of studies included in the analysis is provided in Appendix A (available in the online journal).

All but two of the studies were correlational in design with the majority (k = 13), adopting the three-wave prospective design of the original development article (Hagger et al., 2003). The vast majority (k = 17) focused on the PE and leisure-time physical activity contexts with two studies focusing on math education and homework contexts. Some studies included multiple samples resulting in maximum number of tests to 24. Some of the included studies also measured additional variables that were not part of the original conceptualization of trans-contextual model, such as satisfaction of basic psychological needs (Barkoukis et al., 2010; González-Cutre et al., 2014), psychological well-being (Bagøien, Halvari, & Nesheim, 2010; Standage et al., 2012), and perceived autonomy support from other sources like peers and parents (González-Cutre et al., 2014; Hagger et al., 2009).

Others did not include the full gamut of measures of constructs from the model such as those that excluded a measure of behavior (Lim & Wang, 2009) or omitted some of the components of the theory of planned behavior (Standage et al., 2012). However, all studies included tests of the fundamental

trans-contextual proposition of the model and at least a measure of intentions from the theory of planned behavior, the minimum specifications for inclusion in the analysis based on our a priori criteria. In addition, our test of model hypotheses based on the meta-analytically derived effect sizes would not be affected by the inclusion or exclusion of other variables because our analysis is based on the zero-order (i.e., unattenuated) correlations among constructs in the model, as required in meta-analytic syntheses.

We coded the measured variables to ensure there was satisfactory consistency in the measures of the appropriate constructs across studies. Specifically, we examined the content as well as the label of each construct (e.g., autonomous motivation, attitudes, etc.) to avoid the potential problems outlined by previous researchers regarding the problem of mixing variables with the same terminology or label but differing content within the analysis (Borenstein, Hedges, Higgins, & Rothstein, 2009; Hagger, 2014). We conducted a content analysis of the items used to tap each construct in the studies to evaluate the degree of consistency in the measures included in the final analysis. The constructs from self-determination theory were exclusively measured using previously validated measures of autonomy support in educational contexts (e.g., Hagger, Chatzisarantis, Hein, et al., 2007; Ryan & Connell, 1989) and the behavioral regulations from the perceived locus of causality (e.g., Markland & Hardy, 1997; Mullan, Markland, & Ingledew, 1997; Wang, Hagger, & Liu, 2009). This homogeneity in measurement made it relatively straightforward to establish equivalence in measures across studies as the questionnaire items used in the measures had similar definition and content. In most cases, differences were subtle pertaining mainly to the word order, use of synonyms, and behavior of interest.

As the key distinction in the self-determination theory and the trans-contextual model is between autonomous and controlled forms of motivation and to maintain a degree of parsimony within the tests of the model, we classified items tapping intrinsic motivation and identified regulation from the perceived locus of causality as measures of *autonomous* forms of motivation and items tapping introjected and external regulation as measures of *controlled* forms of motivation. Variables from the theory of planned behavior were exclusively measured using standardized direct measures of attitudes, subjective norms, perceived behavioral control, and intentions proposed by Ajzen (2003; Fishbein & Ajzen, 2009). There was no variation in the items used to tap these constructs other than minor alterations in wording in order to refer to the specific time, action, and context relevant to the study.

To provide external validity for our coding, we employed two experts in self-determination theory and social cognitive theories to independently classify the various measures into categories based on formal definitions of the constructs. In both cases, the experts' classification was a perfect match with the initial coding, including assignment of the measures to regulation types from the perceived locus of causality and their classification into *autonomous* and *controlling* categories. This outcome is unsurprising given the relative homogeneity in the instruments used and definitions provided for the key variables from the eligible studies included in our analysis. Summary statistics and characteristics of the studies

included in the analysis are included in Table S1 (available in the online journal).

Hunter and Schmidt's (1994) algorithms were adopted to correct the effect sizes for statistical artifacts. The Hunter and Schmidt approach is equivalent to a random effects model for meta-analysis and is considered optimal as it provides estimates that are generalizable to the population rather than to the extracted sample of effect sizes alone (Field, 2001; Hagger, 2006; Hunter & Schmidt, 2000). We corrected the effect sizes for both sampling and measurement error and used the zero-order correlation coefficient as the effect size metric. Studies reporting other metrics were converted into correlation coefficients. We corrected for measurement error using the reliability statistics, usually Cronbach's alpha coefficients, of the constructs used in each effect size calculation. Where reliability statistics were unavailable, measurement error was inferred from available attenuation statistics using a formula supplied by Stauffer (1996).

The analysis yields key summary statistics of the effects among the trans-contextual model variables: the "bare bones" correlation coefficient (r_{+}) for each effect, which represents the averaged effect size corrected for sampling error only, and the fully corrected correlation coefficient (r_{++}), which represents the averaged effect size corrected for both sampling and measurement artifacts. We also report the 95% confidence interval (CI_{95}) for each effect that summarize the distribution of scores about the averaged effect size and are used to provide a formal test of statistical significance for the effect. If the CI_{95} excludes the value of zero then it indicates a null finding for that effect in the sample of studies (Hunter & Schmidt, 1994).

The 90% credibility interval (CrI_{90}) is also reported and represents the distribution about the effect size in the population. This is typically used to evaluate the discriminant validity of the constructs (i.e., the hypothesis that population effect size is significantly different from unity). We also computed the fail-safe sample size (N_{FS}), which represents the number of studies with null findings required to reduce the effect size to a value that is trivial or not statistically significant (Rosenberg, 2005). Large values for N_{FS} (typically $5k + 10$) provide some evidence for the robustness of the effect size although we recognize the limitations of this measure. As an alternative, we planned to apply the regression techniques proposed by Sterne, Egger, and Smith (2001) in order to identify evidence of small study bias. These techniques are designed to identify asymmetry in the precision effect size funnel plots for each effect and signal whether larger effects tend to be found in smaller (less precise) studies. Such asymmetry is often thought to be indicative of publication bias, that is, the tendency for journals to favor statistically significant results.

We also report the proportion of the variance in the effect size attributed to the statistical artifacts relative to the overall variance across studies. If the vast majority of the variance in the effect size can be accounted for by statistical artifacts-Hunter and Schmidt (1994) recommend a 75% cutoff criterion-then the effect can be considered homogenous (i.e., free from bias other than sampling and measurement error). If the proportion of the variance falls below this criterion, then it is likely that there is substantial variance in the effect size across the studies that cannot be attributed to methodological artifacts and indicates the possibility that additional variance in the effect exists across the studies that can be attributed to

extraneous or moderator variables. There is also a formal statistical test for this proportion: Cochran's (1952) *Q* statistic, which equates to a chi-square distribution. Given that the number of studies (*k*) varies across meta-analyses, the *Q* statistic cannot be compared across analyses. An alternative is offered by the I^2 statistic and its CI_{95} (Higgins, Thompson, Deeks, & Altman, 2003). I^2 is an index of the true heterogeneity of the effect expressed as a percentage with 25%, 50%, and 75% representing low, medium, and high levels of heterogeneity, respectively (Higgins & Thompson, 2002). An I^2 value that exceeds 25% with large CI_{95}s and a lower bound that includes the value of zero is indicative of substantial heterogeneity in the effect (Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006) and should prompt a search for extraneous moderators of the effect.

Results

Corrected correlations and associated meta-analytic statistics for all the hypothesized effects in the trans-contextual model are summarized in Table 2. The effects representing the fundamental propositions in the model were all nonzero and statistically significant (i.e., exhibited CI_{95} values that excluded the value of zero). Specifically, the trans-contextual relationships between perceived autonomy support and autonomous motivation in both educational and out-of-school contexts and between autonomous motivation in both contexts and attitudes, perceived behavioral control, intentions, and behavior from the theory of planned behavior were statistically significant. However, it should be noted that the variance attributable to corrected artifacts fell below 75%, and the I^2 statistic indicated high levels of heterogeneity, in all cases. This finding prevented us from applying Sterne et al.'s (2001) regression analyses to the effect sizes to test for small study bias because high degrees of heterogeneity render the interpretation of the analyses problematic (Hagger & Chatzisarantis, 2014; Sterne et al., 2001). The lack of homogenous effects indicated the possible influence of extraneous moderator variables. The small sample size precluded a meaningful search for moderators, so the interpretation of these results should be made with the caveat that substantial unattributed variation exists in these effects. We will discuss later how we dealt with this problem in subsequent multivariate analyses based on these correlations.

We tested the hypotheses of the trans-contextual model by using the corrected correlation matrix as input for a path analytic model that specified the motivational sequence proposed in the model (see Figure 1). We used the EQS (Version 6.1) program to estimate the model and employed a maximum likelihood estimation method with simultaneous process to evaluate the fit of the proposed model specified by a series of structural equations with the meta-analytic data. The average sample size across the studies was used as the input sample size. The model satisfied multiple criteria for adequate model fit with multiple goodness-of-fit indices in keeping with Hu and Bentler's (1999) recommended cutoff criteria (Table 3). Standardized beta weights for the structural model are given in Figure 2.

In accordance with the fundamental model hypothesis (H1) and Proposition 1, perceived autonomy support predicted autonomous motivation in educational contexts. Autonomous motivation in educational contexts significantly predicted autonomous motivation in out-of-school contexts, consistent with fundamental

TABLE 2

Results of meta-analysis of the trans-contextual model

					CI_{95}		CrI_{90}							I^2 CI_{95}	
Effect	*k*	*n*	r_+[a]	r_{++}[b]	LB	UB	LB	UB	*SD*	*SE*	N_{FS}	Variance[c]	I^2	LB	UB
Perceived autonomy support (educational context)–Autonomous motivation (educational context)	22	6,503	.36	.42	.37	.47	.25	.59	.10	.03	4,320	27.88**	75.14	62.40	83.56
Perceived autonomy support (educational context)–Autonomous motivation (out-of-school context)	21	5,749	.24	.29	.20	.37	.01	.58	.18	.04	1,690	13.21**	89.58	85.48	92.53
Perceived autonomy support (educational context)–Attitude	17	4,369	.23	.26	.18	.33	.01	.50	.15	.04	969	16.95**	88.51	83.16	92.15
Perceived autonomy support (educational context)–Subjective norm	15	3,834	.15	.19	.08	.30	−.14	.52	.20	.06	402	13.91**	92.90	89.89	95.01
Perceived autonomy support (educational context)–PBC	17	4,369	.15	.17	.09	.25	−.09	.43	.16	.04	382	17.18**	84.05	80.80	91.28
Perceived autonomy support (educational context)–Intention	21	6,009	.18	.21	.16	.26	.05	.37	.10	.03	1,023	31.33**	76.09	63.63	84.27
Perceived autonomy support (educational context)–Behavior	21	5,802	.14	.17	.10	.25	−.09	.44	.16	.04	718	17.27**	85.87	79.69	90.17
Autonomous motivation (educational context)–Autonomous motivation (out-of-school context)	21	8,204	.46	.56	.48	.63	.28	.84	.17	.04	7,892	10.66**	92.74	90.21	94.61
Autonomous motivation (educational context)–Attitude	18	5,022	.26	.32	.25	.39	.09	.55	.14	.04	1,502	19.90**	82.77	73.91	88.62
Autonomous motivation (educational context)–Subjective norm	16	4,487	.10	.14	.04	.24	−.16	.43	.18	.05	194	17.44**	84.92	76.93	90.14

(continued)

TABLE 2 (CONTINUED)

Effect	k	n	r_+[a]	r_{++}[b]	CI_{95} LB	CI_{95} UB	CrI_{90} LB	CrI_{90} UB	SD	SE	N_{FS}	Variance[c]	I^2	I^2 CI_{95} LB	I^2 CI_{95} UB
Autonomous motivation (educational context)–PBC	18	5,022	.16	.20	.13	.27	−.02	.43	.14	.04	377	22.76**	79.09	67.61	86.50
Autonomous motivation (educational context)–Intention	22	6,662	.26	.31	.25	.37	.09	.53	.13	.03	2,334	20.19**	81.92	73.58	87.63
Autonomous motivation (educational context)–Behavior	22	8,578	.21	.27	.20	.33	.04	.49	.14	.03	1,664	18.16**	84.85	78.26	89.44
Autonomous motivation (out-of-school context)–Attitude	17	4,369	.50	.60	.54	.67	.41	.80	.12	.03	5,242	22.43**	89.05	84.05	92.48
Autonomous motivation (out-of-school context)–Subjective norm	15	3,834	.19	.26	.12	.40	−.16	.68	.26	.07	531	10.71**	92.75	89.65	94.92
Autonomous motivation (out-of-school context)–PBC	17	4,369	.40	.51	.41	.60	.19	.82	.19	.05	2,660	12.19**	89.01	83.98	92.46
Autonomous motivation (out-of-school context)–Intention	19	5,093	.46	.56	.51	.61	.42	.70	.08	.02	5,349	38.52**	72.27	56.12	82.48
Autonomous motivation (out-of-school context)–Behavior	21	8,204	.29	.37	.31	.43	.17	.57	.12	.03	3,374	21.95**	83.34	75.64	88.60
Attitude–Subjective norm	16	4,487	.29	.38	.24	.52	−.08	.84	.28	.07	1,736	7.97**	94.99	93.18	96.31
Attitude–PBC	18	5,022	.47	.57	.54	.69	.16	.98	.25	.06	5,447	5.84**	94.63	92.78	96.00
Attitude–Intention	18	5,022	.58	.68	.63	.73	.53	.83	.09	.02	9,805	25.13**	83.55	75.22	89.08
Attitude–Behavior	18	5,022	.33	.42	.33	.50	.14	.69	.17	.04	3,061	14.94**	88.35	83.11	91.97
Subjective norm–PBC	16	4,487	.33	.46	.33	.58	.06	.85	.25	.06	2,250	12.04**	93.12	90.34	95.09
Subjective norm–Intention	16	4,487	.32	.42	.29	.55	.01	.83	.25	.07	2,087	10.33**	93.88	91.51	95.58

(continued)

TABLE 2 (CONTINUED)

Effect	k	n	r_+[a]	r_{++}[b]	CI_{95} LB	CI_{95} UB	CrI_{90} LB	CrI_{90} UB	SD	SE	N_{FS}	Variance[c]	I^2	I^2 CI_{95} LB	I^2 CI_{95} UB
Subjective norm–Behavior	16	4,487	.22	.31	.18	.45	−.12	.74	.26	.07	1,063	10.23**	92.93	90.05	94.97
PBC–Intention	18	5,022	.51	.63	.50	.76	.17	.99	.28	.07	6,805	4.71**	95.97	94.73	96.93
PBC–Behavior	18	5,078	.33	.43	.32	.53	.07	.78	.21	.05	2,683	10.83**	91.67	88.33	94.05
Intention–Behavior	21	5,961	.47	.60	.51	.69	.27	.92	.20	.05	9,322	10.30**	93.11	90.76	94.87
Past behavior–Perceived autonomy support (educational context)	17	3,806	.15	.18	.11	.29	−.10	.47	.17	.05	437	17.07**	85.14	77.60	90.14
Past behavior–Autonomous motivation (educational context)	15	3,422	.22	.29	.20	.39	.01	.58	.17	.06	607	20.33**	82.09	71.60	88.71
Past behavior–Autonomous motivation (out-of-school context)	15	3,369	.31	.40	.30	.50	.10	.69	.18	.05	1,321	17.52**	85.73	78.01	90.75
Past behavior–Attitude	12	2,483	.41	.44	.32	.56	.10	.77	.20	.06	1,393	8.39**	92.80	89.27	95.18
Past behavior–Subjective norm	12	2,483	.29	.35	.23	.46	.04	.65	.19	.06	566	17.25**	87.11	79.31	91.97
Past behavior–PBC	12	2,483	.30	.33	.20	.47	−.05	.72	.23	.07	679	8.81**	92.54	88.82	95.02
Past behavior–Intention	14	3,093	.50	.54	.44	.65	.23	.86	.19	.05	3,554	8.01**	93.11	90.10	95.21
Past behavior–Behavior	14	3,093	.50	.59	.48	.69	.27	.91	.20	.05	3,617	10.74**	92.31	88.81	94.72

Note. PBC = perceived behavioral control; k = number of effect sizes contributing to averaged corrected correlation from the meta-analysis; n = total sample size across studies contributing to correlation; CI_{95} = 95% confidence intervals for averaged correlation corrected for sampling error only; CrI_{90} = 90% credibility interval for averaged correlation corrected for measurement error; LB = lower bound of confidence/credibility interval; UB = upper bound of confidence/credibility interval; SD = standard deviation of averaged correlation corrected for sampling and measurement error; SE = standard error of averaged correlation corrected for sampling and measurement error; N_{FS} = fail-safe N; I_2 = I-square index of heterogeneity.

[a]Averaged correlation corrected for sampling error only.

[b]Averaged correlation corrected for sampling error and measurement error.

[c]Variance accounted for by statistical artifacts of sampling and measurement error, significance levels derived from Cochran's Q test.

TABLE 3

Goodness-of-fit statistics for multisample path analytic models testing for invariance across models based on the mean correlations and models based on the upper and lower confidence interval limits

Model	χ^2	p^a	*df*	CFI	IFI	RMSEA	SRMSR	Δdf	$\Delta\chi^2$	p^b
Model based on mean corrected correlations	14.01	.081	8	.99	.98	.050	.025	—	—	—
Model based on upper CI_{95} limit	28.39	<.001	8	.99	.94	.092	.032	—	—	—
Model based on lower CI_{95} limit	7.12	.523	8	1.00	1.00	.000	.002	—	—	—
Invariance tests										
Upper limit model										
Baseline	42.40	<.001	16	.99	.96	.029	.029	—	—	—
Constrained model	57.24	.047	41	.99	.98	.064	.064	25	14.84	.945
Lower limit model										
Baseline	21.14	.173	16	1.00	.99	.033	.022	—	—	—
Constrained model	57.24	.047	41	.99	.99	.036	.064	25	36.10	.071

Note. χ^2 = goodness-of-fit chi-square statistic; *df* = degrees of freedom for chi-square statistic; CFI = comparative fit index; IFI = incremental fit index; RMSEA = root mean square error of approximation; SRMSR = standardized root mean square of residuals; Δdf = incremental change in degrees of freedom; $\Delta\chi^2$ = incremental change in goodness-of-fit χ^2; CI_{95} = 95% confidence intervals for model parameter estimates.

[a]Probability of goodness-of-fit chi-square statistic.

[b]Probability for incremental change in goodness-of-fit chi-square statistic.

model hypothesis (H2) and Proposition 2. Autonomous motivation in education also mediated the effects of perceived autonomy support on autonomous motivation in out-of-school contexts (direct effect, $\beta = .05$, $p = .334$; indirect effect, $\beta = .18$, $p < .001$; total effect, $\beta = .24$, $p < .001$), consistent with fundamental model hypothesis (H3) and Proposition 2. Consistent with hypotheses from Proposition 3, autonomous motivation in out-of-school contexts significantly predicted the attitude (H6), subjective norm (H7), and perceived behavioral control (H8) constructs from the theory of planned behavior. Attitudes (H9) and perceived behavioral control (H11) significantly predicted intentions, but there was no significant effect of subjective norms on intentions (H10), so this hypothesis was rejected.

Importantly, there was a significant indirect effect of autonomous motivation in out-of-school contexts on intentions (H4) that was decomposed into two indirect effects via the mediation of attitudes (H12; $\beta = .17$, $p < .001$) and perceived behavioral control (H14; $\beta = .13$, $p < .001$), both of which accounted for the substantive proportion of the total effect ($\beta = .40$, $p < .001$). There was no significant indirect effect via subjective norms leading to a rejection of this H13 ($\beta = .01$, $p = .450$). Intentions (H15) and perceived behavioral control (H16) significantly

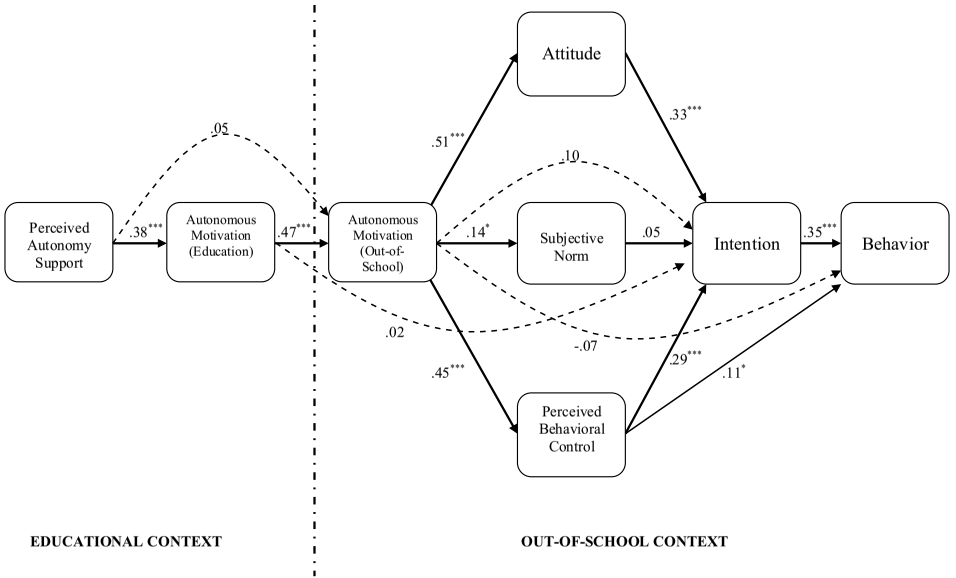

FIGURE 2. *Meta-analytic path analysis of the trans-contextual model.*

Note. Solid unidirectional arrowed paths represent statistically significant relations among the model variables, broken unidirectional arrowed paths represent nonsignificant effects. Paths freely estimated in the model but not depicted in diagram: perceived autonomy support (education) → behavior (β = .01, p = .956); perceived autonomy support (education)→intention (β = −.02, p = .699); autonomous motivation (education) → behavior (β = .07, p = .199); past behavior → perceived autonomy support (education; β = .18, p < .001); past behavior → autonomous motivation (education; β = .22, p < .001); past behavior → autonomous motivation (out-of-school; β = .26, p < .001); past behavior → attitude (β = .24, p < .001); past behavior → subjective norm (β = .29, p < .001); past behavior → perceived behavioral control (β = .15, p = .005); past behavior → intention (β = .24, p < .001); indirect effect, past behavior → intention (β = .30, p < .001); total effect, past behavior → intention (β = .54, p < .001); past behavior → behavior (β = .37, p < .001); indirect effect, past behavior → behavior (β = .21, p < .001); total effect, past behavior → behavior (β = .59, p < .001). Errors in prediction (ε) and R^2 values freely estimated but not included in diagram: behavior, ε = .72, R^2 = .47; intention, ε = .62, R^2 = .62; attitude, ε = .77, R^2 = .41; subjective norms, ε = .93, R^2 = .14; perceived behavioral control, ε = .85, R^2 = .28; autonomous motivation (out-of-school), ε = .79, R^2 = .38; autonomous motivation (education), ε = .88, R^2 = .22; perceived autonomy support, ε = .98, R^2 = .03. Correlated errors among predictor variables in the model (ϕ) freely estimated but not included in diagram: attitude–subjective norms, ϕ = .23, p < .001; attitude–perceived behavioral control, ϕ = .36, p < .001; attitude–subjective norms, ϕ = .37, p < .001. *p < .05. **p < .01. ***p < .001.

and directly predicted behavior as expected. The indirect effects of attitudes (H17; $\beta = .11$, $p < .001$) and perceived behavioral control (H19; $\beta = .10$, $p < .001$) on behavior mediated by intentions were significant, but the indirect effect for subjective norms (H18; $\beta = .02$, $p = .209$) was not significant, leading us to reject our hypothesis. Examining the indirect effects via the mediation of the entire motivational sequence, autonomous motivation in out-of-school contexts was significantly related to behavior (H5; $\beta = .19$, $p < .001$), confirming this fundamental hypothesis. There were also significant indirect effects of perceived autonomy support on intentions (H20; $\beta = .10$, $p < .001$) and behavior (H21; $\beta = .05$, $p = .035$), and significant indirect effects of autonomous motivation in educational contexts on intentions (H22; $\beta = .19$, $p < .001$) and behavior (H23; $\beta = .06$, $p = .034$), via the motivational sequence proposed in the trans-contextual model, confirming these fundamental hypotheses. The model explained 61.56% and 47.00% of the variance in intentions and behavior, respectively.[1] The results of the meta-analytically derived path analysis corroborate the proposed pattern of relations among the trans-contextual model components and provide support for the mediational processes in the hypothesized motivational sequence.[2]

One of the limitations of the path analysis was that the input matrix of correlations derived from the meta-analysis included effect sizes with substantial variance unaccounted for by the methodological artifacts of sampling and measurement error. This is a recognized limitation of regression and path analyses based on meta-analytic correlations (Viswesvaran & Ones, 1995). Viswesvaran and Ones (1995) provide a method to check whether the heterogeneity associated with the input correlations does not adversely affect the pattern of relations estimated in path models based on such correlations. The method requires the specification of two alternative models using the upper and lower bound values of the CI_{95} values about the meta-analytic correlations as the input matrix. Formal comparisons are then made between the parameter estimates from these models with those from the model based on the averaged corrected correlations.

Applying this method to our current analysis, we estimated the two models using upper and lower bound CI_{95} values of the corrected correlations and found that the models exhibited adequate fit with these data. This process was followed up by the estimation of two multigroup path analyses in which the parameter estimates from the models based on the upper and lower CI_{95} values of the corrected correlation matrix were constrained to be equal to the parameter estimates from the model based on the averaged corrected correlation matrix. Fit indexes for the models based on the upper and lower bound of the CI_{95} values and for the baseline and constrained models from the multigroup analysis are given in Table 3 (see models based on CI_{95} limits). Results revealed minimal deviation in model fit as indicated by nonsignificant differences in the goodness-of-fit chi-square across the baseline and constrained models and marginal differences in the incremental fit indexes (Cheung & Rensvold, 2002). Based on these criteria, we found that there was unsubstantial variation in model fit across the baseline and constrained invariance models for the upper and lower CI_{95} values for the input correlation matrix (see Table 3). These results indicate that heterogeneity in the input matrix for the path analysis had minimal effect on the pattern and size of the relations among the variables specified in the trans-contextual model.

Discussion

Overall, results from the current meta-analysis provide robust evidence to support the proposed relationships among the constructs in the trans-contextual model. Specifically, the path analysis based on the meta-analytically derived correlations among model constructs across multiple studies corroborates the hypothesized pattern of relationships in the model. In particular, our analysis indicates that the hypothesized relations among the variables outlined in the model propositions, and considered fundamental to the decision to accept or reject the model, were statistically significant with medium-to-large effect sizes. Results demonstrate that the motivational sequence that charts the effects of distal factors reflecting teachers' support for autonomy in educational contexts (i.e., perceived autonomy support) on more proximal predictors of engagement in educational activities in an out-of-school context (e.g., autonomous motivation, intentions) holds across samples and studies. Results also show that the heterogeneity in the effect sizes across studies does not substantially affect model relationships.

Findings of the meta-analytic path analysis provide evidence for the mechanisms underpinning model propositions and hypotheses across multiple studies. Specifically, the effect of students' perceived autonomy support by teachers on autonomous motivation in education lends support to the proposition that providing autonomy support will engender greater internalization of activities by students and lead to a greater tendency for them to perceive the activities as autonomous. Support for the trans-contextual link for autonomous motivation indicates that the motivational scripts or schema developed in the educational context will be consistent with those for related activities in an out-of-school context. The process behind this link may also be through internalization of the educational activities and their perceived propensity to satisfy psychological needs and may lead an individual to actively pursue similar need-satisfying behaviors in other contexts. Internalization may, therefore, be a mediator of the trans-contextual effect.

Furthermore, the direct effects of autonomous motivation on intentions and behavior were small when compared to the indirect effects of these variables mediated by the proximal predictors of the outcome variables from the theory of planned behavior. The pattern of effects provides evidence for another key mechanism in the model; autonomous motivation for engaging in activities outside of school predicts future intentions and behavior through the salient factors related to decision making, namely, attitudes and perceived behavioral control. The role of subjective norms as a mediator of this effect was modest in comparison with the other social cognitive predictors. The weak effect of subjective norms on intentions is consistent across multiple behaviors and contexts (see Armitage & Conner, 2001). As noted earlier, subjective norms may reflect both social pressures and internalized beliefs of others with respect to engaging in the behavior. The likely diversity may introduce a substantive degree of variability in the construct, thus lowering its value in transmitting autonomous motivation to intentions and behavior. Overall, current results provide support for the transfer of autonomous motivation across contexts and, most important, explain a substantial proportion of the variance in intentions and prospectively measured behavior in out-of-school contexts.

Limitations

Although the current analysis provides cumulative support for the propositions of the trans-contextual model, it would be remiss not to identify and discuss potential limitations of the analysis and these data. Limitations include the relatively small sample of studies, the presence of substantial heterogeneity in the effect sizes, the predominance of correlational designs, the overreliance on homogenous self-report measures of model constructs, a disproportionate number of studies testing the effects in PE and leisure-time contexts, and the majority of tests of the model originating from one research group. We deal with each of these limitations in turn and evaluate extent to which they may temper conclusions drawn from the data.

Although the current analysis provides robust evidence that the proposed model relationships exist in the population and leads us to reject the hypothesis of a null effect in each case, it must be recognized that there is significant variation in terms of the size of the effects across studies. This heterogeneity indicates the likelihood that other extraneous variables exist that affect the hypothesized relationships in the model. Although the sample size of studies included in the current analysis was sufficient to conduct the overall analysis, it was not large enough to segregate into meaningful groups for separate moderator analyses. Although there are no explicit guidelines as to a minimum number of studies required for a meta-analysis, very small sample sizes (e.g., $k < 10$) are regarded as insufficient to conduct a meta-analysis as the averaged effects lack meaning and are oversensitive to change caused by one or two effects in the sample. To speculate, potential moderator variables of the effects in the current study may take the form of demographic factors (e.g., nationality, gender, age) or sample-level differences in behavior type or psychological factors such as general causality orientations (Deci & Ryan, 1985a; Hagger & Chatzisarantis, 2011). Clearly, resolution lies in further tests of the model in diverse samples representative of these moderator groups to replicate the hypothesized relations of the trans-contextual model and identify or eliminate such factors as moderators.

We also acknowledge that all but two of the studies included in the analysis were correlational in design. Much has been said of the proliferation of correlational tests of psychological theories in educational and other contexts and the implications this has for the inference of causality (Biddle & Marlin, 1987; Hagger & Chatzisarantis, 2009a; McDonald, 1997; Rutter, 2007). It is important, therefore, to acknowledge that the proposed flow of effects from one context to another in the causal direction specified in the model is implied by theory alone, not by the data. This caveat means that models specifying paths in the opposite direction to those proposed in the trans-contextual model (or even paths that were reciprocal in nature) would be empirically verified, even though such paths may not be specified theoretically.

The two intervention studies included in the current sample manipulated autonomy support in an education context and noted observed changes in autonomous motivation, the theory of planned behavior variables, and actual behavior in an out-of-school context (Chatzisarantis & Hagger, 2009; Yli-Piipari, Layne, & Irwin, 2014). These tests provide better support for the proposed directional

relations among the variables. Nevertheless, more experimental and intervention research of this nature is required to provide further validation of the causal direction of model relationships.

A further problem with the current sample of studies is the exclusive reliance on self-report measures of key constructs and behavioral variables from the trans-contextual model and the substantial degree of homogeneity in the measures. The motivational literature is replete with research adopting self-report measures, and there is substantial evidence that individuals can reliably report their internal motivational and attitudinal states. There is, however, a contention that an over-reliance of self-report measures has the propensity to introduce an element of measurement error to results and bias relations among constructs downward (Hagger & Chatzisarantis, 2009a). Furthermore, studies adopting the trans-contextual model have tended to adopt a narrow set of measures developed from the same original instruments (e.g., Ajzen, 2003; Markland & Hardy, 1997; Ryan & Connell, 1989). Such measurement homogeneity is advantageous in the current meta-analytic synthesis because it minimizes measurement variability that could be introduced by use of dissimilar measures to tap model constructs. However, it is also a limitation in that it represents a barrier to the generalizability of findings to other domains. A recommended resolution is that researchers should seek to adopt alternative measures of the psychological constructs, and more objective measures of behavioral outcomes, in order to minimize the systematic error introduced by the use of homogenous, self-report measures.

A substantial problem, noted previously, in the current sample of studies is the near-exclusive focus on the PE and leisure-time physical activity contexts. This focus seriously compromises our ability to generalize the findings of the current meta-analysis to contexts in other educational domains. Although two studies in the current analysis focused on other domains (math activities and homework contexts) and demonstrated patterns of effects similar to those observed in the studies in the PE and physical activity contexts, we did not have sufficient data to make a formal comparison of model effects across educational domains in a moderator analysis. The current analysis, therefore, precludes an unequivocal statement on the generalizability of model effects to other domains. We cannot rule out the possibility that the pattern of effects observed in the current meta-analytic path analysis is specific to this domain, our conceptually driven hypotheses relating to the generalizability of the proposed pattern of effects notwithstanding. The lack of studies represents a gap in the literature and indicates the need for additional tests of the model in multiple educational domains.

Finally, it should be noted that just over half of the studies included in the meta-analysis (k = 10) emanated from our research group. This exclusivity has the propensity to introduce bias in the findings as the trans-contextual model originated from this group. However, it is important to stress that each individual test of the theory adopted a rigorous, hypothesis-driven approach testing the fit of a proposed set of relations based on theory against observed data from numerous samples. In addition, it should also be noted that although studies from our group formed the majority, a substantive number of studies emanating from other groups that report similar conclusions to ours was included (e.g., Lim & Wang, 2009; Shen, McCaughtry, & Martin, 2007; Standage et al., 2012). One of the problems of the

current analysis is that there were insufficient effect sizes from other research groups to conduct a moderator analysis testing whether the source of these data (Hagger vs. other) could account for additional variance observed in the effect sizes across the studies in the meta-analysis. Such an analysis would be necessary to confirm our contention that the originating research group was not a source of bias in trans-contextual model effect sizes across studies and should be an avenue for future research.

Gaps in the Model and Priorities for Future Research

Despite an increasing body of literature that lends increasing support for the trans-contextual model in education and out-of-school contexts, questions and problems remain. Two important elements largely absent from current literature are the lack of experimental and intervention research and the need for greater diversity in the educational contexts and associated out-of-school behaviors studied. The lack of data on these elements limits the inference of causality and generalizability of the proposed pattern of effects in the trans-contextual model. In this section, we deal with each of these limitations and propose priorities for future research to address these gaps.

Experimental and Intervention Research

One of the main limitations of the literature on the trans-contextual model is the preponderance of studies adopting prospective correlational designs. A possible reason for the prevalence of this design is that the original test of the model adopted a clearly defined three-wave correlational design using previously validated measures (Hagger et al., 2003), and subsequent tests have tended to adhere to this original design. However, although the variables are temporally ordered in this prospective design, the correlational data generated mean that causal effects of the proposed relationships in the model and actual change in dependent variables as a result of the key predictor variables in the model cannot be inferred. Researchers are, therefore, encouraged to adopt intervention and experimental designs that will change model constructs and examine their effects on the target outcome variables. Such tests are important if the causal nature of the proposed pattern of effects in the model is to be confirmed.

Increasing Diversity

A further limitation of the current literature on the trans-contextual model is the predominance of studies conducted in the PE and leisure-time physical activity contexts and the lack of studies conducted in other educational domains and associated out-of-school behaviors. Although the promotion of leisure-time physical activity through increasing motivation in PE contexts is an extremely worthwhile endeavor, we have proposed that the trans-contextual model is generalizable to multiple educational domains (Hagger & Chatzisarantis, 2012). This proposition is in keeping with the underlying assumptions of the component theories of the model. Self-determination theory and the theory of planned behavior have been applied and tested in multiple and diverse behavioral contexts with the basic tenets of the theories supported (Armitage & Conner, 2001; Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Su & Reeve, 2011). Although there have

been attempts to apply the trans-contextual model in different contexts, they are still in the extreme minority.

For example, a recent unpublished data set obtained in the course of data collection for the current meta-analysis tested model effects in the domain of math education (Hagger, Sultan, et al., 2015). Solving math problems in the classroom was the target activity in the educational context and math homework engagement and performance were the out-of-school dependent variables. The model has also been tested in noneducational contexts such as occupational settings and rehabilitation from occupational injury (e.g., Chan & Hagger, 2012a, 2012b). We look to future research to provide replications of studies on the trans-contextual model in diverse educational and noneducational domains. This will provide important data to support or disconfirm the generalizability hypothesis.

Implications for Practice

Evidence from research adopting the trans-contextual model suggests that fostering autonomous motivation toward activities in a PE context may be an important means to promote autonomous motivation, and actual behavior, with respect to related activities (i.e., leisure-time physical activity) in out-of-school contexts. Social agents, and the learning climate they foster in PE contexts, are the conduits by which autonomous motivation is promoted. Cheon et al. (2012) have identified a number of key behaviors typically displayed by autonomy-supportive teachers in PE contexts, including provision of meaningful rationale, encouragement to boost student engagement, avoidance of directives and commands, acknowledgement of the pupil's perspective through empathic statements, and offering hints on how to make progress on a task. These behaviors can be promoted by developing training protocols that provide teachers with instruction on the specific techniques and behaviors that support autonomy in students.

The protocols should include instruction, worked examples, and role-play, with an accompanying training manual to ensure quality and consistency in the techniques adopted and behaviors displayed across teachers (McLachlan & Hagger, 2010b; Reeve & Jang, 2006). Cheon et al. (2012; Cheon & Reeve, 2013), for example, have developed an autonomy-supportive training program that provides explicit instructions and training materials to engender autonomy-support in physical educators. We expect such training programs to have potential in developing autonomous motivation toward in-school and out-of-school activities in multiple educational domains consistent with the trans-contextual model. However, research to corroborate the effectiveness of such programs within interventions guided by the model is needed.

Given evidence from the model indicating that autonomous motivation, attitudes, and perceived behavioral control are significant predictors of intentions to engage in related behaviors, such as leisure-time physical activity, in out-of-school contexts, interventions may also target these variables. There are two ways this can be achieved according to the trans-contextual model. First, interventions might seek to train social agents relevant to students in out-of-school contexts, particularly parents and caregivers, to provide autonomy support for out-of-school activities. Such interventions may be effective in changing autonomous motivation and salient behavioral outcomes in the out-of-school context. Research has

provided preliminary support for the potential effectiveness of such interventions. Hagger et al. (2009), for example, found significant relationships between perceived autonomy support from parents and autonomous motivation, intentions, and actual behavior toward activities in the out-of-school context. The content of autonomy-support training programs for parents would be similar to that provided to teachers (McLachlan & Hagger, 2010b; Reeve & Jang, 2006). The delivery of the training programs to parents, however, will present considerable challenges to interventionists because access to parents is likely to be more limited relative to access to teachers. Again, intervention research based on the model is needed to confirm the efficacy of programs targeting this route to changing behavior in out-of-school contexts, and such research is needed in multiple domains to test the generalizability of the effects.

Second, interventions could use persuasive communication to promote positive attitudes and perceptions of control toward out-of-school educational activities and, thus, may boost or augment intentions independent of the autonomy support provided in educational contexts. Communications to change social-cognitive factors have been used in a number of interventions based on the theory of planned behavior (e.g., Hardeman et al., 2002). The persuasive communication could be delivered by encouraging children to visit online learning materials that accompany their homework assignments. These proposed strategies may pave the way for interventions using factorial designs to evaluate the independent effects of autonomy support and persuasive communications targeting social cognitions on engagement in out-of-school education-related activities.

Conclusion

In the decade since its inception, the trans-contextual model has provided a framework to understand the processes by which students' perceived autonomy support and autonomous motivation toward activities in an educational context are related to autonomous motivation toward related activities in an out-of-school context. It also charts the relationships between autonomous motivation toward activities in the out-of-school context and the belief-based constructs that precede engagement in the activities in the future, intentions to engage in the activities, and actual behavior. In the current article, we aimed to clarify the key hypotheses of the model and address some of the outstanding conceptual issues. We have presented a series of propositions that outline the not only fundamental and peripheral hypotheses of the model but also the criteria that would lead to the rejection or a failed replication of the model.

We have also critically reviewed the relevance of the belief-based decision making variables from the theory of planned behavior and the ordering of the constructs in the model. We presented a meta-analysis of the growing number of empirical tests of the model. The analysis provided qualified support for model propositions and hypotheses. However, the analysis also revealed substantial heterogeneity in model effects, suggesting that considerable unattributed variance exists in the effects pointing to the presence of moderators. The analysis also indicated that the vast majority of tests of the model have been conducted in the PE and leisure-time physical activity contexts. Based on the current review and synthesis, future research needs to provide further replications of the model in

homogenous samples that may shed light on potential moderators, develop experimental and intervention tests of the model, and test the model in more diverse educational domains to support its generalizability.

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[1]The percentage variance values are inclusive of the effects of past behavior. The inclusion of past behavior in the current model is important because it illustrates the extent to which past behavior accounts for unique variance in the outcome measures (Ajzen, 2002; Ouellette & Wood, 1998). Such variance is independent of the variance accounted for by hypothesized model predictors and may capture unmeasured variance in the outcome variables attributable to previous decision making or nonconscious, unintended, impulsive influences on these variables (Hagger et al., 2006a). If past behavior attenuated all effects of the social-cognitive and motivational constructs in the model, it would render the model redundant, as the capacity of the model to explain unique variance in the outcome variables would be nil (Hagger, Rebar, Mullan, Lipp, & Chatzisarantis, 2015; Rebar, Loftus, & Hagger, 2015). It is therefore essential that all effects in the model are evaluated when controlling for past behavior. Omitting past behavior resulted in values of 57.36% and 36.64% for variance explained in intentions and behavior, respectively. These figures represent substantial proportions of variance in the dependent variables explained by the trans-contextual model when omitting the statistical control for past behavior. To allow comparisons of model effects with and without the statistical control of past behavior, parameter estimates for both models are presented in Table S2 (available in the online journal).

[2]It is important to note that we included a number of correlations among the errors in prediction of the constructs contained in the path analytic model that are not presented in the diagram. Specifically, we correlated the error terms associated with the attitude, subjective norm, and perceived behavioral control variables from the theory of planned behavior. According to Ajzen (1991), these variables, although distinct, are not orthogonal and are likely to be intercorrelated. The inclusion of correlated errors in prediction is, therefore, standard practice in empirical texts of the theory of planned behavior (e.g., Chatzisarantis, Hagger, Smith, & Phoenix, 2004; Hagger et al., 2002b; Orbell, Hagger, Brown, & Tidy, 2006). These correlations reflect the shared variance among these constructs not shared with intentions and indicate that the belief systems that underlie these factors have some level of commonality. However, this level of empirical overlap notwithstanding, these constructs still retain a satisfactory degree of discriminant and predictive validity in this study and elsewhere (Hagger & Chatzisarantis, 2005).

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