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Interpersonal Supports for Basic Psychological Needs and Their Relations With Motivation, Well-Being, and Performance: A Meta-Analysis

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People's motivational processes, well-being, and performance are likely to be facilitated through the support of others. Self-determination theory argues that interpersonal supports for autonomy, competence, and relatedness are crucial to achieve these outcomes. In the present study, we provide a comprehensive examination of this formulation based on a meta-analytic database consisting of 4,561 effect sizes from 881 independent samples (N = 443,556). Our results indicate that supports for autonomy, competence, and relatedness were strongly positively related with the satisfaction of these basic needs and strongly negatively related to their frustration. Interpersonal supports for basic needs were strongly positively related with subjective well-being and exhibited small to moderate positive associations with performance. Moderation analyses showed general stability of effects across cultures, although correlations of autonomy support to autonomous motivation weakened as a function of individualism. The opposite pattern was observed for the correlation between relatedness support and intrinsic motivation. Some effects also declined as a function of sample age and lag in measurements. We also find that competence- and relatedness-supportive behaviors explained incremental variance in basic need satisfaction even after controlling for the more established effects of autonomy support. In addition, lateral need supports explained incremental variance in basic need satisfaction after controlling for vertical sources of support. In sum, our results are consistent with the premise that to support optimal motivation, well-being, and performance, a broad set of behaviors that nurture all three basic needs, together with different sources of interpersonal support, should be considered to yield the most benefit.

Keywords: self-determination theory, meta-analysis, autonomy support, competence support, relatedness support

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Supportive behaviors that unfold within interpersonal relationships, whether from a parent, teacher, boss, colleague, clinician, coach, friend, or intimate partner, are core determinants of a recipient's motivation, well-being, and performance. Positive feedback from a teacher can build a student's sense of mastery that gratifies and sustains effort (R. M. Ryan & Deci, 2017). An expression of trust from a manager can build a worker's initiative and proactivity (Bindl & Parker, 2011). Expectations established by a coach can

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prompt an athlete's engagement and striving for growth (Edmunds et al., 2008).

The effect of such supportive behaviors on motivation, behavior, and wellness has been a topic of research for decades within literature focusing on self-determination theory (SDT; R. M. Ryan & Deci, 2000, 2017), which has, to date, largely centered on interpersonal behaviors that facilitate the satisfaction of basic psychological needs for autonomy, competence, and relatedness. These needs are deemed "basic" insofar as their satisfaction is considered essential for ongoing psychological growth and well-being (Deci & Ryan, 2000). *Autonomy* involves experiencing one's behavior as self-endorsed and volitional. *Competence* involves feeling effective in one's environment, and *relatedness* involves a feeling of care and connection with others (Vansteenkiste et al., 2020). Within SDT, the autonomy, competence, and relatedness basic needs align with specific interpersonal behaviors that nurture their satisfaction and thereby trigger self-determined motivation, well-being, and performance (R. M. Ryan & Deci, 2017).

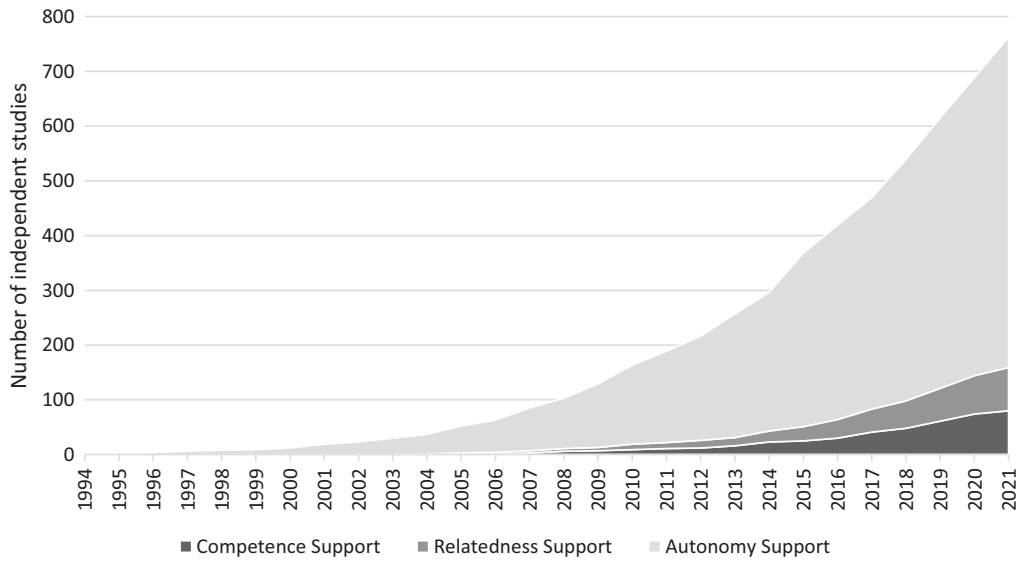
Autonomy support involves taking a person's internal frame of reference to recognize their perspective (empathy) and taking actions to encourage more self-directed behavior (W. S. Ryan & Ryan, 2019). It requires provisions of rationale and choice and minimal use of external controls (rewards or sanctions) to motivate behavior (e.g., Patall et al., 2008, 2018; Steingut et al., 2017). *Competence support* involves taking steps to promote efficacy and mastery, such as providing feedback, structure, and guidance about how to perform activities, sharing knowledge and expertise, and establishing clear and realistic expectations (Pulido et al., 2018; Standage et al., 2005). *Relatedness support* involves behaviors that demonstrate authentic interest, care, warmth, and companionship, such as encouraging teamwork and collaboration, or demonstrations of unconditional positive regard (Parfyonova et al., 2019; R. M. Ryan & Deci, 2017).

The three interpersonal supports for basic psychological needs are viewed as central precursors to basic need satisfaction and, in turn, self-determined motivation, well-being, and performance (Reeve, 2002, 2015; R. M. Ryan & Deci, 2017). Their associations with motivational processes and associated outcomes have been studied heavily across several subdomains of applied psychology, including organizational psychology (e.g., Deci et al., 2001; Parfyonova et al., 2019), educational psychology (e.g., Aelterman et al., 2019; Hardré & Reeve, 2003), sport psychology (Mouratidis et al., 2010; Ntoumanis & Standage, 2009), developmental psychology (Kins et al., 2009; Soenens et al., 2007), and health psychology (R. M. Ryan et al., 2008; Williams & Deci, 1996). Indeed, as SDT has grown in reach and influence, research across domains has expanded rapidly (see Figure 1).

Figure 1 shows accelerating growth in empirical research over several decades, which is also evident in a recent systematic review by R. M. Ryan et al. (2022) that examined the available meta-analyses based on SDT. This review, in fact, revealed considerable evidence for the positive effects of *autonomy satisfaction* across diverse cultures (e.g., Yu et al., 2018) and also for all three need satisfactions across multiple life domains, such as work, physical education (PE), and education. Evident, too, in this review was a heavy focus on *autonomy support* as a predictor of these need satisfactions and positive outcomes within specific domains. For example, Slemp et al. (2018) meta-analytically demonstrated positive effects of leader autonomy support on employees' autonomy, competence, and relatedness need satisfactions across cultures. Likewise, Ng et al. (2012) similarly showed positive effects of practitioner autonomy support on need satisfactions and associated outcomes in health care, whereas Bureau et al. (2022) and Vasquez et al. (2016) showed how teacher and parental autonomy support impacted education-related need satisfaction and outcomes. However, few meta-analytic studies have examined interpersonal

Figure 1

Cumulative Number of Independent Primary Studies Reporting Effect Sizes of Supports for Basic Needs on Basic Need Satisfaction (Autonomy, Competence, or Relatedness) or Self-Determined (Autonomous) Motivation



supports beyond autonomy support. The one exception in this review was Vasconcellos et al. (2020), a meta-analysis that exclusively examined the effects of the interpersonal supports for each of the needs in the context of PE, although not their incremental effects. Thus, existing meta-analyses focusing on interpersonal supports for basic needs have been limited by either a focus on only autonomy support or an exclusive focus on one domain of research, such as PE, which only encompasses a very specific aspect of people's lives.

The emphasis on autonomy support within the SDT literature stems from an assumption that when a person is autonomy supportive, they are more prone to be sensitive and responsive to the psychological needs of the other (R. M. Ryan & Deci, 2017). However, this emphasis has also resulted in several gaps in knowledge, especially concerning whether competence- or relatedness-supportive behaviors exhibit differential and/or additive effects on motivational processes, well-being, or performance, or whether they are moderated by similar factors. This limits our understanding of competence- or relatedness-supportive behaviors in facilitating motivational processes, well-being, and performance. Similarly, it renders it difficult to comprehensively examine SDT's broad postulation that *across domains*, need-supportive interpersonal behaviors yield positive effects on basic needs and wellness, and that these effects would be evident across cultures, research domains, or measurement strategies.

Another important focus in the current meta-analysis is how the effects of interpersonal supports for basic needs vary as a function of the source of support. Specifically, prior syntheses have focused either exclusively on vertical supports (teachers, parents, supervisors; see Bureau et al., 2022; Su & Reeve, 2011), and/or restricted their analyses to a specific domain (e.g., Vasconcellos et al., 2020), thereby limiting the available studies. Whether or not there is evidence supporting an additive benefit of lateral supports (e.g., peers, friends, siblings) is important for both theory and interventions targeting motivation, wellness, and performance. This is the first meta-analysis to examine this important question.

Hence, we advance both theory and practice by providing the most comprehensive meta-analysis to date of the effects of interpersonal supports for basic needs on motivational processes, well-being, and performance, with an aim to answer the following four questions:

1. To what extent do autonomy-, competence-, and relatedness-supportive interpersonal behaviors predict basic psychological needs (i.e., autonomy, competence, and relatedness), self-determined forms of motivation, subjective well-being, and performance?
2. Do associations with need-supportive interpersonal behaviors vary as a function of culture, the measures used, the applied research domain, or the source of support?
3. Do competence- and relatedness-supportive interpersonal behaviors explain incremental variance in basic need satisfaction over and above effects from autonomy support?
4. To what extent are benefits of supports for basic needs additive across sources of support? Specifically, how do lateral sources of interpersonal support compare with the more widely discussed vertical sources of support?

Providing answers to these questions will reveal if cumulative scientific knowledge supports SDT's central postulation that interpersonal supports for autonomy, competence, and relatedness universally enhance people's basic psychological needs, and, in turn, optimize their motivation, well-being, and performance. In the following sections, we expand on the four aims, which are each tied to resolving the four research questions listed previously.

Aim 1: Examine the Effect of Interpersonal Supports for Basic Psychological Needs on Motivational Processes and Associated Outcomes

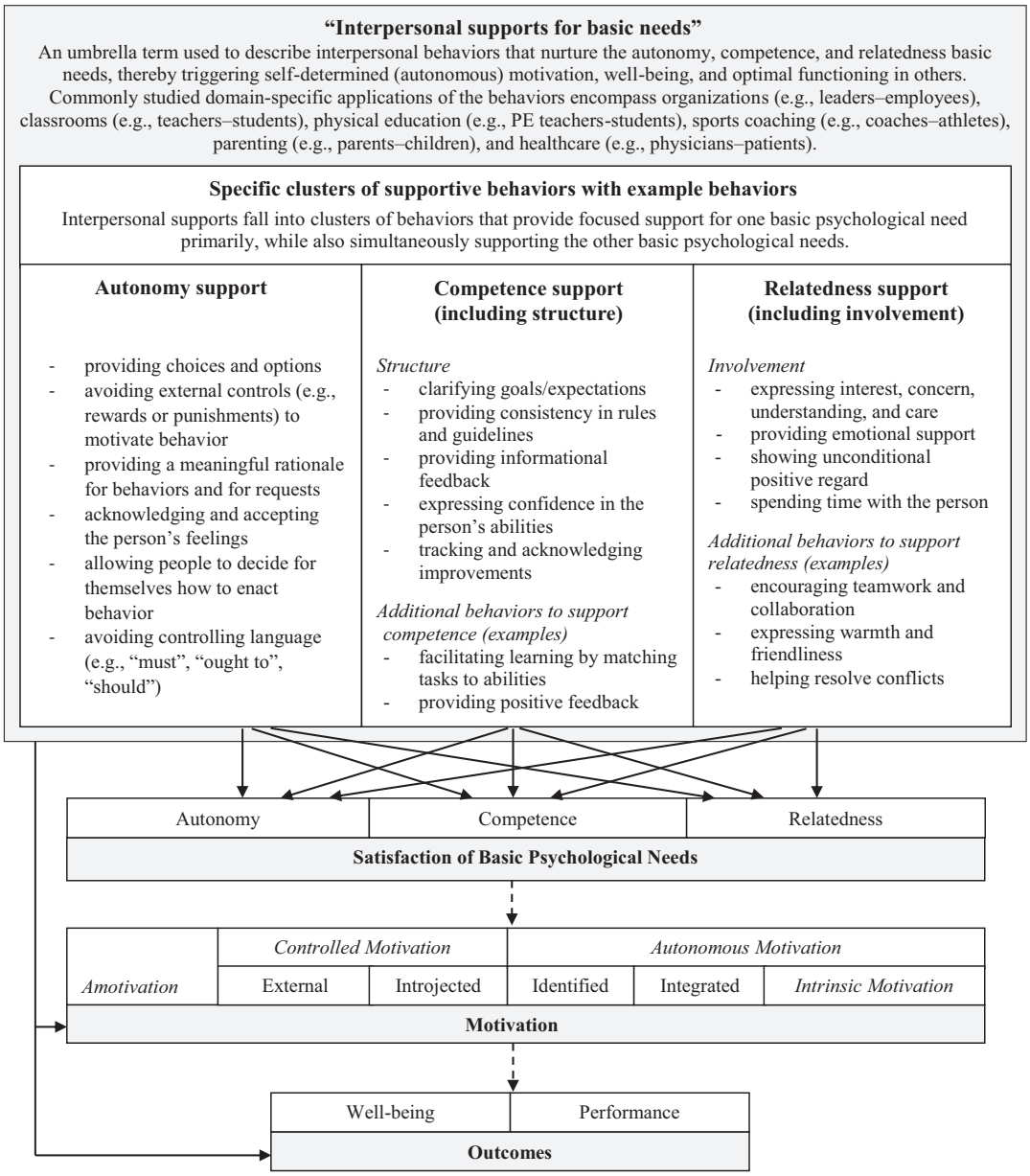
A comprehensive conceptualization of the three interpersonal supports and how they are theoretically expected to affect key outcomes examined in the present meta-analysis is displayed in Figure 2. Within SDT, interpersonal autonomy support occupies a central space. Of all types of support studied, it emerged the earliest, with initial work traceable to the early 1980s in classroom interactions between teachers and students (e.g., Deci et al., 1981; R. M. Ryan & Grolnick, 1986). For instance, Deci et al. (1981) used an early teacher self-report scale to establish their orientation toward their teaching (autonomy supportive vs. controlling) and later evaluated students on intrinsic motivation, perceived competence, and their perception with their teachers' style. Results showed that students of the autonomy-supportive teachers were more intrinsically motivated, demonstrated elevated perceived competence, and perceived their teachers as more supportive. Such research indicated that taking the perspective of students and supporting their experience of choice and self-regulation is central to healthy self-development and functioning.

Interest in other supportive mechanisms that could complement autonomy support in nurturing basic needs followed. Early research on children centered on two areas of behavior that could fulfill this supportive function: the provision of structure and involvement (Grolnick & Ryan, 1989; Grolnick et al., 1999; Reeve, 2002). *Structure* concerned whether socializing agents, such as teachers or parents, organized the social environment of a child to promote mastery and competence (R. M. Ryan & Deci, 2017). Behaviors included establishing clear and consistent guidelines for behavior, conveying clear expectations and feedback as children actively engaged with their social world, and helping children to connect their behavior to specific outcomes (Reeve, 2002). By contrast, *involvement* concerned whether socializing agents showed interest, investment, and engagement in the child's life, which is considered important for relatedness (Grolnick & Ryan, 1989). Although research on them remained embryonic until the mid-2000s, more recently, interest has expanded as more general clusters of behaviors focused on competence support (which encompasses structure) and relatedness support (which encompasses involvement) were formulated across domains (e.g., Parfyonova et al., 2019; Pulido et al., 2018), which we discuss in more detail shortly.

As shown in Figure 2, while each interpersonal support is thought to enable the satisfaction of its own need, they are also expected to exert positive effects on the other needs. For instance, apart from fostering autonomy, autonomy support also affords people with greater scope to pursue activities that build their competence and the perspective taking inherent in autonomy support is likely to foster a sense of relatedness (R. M. Ryan & Deci, 2017). In fact, *relationships motivation theory*, a specific mini theory within SDT, formally proposes that relatedness satisfaction in close relationships requires

Figure 2

Self-Determination Theory Model Describing the Psychological Process Through Which Interpersonal Supports for Basic Needs Influence Basic Psychological Need Satisfaction, Motivation, Well-Being, and Performance



Note. While this figure and self-determination theory suggest direct effects (solid arrows) and indirect effects (dashed arrows) between the interpersonal supports and more distal outcomes of motivation, well-being, and performance, in the present meta-analysis, we only examine direct effects, represented by solid arrows. PE = physical education.

perceived support for autonomy within the relationship (R. M. Ryan & Deci, 2017). The effect of autonomy support on the satisfaction of all three needs is also supported by meta-analytic evidence (e.g., Ng et al., 2012; Slemp et al., 2018; Vasconcellos et al., 2020). Despite autonomy support receiving the most attention to date, it is also likely that competence and relatedness supports have cross-need impacts. For instance, competence support is likely to open further freedoms and choices in life, affording autonomy. Similarly, relatedness support is likely to facilitate relations with others, from which one can learn, enhancing competence. Hence, we expect each of the different supports to relate to each of the basic needs.

In addition to their effects on basic psychological needs, interpersonal supports for autonomy, competence, and relatedness have long been argued to facilitate more autonomous forms of motivation (Figure 2; Deci & Ryan, 1985). *Autonomous motivation* is defined by a sense of volition and choice in behavior, encompassing

actions performed due to a sense of enjoyment or interest in an activity (*intrinsic motivation*), because it is experienced as congruent with one's identity (*integrated regulation*), or from a perceived value placed on an activity (*identified regulation*; Howard et al., 2017). By contrast, *controlled motivation* encompasses behaviors performed out of perceived internal or external pressure. This pressure could emerge from internalized evaluative standards placed on the self (e.g., guilt) known as *introjected regulation* or stem from fully external pressures created by reward or punishment contingencies within the social environment, known as *external regulation* (Howard et al., 2017). *Internalization*, a central feature of this motivation continuum, suggests that if the social context is supportive of basic needs, people more deeply internalize the regulation and value of their behavior and act through more autonomous forms of motivation (Deci et al., 1994; R. M. Ryan, 1995). Behaviors that support basic psychological needs are viewed as central to the internalization of behavioral regulations and values, ultimately giving rise to greater self-determination in behavior, with corresponding positive effects in terms of well-being and performance (see Figure 2; R. M. Ryan & Deci, 2017; Van den Broeck et al., 2021). Although Figure 2 also displays indirect effects of interpersonal supports on motivation, well-being, and performance through the satisfaction of basic psychological needs (dashed arrows in Figure 2), we only examine direct effects in this meta-analysis (solid arrows in Figure 2) as these relationships are central to much research on SDT and therefore heavily studied (Deci et al., 2017).

Given that SDT argues for the importance of social supports for each specific need, our first aim of the present study is to evaluate these basic premises of SDT via a large-scale meta-analysis that spans across research domains to establish the relative strength of each interpersonal support across basic psychological needs, motivation, well-being, and performance-based outcomes. Based on tenets of SDT, which suggests that interpersonal behaviors that nurture autonomy, competence, and relatedness are central to positive functioning, we expect that all three supports for basic needs exert positive associations with the satisfaction of each of the basic psychological needs, autonomous relative to controlled motivation, as well as well-being and performance. By contrast, we expect negligible effects on controlled motivation and negative effects on basic need frustration.

Aim 2: Examine Moderators of Meta-Analytic Associations

Our second aim pertains to whether effect sizes vary as a function of potential moderating factors. In their recent review of 60 meta-analyses that focused on SDT-framed research, R. M. Ryan et al. (2022) documented that even though SDT's associations and effects are typically in the predicted direction, there is substantial between study variation in effect sizes. Moreover, this heterogeneity has not been extensively examined. In the present review, we examine potential sources of heterogeneity by examining the effects of culture, research context, measures, and the source of need-supportive behaviors as possible moderators.

Effects of Culture

One area of debate in SDT-related research is whether supports for basic needs are universally desired or culturally relative, with most debate focusing on autonomy and its relevance within individualist and collectivist contexts (V. Chirkov et al., 2003). Individualism prevails in most Western countries and describes a cultural norm of independence, in which people tend to perceive themselves as unique and self-reliant. By contrast, collectivism prevails in most Eastern countries and describes a cultural norm of interdependence, in which people tend to perceive the larger social network as integral to the self (Hampton & Varnum, 2020; Hofstede, 2001; Markus & Kitayama, 1991). Those who criticize the universality hypothesis often do so on the basis that personal autonomy is an inherently Western idea and emerged out of its prevailing values of individualism and independence (Iyengar & Lepper, 1999; Tripathi et al., 2018). Notions of autonomy are thus viewed as logically opposed to the values of group obligation and interdependence that prevail in the East. Yet, SDT's formulation of autonomy is distinct from independence and individualism, as it is characterized by behavior that is self-endorsed and volitional, which serve a valuable function for self-determined motivational processes regardless of cultural preferences (V. I. Chirkov, 2009; V. Chirkov et al., 2003, 2011).

Although some meta-analyses have provided initial evidence to support the beneficial effects of interpersonal supports across cultures (e.g., Mossman et al., 2022; Slemp et al., 2018; Yu et al., 2018), they did not examine the specific issues we address here. For example, Yu et al. (2018) tested whether the relations of autonomy and well-being were similar across East Asian and North American cultures, but they did not focus on the three need supports or their facilitative role on motivational processes. Likewise, Slemp et al. (2018) and Mossman et al. (2022) examined autonomy support across cultures, but their meta-analyses were restricted to organizational and sport studies, respectively. Indeed, none of the meta-analyses previously published has addressed the specific questions posed by our focus on autonomy, competence, and relatedness need supports; they have either not directly tested the relations of need supports to need satisfaction, motivation, well-being, and performance outcomes across domains and cultures or lacked sufficient power to detect the subtle differential effects of culture (Field et al., 2021). This is important insofar as some recent studies have suggested that the practice of autonomy support can manifest differently in cultures characterized by individualism and collectivism (e.g., Soenens et al., 2018; Tripathi et al., 2018). To address these issues and to help establish boundaries of the universality hypothesis claim within SDT, we conduct the most comprehensive test of whether effects of supports for basic needs, including autonomy support, vary as a function of culture. Given its centrality to recent debates, we focus on the distinction between individualism and collectivism (Hofstede, 2001), and in line with SDT, we expect that effects of need supports will remain stable across individualist and collectivist samples.

Effects of Measures

As noted, the body of knowledge on autonomy support is considerably more established than that for the other needs. One reason for this is perhaps the fairly consistent use of surveys to measure autonomy support. Although initial surveys measured autonomy support in classrooms (Deci et al., 1981; R. M. Ryan & Grolnick, 1986), subsequent surveys—such as the autonomy-supportive climate questionnaires—have become increasingly prominent. These measures

emerged in health care (Health Care Climate Questionnaire [HCCQ]; Williams et al., 1996) and were later adapted for use in workplaces (Work Climate Questionnaire [WCQ]; Baard et al., 2004), education (Learning Climate Questionnaire [LCQ]; Williams & Deci, 1996), and sport (Sport Climate Questionnaire [SCQ]; Deci, 2001). The measures are domain general, with only minor adjustments made to adapt scale items for use across different research domains. They remain in wide use today.

For competence and relatedness support, initial research focused on the provision of structure and involvement (Grolnick & Ryan, 1989; Grolnick et al., 1999; Reeve, 2002) and such interpersonal strategies were incorporated into self-report scales for empirical research, such as the Teachers as Social Context Questionnaire (TASC; Belmont et al., 1992) and the Perceptions of Parenting Scale (POPS; Grolnick et al., 1991), and more recently the Situations in School Questionnaire (Aelterman et al., 2019). In general, such scales are domain specific, with items purposely developed for use in a particular research context, such as schools or parenting.

More general clusters of behaviors focused on competence support and relatedness support have also emerged that encompass structure (i.e., competence support) and involvement (i.e., relatedness support), with these broader measures typically intended for general use with adolescents and adults (see Parfyonova et al., 2019; Pulido et al., 2018; Rocchi, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017; Standage et al., 2005, for example measures). Still, measures for structure and involvement remain in wide use today not only for research on child social adjustment but are also adapted for young adults (e.g., McDavid et al., 2017) and in PE (e.g., Taylor & Ntoumanis, 2007). They coexist alongside measures based on autonomy support, competence support, and relatedness support that are commonly applied in research with adults (e.g., Parfyonova et al., 2019; Rocchi, Pelletier, Cheung, et al., 2017) and children (e.g., Sánchez-Oliva et al., 2017).

Although the presence of multiple measures for a common construct is prevalent in the social sciences (Cooper, 2017; Webb et al., 2000), it is important to test for agreement across measures, which can strengthen the conclusions in a research literature and allow for stronger inferences (Cooper, 2019). It is also important to examine for the possibility that subtle construct variations that are built into the measures are yielding systematic variation in effect sizes (see Steel et al., 2008, for an example). In the present meta-analysis, we test this possibility and examine whether the operational frameworks that underpin measures (i.e., structure vs. competence support; involvement vs. relatedness support), or indeed, different measures moderate the relationships between the different types of interpersonal support and their associated outcomes.

Effects of Domain

The effects of research domain, such as whether studies were conducted in a classroom, PE, sport, workplace, parenting, or health care context, present another area for investigation. While SDT has shown a long history of examining the interpersonal supports for basic needs across a wide range of areas in applied psychology and assumes that the impact of interpersonal supports is universally beneficial across life domains, little is known about whether the behaviors are more or less impactful across the different domains, or indeed aspects of people's lives. What adds to this uncertainty is that many of the available measures used to operationalize interpersonal supports have been developed for use *within* specific research domains. For instance, the TASC (Belmont et al., 1992) was developed for use in classrooms, whereas the POPS (Grolnick et al., 1991) was developed for use within parenting contexts. Thus, the measures used to operationalize the interpersonal supports cannot necessarily be dissociated from the research domain. Hence, in addition to examining the independent moderating effects of research domain and measures, we hierarchically explore their effects while holding one of them constant (see Schmidt, 2017). This will allow us to comprehensively examine whether any differences that emerge are due to the interpersonal behaviors being more or less effective across domains or whether differences are really just a function of the different measures.

Effects of Vertical or Lateral Origin of Supports

The concept of supports for basic needs emerged to describe conditions within the social context that nurture motivational processes, well-being, and performance. This research has most often focused on hierarchical relationships, within which supportive behaviors are conveyed vertically from caretakers to those under their care (Reeve, 2015). Accordingly, they typically involve teacher–student, leader–employee, coach–athlete, doctor–patient, or parent–child relationships. Yet, need-supportive behaviors can also be conveyed laterally, such as between peers, colleagues, siblings, or within intimate partnerships, with positive effects (e.g., Audet et al., 2021; Carbonneau et al., 2019; Moreau & Mageau, 2012). Although evidence suggests both sources of support are consistent with motivational and well-being benefits (e.g., Gilbert et al., 2021; Ratelle et al., 2013), it is yet to be determined which source, if any, is more potent. The few studies that have simultaneously examined effects from vertical and lateral origins of support show comparable (e.g., Wentzel et al., 2010), or potentially even stronger (e.g., Gilbert et al., 2021) lateral effects. This suggests that peers potentially offer a powerful source of support in the social context. Establishing whether or not lateral sources of support yield comparable effects to vertical sources—as we do here—will be particularly informative for practice, with current interventions almost exclusively focusing on engendering change in vertical sources (e.g., Reeve et al., 2022). Expanding the focus to incorporate lateral effects on basic needs may increase their effectiveness. The only meta-analytic study attempting to address the effects of lateral supports on basic needs is Vasconcellos et al. (2020). They examined associations of peer-related interpersonal supports, but because they were focusing exclusively on PE, they could not differentially examine lateral versus vertical sources of support across the different forms of interpersonal support (autonomy, competence, and relatedness support), or their incremental benefit (as we do), because insufficient studies were available ($k = 5$). By conducting our review across domains of research, we advance literature beyond prior meta-analytic evidence to comprehensively examine whether lateral sources of autonomy-, competence-, or relatedness-support independently or incrementally predict basic needs above and beyond vertical interpersonal supports.

Importantly, our first and second aims of the present meta-analysis are important precursors to our third and fourth aims, which address the incremental effects of each interpersonal support on basic needs. This is because prior research has suggested that the three supports may associate in similar directions and magnitudes

with each need, as well as possess strong intercorrelations (e.g., Mossman et al., 2022; Rocchi, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017; Vasconcellos et al., 2020). Indeed, this is not unexpected under SDT because, as explained previously, each interpersonal support is expected to exert cross-need impacts. Similarly, socializing agents who support one need are also more likely attuned to and supportive of other needs (Deci et al., 2017), which at least partially explains their high covariation. Nevertheless, if we confirm similar observations in the current meta-analysis, then it becomes of utmost importance to establish whether the three interpersonal supports explain incremental variance in basic needs, which will establish whether each support indeed offers new information. We focus on these important contributions below as we address our third and fourth aims.

Aim 3: Examine the Incremental Benefit of the Competence- and Relatedness-Supportive Interpersonal Behaviors

Given the focus on autonomy support in SDT research, and the fact that competence support and relatedness support emerged later, a salient question is whether a focus on autonomy support is sufficient or whether support that is specifically aligned with the needs for competence and relatedness can add incrementally to need satisfactions and associated outcomes. This question is important not only due to their increased prominence in research but also due to a growth in the use of practical interventions that focus on training all three supportive behaviors as ways to cultivate basic psychological needs, and in turn, self-determined motivation, well-being, and performance (Reeve et al., 2022; R. M. Ryan & Deci, 2019; Slemp et al., 2021). The increased uptake of competence and relatedness support is likely attributable to the claim within SDT that the three basic need supports operate as influential clusters of behavior that contribute unique variance to basic need satisfactions and healthy functioning (Hagger & Protogerou, 2020; Jang et al., 2010; R. M. Ryan & Deci, 2017).

Yet, research has traditionally focused on autonomy support and even when all three interpersonal supports are distinctly measured, a common practice is to statistically combine them into a composite (e.g., Fernet et al., 2012; Jeno et al., 2018; Pulido et al., 2020; Wu et al., 2023). On the one hand, this seems justified as strong covariation is expected by SDT, as noted. Past research has also shown that the different types of support are indeed highly intercorrelated (e.g., Mossman et al., 2022; Rocchi, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017), which also justifies combining them. On the other hand, the practice of combining them hinders research into their independent contributions, and high covariation also raises the possibility of empirical redundancy. In line with our third aim, in the present meta-analysis, we therefore seek to address the incremental contribution of competence and relatedness support over and above autonomy support, which will either legitimate the incorporation of the distinct interpersonal behaviors in research and practice or allow for greater parsimony.

Aim 4: Examine the Incremental Benefit of Sources of Need Supports

Another related question is whether incremental benefits are observed when people receive autonomy-, competence-, or relatedness-supportive behaviors from different sources and, if so, how much added benefit exists. Researchers have generally suggested that interpersonal supports for basic psychological needs from one source can supplement support received from different sources (Gaudreau et al., 2016), such that experiences accumulate to yield an additive benefit (Benson et al., 2006), which is consistent with SDT (R. M. Ryan & Deci, 2017). While some preliminary evidence supports this premise, mixed findings exist. For instance, in workplaces, Moreau and Mageau (2012) investigated the joint effects of lateral autonomy support from colleagues and vertical autonomy support from supervisors in a sample of health care professionals ($N = 597$). Results showed that lateral autonomy support explained incremental variance in job satisfaction, subjective well-being, and suicidal ideation after controlling for vertical autonomy support. Yet, the additional variance explained was modest (from 1% to 2%) and colleagues' autonomy support failed to explain incremental variance in other outcomes. Similarly, in health care, Williams et al. (2006) showed that lateral autonomy support received by medical patients from important others (e.g., family members) explained incremental variance in dieting outcomes over vertical autonomy support they received from health care providers. Yet, their analyses did not reach significance for basic psychological needs.

A host of further research has examined independent effects of lateral and vertical sources of support but did not examine whether they, together, explain incremental variance in basic needs beyond that observed from one in isolation (e.g., González-Cutre et al., 2014, 2018; Hagger et al., 2007). Although these studies cannot answer the question of incremental contribution, they provide essential quantitative information that could be statistically aggregated via meta-analysis to address this important question. We do so in the present study.

The Present Study

To summarize, in the present study, we addressed four primary objectives. First, we aimed to systematically locate, combine, and meta-analyze the associations of the autonomy-, competence-, and relatedness-supportive behaviors to basic need satisfaction, motivation, subjective well-being, and performance, across a range of applied research fields. In doing so, we provide high-powered analyses to empirically discern whether the direction and magnitude of artifact corrected correlations are consistent with SDT propositions (R. M. Ryan & Deci, 2017). Second, we aimed to examine moderators of these observed associations. In particular, by focusing on basic psychological needs and autonomous motives as the most proximal theorized consequences of interpersonal supports (Deci et al., 2017), we examined whether correlation magnitudes differ as a function of (a) the culture of the sample and (b) the applied research domain of the study. As the latter is confounded with the use of specific measures, we also examine (c) the measures or the operational framework by which each need support was measured. Finally, we examine (d) whether the source of each interpersonal support was vertical or lateral. In addition to these moderators, we run exploratory continuous moderator analyses to determine whether (e) sample age or (f) time lag between the measurement of each need support and its associated criteria affect correlation magnitudes.

Our third aim was to assess whether the competence- and relatedness-supportive interpersonal behaviors contribute to the

satisfaction of basic needs over and above the more established effects of autonomy support. Finally, and similarly, our fourth aim was to examine whether vertical and lateral sources of supports for basic needs yield incremental variance in the three basic needs, over and above benefits stemming from one source in isolation.

Method

Literature Search Strategy

Our search strategy involved three approaches. First, we conducted searches of seven electronic databases through to November 27, 2021: APA PsycInfo, MEDLINE, SPORTDiscus, CINAHL, Web of Science, Educational Resources Information Centre, and Scopus. These databases were selected because they provided broad coverage of social science research. Our search terms were selected to capture a variety of behaviors to support basic psychological needs: *support* for autonom** OR *needs support** OR *autonom*-support** OR *competence-support** OR *support* for competence* OR *relatedness-support** OR *support* for relatedness* OR *self determin** OR *SDT*. The asterisk truncation symbol was used to capture different spellings of key terms and the Boolean "OR" operator was used to suggest that only one term was needed for a record to be captured. We imposed no date restrictions but limited the search to the title, abstract, or key words of each record. Using this approach, we obtained 9,417 records.

Our next strategy was to use Web of Science to prospectively search the citing articles of studies that validated key measures of interpersonal supports across different contexts (e.g., Aelterman et al., 2019; Baard et al., 2004), a process that identified a further 2,520 records. Our final approach was to examine other related sources for relevant records we may have missed, including reference lists of key SDT-related books, literature reviews, empirical articles, and book chapters (e.g., Howard et al., 2017; Mossman et al., 2022; R. M. Ryan & Deci, 2017; Slemp et al., 2018). The process led to the identification of a further 2,588 relevant records for screening.

Eligibility Criteria

Studies were included in the meta-analysis if they satisfied four criteria. First, studies had to use measures that assessed behaviors to support the autonomy, competence, or relatedness needs (i.e., autonomy support, competence support, relatedness support). Given their conceptual overlap, we also included studies that measured structure and involvement, which provided alternative operationalizations of competence support and relatedness support, respectively. We did not limit our research based on measures selected a priori, as there is broad variation in the measures for the three interpersonal supports and decisions about whether to exclude studies based on measures are often made on arbitrary grounds (Schmidt & Hunter, 2015). Supplemental Materials include a list of measures we observed.

Our second criterion was that studies had to report zero-order correlations between at least one of the autonomy-, competence-, or relatedness-supportive interpersonal behaviors and one of our criteria of interest: basic psychological needs (autonomy, competence, or relatedness satisfactions or frustrations); motivation (intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, amotivation, or the composites of autonomous and controlled motivation); facets of subjective well-being (positive affect, negative affect, and satisfaction with life); and performance (see Supplemental Materials, for more details about how these were measured). We included studies if they reported correlations between the interpersonal behaviors (e.g., autonomy support to competence support) but failed to report correlations with outcomes of interest, but we excluded studies where correlations only involved statistical composites of two or more interpersonal behaviors (e.g., composites of *need-supportive* behaviors). We did not include studies if the only effect size metric that was available was an indicator of group differences (e.g., *d*-values), because this cannot be combined with correlations (Schmidt & Hunter, 2015). Instead, where necessary, we emailed the corresponding authors to request correlations among the study variables (e.g., at baseline, as described below). Third, studies had to be based on independent primary data and could not be based on preexisting public data sets. Last, studies needed to report a sample size or sufficient information to ascertain standard error. We included both published and unpublished studies when they emerged in our search but given the vast number of studies involved, we did not actively search for additional gray literature.[1]

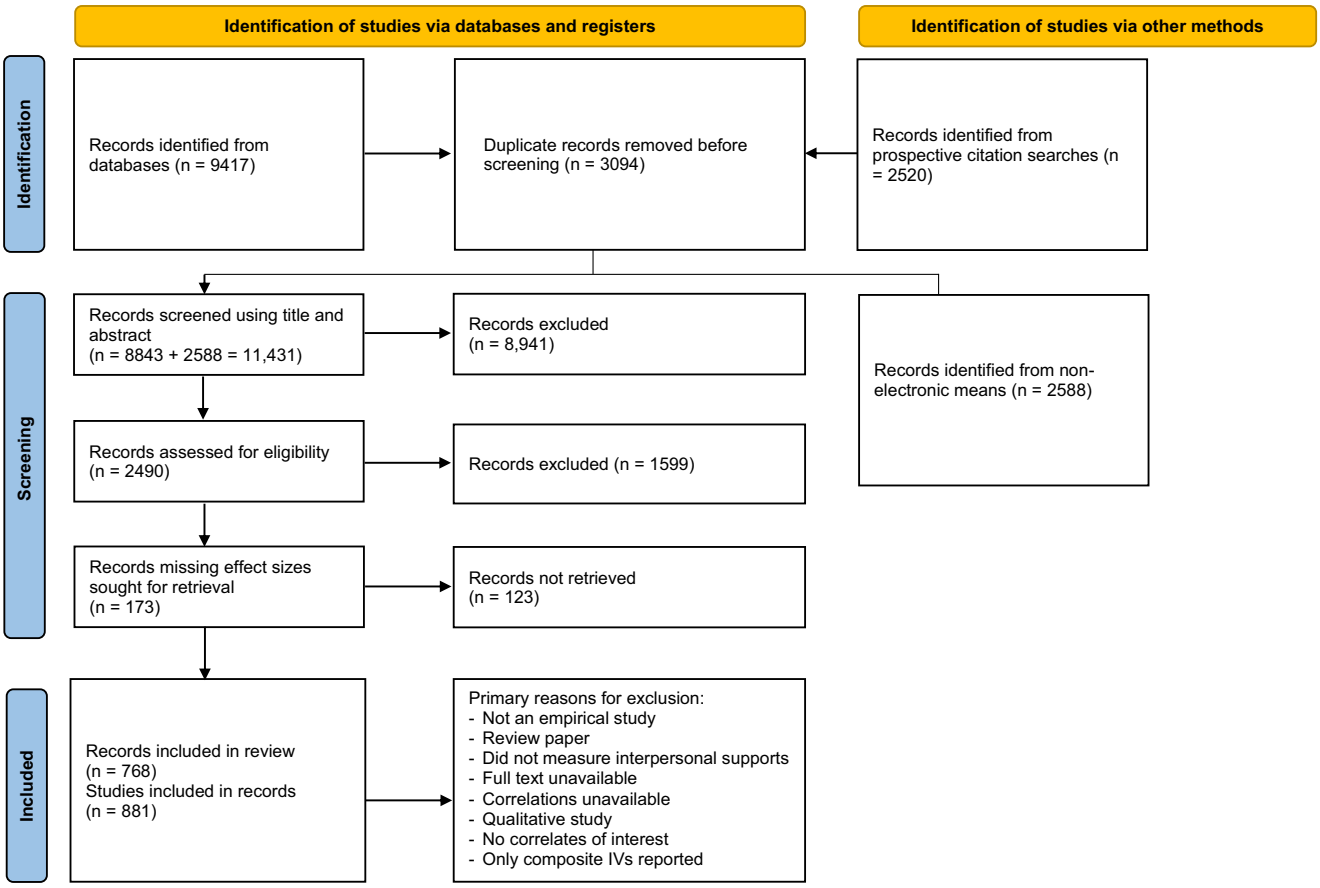
Our Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (Figure 3) shows that after 3,094 duplicates were removed, the initial search generated 11,431 records for screening. Initial screening of the titles and abstracts led to the removal of 8,941 records, which failed our inclusion criteria described previously. The remaining 2,490 full texts were screened for eligibility, leading to a further removal of 1,599 records that failed our eligibility criteria. The screening decisions of the initial 2,490 records were initially completed by the first author, but to determine the accuracy of our screening process, a subset of just over 20% of the eligible studies were screened by a second author to establish interrater agreement in the decisions. Results showed very high agreement (98% interrater agreement; $\kappa = .93$). Disagreements were resolved by discussion.

As noted previously, when studies failed to report correlation coefficients but otherwise met our eligibility criteria, we emailed the corresponding author ($n = 173$) to request this information. This was particularly evident in experimental studies that did not typically report baseline correlations. After 2 weeks, we sent follow-up emails as a further prompt. The process added an additional 50 correlation matrices from 50 independent samples. Our final step was to screen our database for the possibility of duplicate study effects by using the heuristic generated by Wood (2008), which helped satisfy the assumption that each observation was statistically independent. Our final database consisted of 4,561 effect sizes from 768 records and 881 independent studies (overall $N = 443{,}556$).

[1] We expect that our decision not to actively search for additional gray literature is less of an issue for the current meta-analysis for three reasons. First, previous meta-analyses of SDT-based correlations have generally found little evidence of publication bias (e.g., Bradshaw et al., 2023; Howard et al., 2017; Slemp et al., 2018, 2020). Second, we run comprehensive sensitivity analyses to examine the degree to which our results are potentially biased upward or downward by missing studies. Last, at least in our tests for incremental validity, any effects of publication bias are likely to be counterbalanced by pushing intercorrelations between the predictors in each model closer to 1, making estimates of their incremental contribution more conservative.

Figure 3

Study Search and Screening Process According to PRISMA



Note. Adapted from "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews," by M. J. Page, J. E. McKenzie, P. M. Bossuyt, I. Boutron, T. C. Hoffmann, C. D. Mulrow, L. Shamseer, J. M. Tetzlaff, E. A. Akl, S. E. Brennan, R. Chou, J. Glanville, J. M. Grimshaw, A. Hróbjartsson, M. M. Lalu, T. Li, E. W. Loder, E. Mayo-Wilson, S. McDonald, … D. Moher, (2021), *BMJ*, *372*(72), p. 5 (https://doi.org/10.1136/bmj.n71). CC BY-NC. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses. See the online article for the color version of this figure.

Coding Procedure

The 768 included records were coded using a systematic coding sheet, available in Supplemental Materials. A subset of 200 records were recoded by a second author to establish interrater reliability in coding across all categories. An accuracy check revealed 97% agreement across all coding items. For completeness, we also analyzed agreement using Kappa (Cohen, 1960) for nominal codes and a two-way absolute single measures intraclass correlation coefficient (ICC; McGraw & Wong, 1996) for continuous codes. These also indicated good agreement, ranging from .77 to .95 for κ and .87 to 1.00 for ICC. A full table containing all agreement statistics for each coding item can be found in Supplemental Materials. Disagreements were resolved via discussion.

The coded fields included (a) the correlation coefficient (r) between the predictor (autonomy support, competence support, relatedness support) and each criterion; (b) sample size; (c) the reliability of the interpersonal support (predictor) variable (R_{xx}); (d) the reliability of the criterion variable (R_{yy}); (e) the country in which the studies took place; (f) the context in which the studies took place (e.g., classrooms, PE, sport, workplace, health care, parenting); (g) the scale with which each interpersonal support was measured; (h) whether the interpersonal supports occurred within vertical (e.g., instructor–student; parent–child) or lateral (e.g., student–student; sibling–sibling) relationships; (i) the mean age of the study samples; (j) the time lag in months (if any) between the measurement of the predictor and each criterion; (k) the year of publication; (l) publication status; and (m) the metric of the predictor and the criterion (e.g., self-report, other report, objective).

Analytic Strategy

To address our first aim, we used Schmidt and Hunter's (2015) psychometric approach to meta-analysis to statistically aggregate correlations across studies. Psychometric meta-analysis is based on the random effects model, which estimates both mean effect sizes and the nonartifactual (true) variability of effect sizes across studies. All analyses were conducted in R (Version 4.2.3) using the RStudio interface (Version 2023.06.0.421). For each analysis, we used the "psychmeta" package (Dahlke & Wiernik, 2019) and the unbiased sample variance estimator.

A 95% confidence interval (CI) was constructed around each correlation. When the CIs encompassed 0, which suggests a possible true correlation of 0, we concluded that the correlation was not significant. We use the values of .15, .25, and .35 reported in Gignac and Szodorai (2016), to indicate weak, moderate, and strong correlation effect sizes, respectively. These benchmarks are derived from a synthesis of 708 meta-analytic correlations in individual differences research and are more appropriate than Cohen (1988) benchmarks to interpret the strength of correlations, as the latter are based on intuited rather than empirical guidelines (Bosco et al., 2015; Gignac & Szodorai, 2016; Paterson et al., 2016). The Gignac and Szodorai (2016) benchmarks are empirically supported and are more closely aligned with the practical and theoretical context of the present research. Similarly, these benchmarks were corrected for attenuation caused by measurement error, which we also do in the present study.

Heterogeneity was examined in four ways. First, we report SD_ρ, which quantifies the residual standard deviation of the meta-analytic mean effect size estimate that is corrected for sampling and measurement error (i.e., ρ); greater values indicate greater heterogeneity. Second, we report the 80% credibility interval (CV), which is derived from SD_ρ and provides an estimate of heterogeneity distributed around each effect. It is interpreted such that 80% of the distribution of true score correlations (i.e., the ρ distribution) lies within this interval. A broader interval represents greater heterogeneity and the likely presence of moderators. Third, we report the Q-statistic and its corresponding significance test. The Q-statistic is based on the chi-square distribution and provides a measure of the weighted squared deviations. The corresponding significance test indicates whether or not heterogeneity is significant. Last, due to difficulties in interpreting Q, we also report I^2 (Higgins et al., 2003), which is more intuitive and denotes the percentage of variance in each effect unexplained by sampling or measurement error. Higgins et al. (2003) suggested benchmarks of low, moderate, and high heterogeneity to I^2 values exceeding 25%, 50%, and 75%, respectively.

Corrections for Unreliability

To correct for the attenuating effects of measurement error in the predictor and criterion, we constructed artifact distributions using the reliability information that was reported in the included studies (Schmidt & Hunter, 2015). Descriptives for these distributions are reported in Supplemental Materials and were used to impose statistical corrections across each variable. The vast majority of studies reported reliability information where the variables were self- or other-reported. However, because only a handful of our included studies reported reliability information for objective metrics of domain-specific performance, such as grade point average (GPA), wherever possible we used estimated reliability information for these studies. In particular, for academic performance, when GPA was taken from records, we used the mean of the reliability coefficients (.90) across all courses and all years reported by Bacon and Bean (2006). When GPA was self-reported, we used the coefficients of .90 for college GPA and .82 for high school GPA that were reported in the meta-analytic review of Kuncel et al. (2005). For class grades or test scores, we used the mean of the reported reliability coefficients across reading (.87), writing (.96), and numeracy (.90), which were reported in the Australian National Assessment Program—Literacy and Numeracy (Australian Curriculum, Assessment and Reporting Authority, 2018), which was .91. These approaches are consistent with previous meta-analytic reviews (e.g., Camacho-Morles et al., 2021; Credé et al., 2017; Poropat, 2009). In the absence of information to estimate missing reliability parameters across the remaining contexts that we studied (e.g., sport performance), we coded these as missing data to be estimated using the artifact distributions produced in our meta-analysis.

Data Transformations

Data transformations and additional analytic decisions were required to ensure we met the meta-analytic assumption that each observation was statistically independent (Bobko & Roth, 2003; Wood, 2008). First, where multiple facets existed for a variable but not an overall composite, we established composite correlations by using formulas provided by Schmidt and Hunter (2015). This approach statistically aggregates effect sizes by taking into account the intercorrelation between the variable facets (see Schmidt & Hunter, 2015, pp. 441–447, for an overview of this method). Second, we used a similar approach to establish composite reliabilities, which we generated using Mosier's (1943) formulas—the recommended approach if variable facets are not orthogonal (Schmidt & Hunter, 2015). Third, when data for subsamples were reported within studies (e.g., primary, middle, secondary students; Vlachopoulos et al., 2013), we treated them as independent studies to be entered separately into the meta-analysis. Last, in cases where studies reported both cross-sectional and time-lagged correlations (e.g., Williams & Deci, 1996), we only used the most distant lagged correlation, consistent with the causal direction implied by SDT (R. M. Ryan & Deci, 2017). That is, interpersonal behaviors to support basic needs were treated as the predictors, whereas basic needs, motivation, well-being, and performance were treated as outcomes (see Figure 2). This also helped to reduce the effect of common method variance in our analyses (Podsakoff et al., 2003).

Tests for Moderators

To address our second aim, moderators were assessed in three ways. First, when multiple categories for a moderator were coded (e.g., lateral vs. vertical interpersonal sources; measures; research domain), we followed recommendations of Schmidt and Hunter (2015) by conducting a series of meta-analyses across different categories of the moderator. If the CIs of the two estimates did not overlap, we concluded that moderation was significant (Borenstein et al., 2021). Where necessary, to avoid confounding of correlated moderators (e.g., measures used and the research domain), we used hierarchical subgrouping of studies to sequentially subgroup studies within moderator categories so that we could explore each moderator while holding the other constant (see Schmidt, 2017). It has been argued that using CIs to infer if moderation is present is overly conservative (Afshartous & Preston, 2010; Cumming, 2009). As such, when there were only up to two levels of a moderator, we used a Wald-type pairwise comparison test to examine the difference in effects between the two levels of the moderator (e.g., vertical vs. lateral sources). This less conservative test is interpreted by examining whether the 95% CI around the (uncorrected) subgroup difference encompasses 0, in which case it is not significant. Finally, where continuous data were available (e.g., mean age, individualism percentile score), we conducted the moderator analyses using meta-regression. We concluded that effects depended on a moderator if the 95% CIs around each regression coefficient did not encompass zero (Borenstein et al., 2021).

Incremental Validity Analyses

To address our third aim to examine whether competence support or relatedness support explained incremental variance in basic need satisfaction over and above autonomy support, we constructed full meta-analytic intercorrelation matrices that contained these six variables by using the database of studies produced in the present meta-analysis. Producing disattenuated correlations matrices in this way overcomes the problem of attenuation caused by measurement error, which biases path coefficients and variance explained in standard path-analysis models (Hunter & Gerbing, 1983; Schmidt et al., 1986). The correlations matrices including the relevant variables then served as the input for seven path-analysis tests, which examined all possible combinations of the three interpersonal supports as predictors of the basic needs while observing changes in variance explained (ΔR^2) relative to when autonomy support was modeled as a single predictor. Following recommendations of Viswesvaran and Ones (1995), in each model tested, we used the harmonic mean of the sample sizes as the input sample, which ranged from $N = 32{,}933$ to $N = 113{,}363$. In addition, because high intercorrelations among the predictors might raise concerns about multicollinearity, we also conduct relative weight analyses (RWA) for each criterion (Johnson, 2000; Tonidandel & LeBreton, 2015). These analyses decompose total variance predicted in a regression model into weights that reflect the proportional contribution of each predictor.

To address our fourth aim, the same procedure was used to assess whether lateral supports for basic needs explained incremental variance in basic need satisfaction over and above vertical supports for basic needs (or vice versa), with harmonic means of the sample sizes ranging from $N = 3{,}252$ to $N = 109{,}364$ across nine models tested.

Transparency and Openness

This meta-analysis was not preregistered. For scientific transparency, our data sets, analytic scripts, and Supplemental Materials are all fully available via the Open Science Framework (see Slemp, 2023, https://osf.io/2ht3s/). In addition, we introduce web-based software that allows readers to interact with our results (see https://basic-psychological-needs.shinyapps.io/gen1/).

Results

Initial Data Inspections

As the psychometric approach to meta-analysis uses partial least squares to estimate the mean and the variance of effect size distributions, it is sensitive to the presence of nonrepresentative, outlying studies (Schmidt & Hunter, 2015). Thus, to first ensure that our results were not threatened by outlying cases, we inspected the forest plot of each analysis and performed preliminary sensitivity analyses using the "leave-one-out" method. This process suggested that Yu and Levesque-Bristol's (2020) study may be labeled as a potential outlier for some associations, due to its large sample ($N = 30{,}765$). When applicable, we report findings with and without the corresponding effect sizes (see Supplemental Table S1), but our interpretations in subsequent sections are based on the distributions excluding this study. Other extreme values were also detected, yet they were smaller studies. Hence, they did not exert a dramatic influence on any results. Because smaller studies contain larger sampling errors, they are considerably more difficult to distinguish from true outliers and by overexcluding them, meta-analyses can be overcorrected for sampling error (Schmidt & Hunter, 2015). For this reason, we retained these smaller studies in our meta-analysis, yet run comprehensive sensitivity analyses to determine their effects, as well as the effect of availability bias, on our results. In the following sections, we report results of our (1) main effect analyses, (2) moderator analyses, (3) incremental validity analyses, and (4) comprehensive sensitivity analyses.

Aim 1: Main Effects of Interpersonal Supports for Basic Psychological Needs on Motivational Processes and Associated Outcomes

For space reasons, we provide broad commentary on main effects below but report our full meta-analytic results in Supplemental Table S1. As shown in Supplemental Table S1, main effect results are reported for relations between behaviors to support autonomy, competence, and relatedness needs and (a) basic need satisfaction, (b) basic need frustration, as well as (c) motivational, (d) well-being, and (e) performance criteria. We also report meta-analytic results for the associations between each of the behaviors to support needs with the domain-general participant demographics of (f) age and (g) gender. The higher order variables displayed in the table (e.g., need satisfaction) include both observed composite correlations as well as estimated composite correlations of these relationships.

Basic Needs and Motivation

The results reveal that all three interpersonal supports were strongly positively related to the autonomy satisfaction (autonomy support: $k = 235$, $N = 106{,}858$, $\rho = .57$, CI [.54, .59]; competence support: $k = 38$, $N = 20{,}636$, $\rho = .50$, CI [.41, .58]; relatedness support: $k = 40$, $N = 21{,}163$, $\rho = .53$, CI [.47, .58]), competence satisfaction (autonomy support: $k = 274$, $N = 165{,}388$, $\rho = .45$, CI [.43, .47]; competence support: $k = 47$, $N = 24{,}414$, $\rho = .48$, CI [.40, .55]; relatedness support: $k = 47$, $N = 26{,}059$, $\rho = .45$, CI [.40, .50]), and relatedness satisfaction (autonomy support: $k = 251$, $N = 147{,}276$, $\rho = .44$, CI [.42, .46]; competence support: $k = 42$, $N = 21{,}558$, $\rho = .48$, CI [.42, .55]; relatedness support: $k = 46$, $N = 28{,}475$, $\rho = .62$, CI [.56, .68]). Associations with the frustration of the needs were in the opposite direction, although were generally slightly weaker. For instance, results showed universally negative associations with autonomy frustration (autonomy support: $k = 31$, $N = 11{,}085$, $\rho = -.30$, CI [–.37, –.23]; competence support: $k = 8$, $N = 5{,}019$, $\rho = -.33$, CI [–.45, –.22]; relatedness support: $k = 8$, $N = 4{,}509$, $\rho = -.30$, CI [–.44, –.16]), competence frustration (autonomy support: $k = 24$, $N = 8{,}913$, $\rho = -.20$, CI [–.28, –.13]; competence support: $k = 8$, $N = 5{,}019$, $\rho = -.38$, CI [–.54, –.22]; relatedness support: $k = 8$, $N = 4{,}509$, $\rho = -.30$, CI [–.44, –.16]), and relatedness frustration (autonomy support: $k = 25$, $N = 9{,}604$, $\rho = -.35$, CI [–.45, –.25]; competence support: $k = 8$, $N = 5{,}019$, $\rho = -.33$, CI [–.45, –.22]; relatedness support: $k = 8$, $N = 4{,}509$, $\rho = -.55$, CI [–.77, –.33]).

For motivation and regulations, all three interpersonal supports showed strong positive correlations with autonomous forms of motivation. This included intrinsic motivation (autonomy support: $k = 174$, $N = 121{,}143$, $\rho = .44$, CI [.41, .46]; competence support:

$k = 29$, $N = 16{,}110$, $\rho = .44$, CI [.36, .52]; relatedness support: $k = 24$, $N = 14{,}701$, $\rho = .42$, CI [.36, .49]) as well as identified regulation (autonomy support: $k = 112$, $N = 79{,}554$, $\rho = .46$, CI [.43, .50]; competence support: $k = 18$, $N = 11{,}105$, $\rho = .42$, CI [.33, .51]; relatedness support: $k = 17$, $N = 10{,}993$, $\rho = .40$, CI [.33, .47]), and the broader autonomous motivation composite (autonomy support: $k = 357$, $N = 184{,}942$, $\rho = .44$, CI [.42, .45]; competence support: $k = 41$, $N = 22{,}053$, $\rho = .44$, CI [.38, .50]; relatedness support: $k = 36$, $N = 20{,}055$, $\rho = .40$, CI [.35, .46]). Correlations with integrated regulation were more variable, ranging from weakly positive and nonsignificant (competence support: $k = 3$, $N = 381$, $\rho = .18$, CI [−.08, .44]) to strongly positive (autonomy support: $k = 15$, $N = 33{,}919$, $\rho = .42$, CI [.39, .46]; relatedness support: $k = 3$, $N = 381$, $\rho = .39$, CI [.16, .62]).

By contrast, meta-analyzed correlations with controlled forms of motivation generally hovered around 0. For external regulation, we observed a negligible negative correlation for autonomy support ($k = 120$, $N = 80{,}551$, $\rho = -.06$, CI [−.10, −.03]) and nonsignificant positive correlations for both competence support ($k = 19$, $N = 7{,}875$, $\rho = .07$, CI [−.07, .20]) and relatedness support ($k = 19$, $N = 7{,}378$, $\rho = .08$, CI [−.05, .21]). For introjected regulation, negligible to weak positive associations were found (autonomy support: $k = 103$, $N = 72{,}540$, $\rho = .08$, CI [.06, .11]; competence support: $k = 16$, $N = 6{,}809$, $\rho = .23$, CI [.13, .33]; relatedness support: $k = 16$, $N = 6{,}755$, $\rho = .19$, CI [.11, .28]). Meta-analyzed associations with the controlled motivation composite ranged from near zero for autonomy support ($k = 203$, $N = 109{,}331$, $\rho = .01$, CI [−.01, .04]) to negligibly positive for competence support ($k = 33$, $N = 14{,}231$, $\rho = .10$, CI [.02, .19]). The correlation for relatedness support was not significant ($k = 30$, $N = 11{,}957$, $\rho = .08$, CI [−.03, .18]). The associations of all three interpersonal supports with amotivation were all negative and varied from weak for both competence support ($k = 18$, $N = 8{,}700$, $\rho = -.24$, CI [−.32, −.16]) and relatedness support ($k = 19$, $N = 8{,}061$, $\rho = -.17$, CI [−.28, −.07]) to moderate for autonomy support ($k = 94$, $N = 64{,}299$, $\rho = -.31$ CI [−.35, −.28]). Thus, in line with SDT, need-supportive interpersonal behaviors are consistent with autonomous forms of motivation and are generally weakly associated with controlled forms of motivation and negatively associated with amotivation.

Subjective Well-Being

For subjective well-being, all three interpersonal supports showed strong positive associations with positive affect (autonomy support: $k = 57$, $N = 19{,}967$, $\rho = .39$, CI [.36, .43]; competence support: $k = 6$, $N = 2{,}510$, $\rho = .49$, CI [.39, .60]; relatedness support: $k = 8$, $N = 2{,}950$, $\rho = .50$, CI [.38, .63]) and were negatively associated with negative affect, which varied from weak to strong (autonomy support: $k = 52$, $N = 17{,}214$, $\rho = -.24$, CI [−.29, −.19]; competence support: $k = 5$, $N = 2{,}057$, $\rho = -.34$, CI [−.53, −.15]; relatedness support: $k = 6$, $N = 2{,}416$, $\rho = -.44$, CI [−.55, −.32]). All three interpersonal supports showed strong positive meta-analyzed correlations with satisfaction with life (autonomy support: $k = 44$, $N = 17{,}083$, $\rho = .42$, CI [.37, .47]; competence support: $k = 3$, $N = 1{,}125$, $\rho = .46$, CI [.26, .66]; relatedness support: $k = 6$, $N = 1{,}849$, $\rho = .50$, CI [.41, .60]).

Performance

Correlations between the interpersonal supports and performance were extracted across all contexts included in our review but primarily fell into three performance-related categories: academic performance, work performance, and sport performance. Results showed that autonomy support observed associations with academic performance ($k = 109$, $N = 96{,}963$, $\rho = .19$, CI [.17, .21]), work performance ($k = 22$, $N = 4{,}733$, $\rho = .24$, CI [.17, .30]), and sport performance ($k = 20$, $N = 3{,}212$, $\rho = .20$, CI [.13, .26]) that were in the weak range but were significant. Relatedness support showed more varied effects, from negligible (academic performance: $k = 13$, $N = 8{,}140$, $\rho = .13$, CI [.08, .19]) to strong (work performance: $k = 3$, $N = 1{,}681$, $\rho = .41$, CI [.12, .70]). Interestingly, competence support showed a near-zero and nonsignificant association with academic performance ($k = 14$, $N = 7{,}770$, $\rho = .03$, CI [−.10, .16]) and a weak positive association with sport performance ($k = 6$, $N = 1{,}074$, $\rho = .24$, CI [.06, .43]).

Beyond these domain-specific performance associations, we statistically aggregated performance associations into more general categories for each interpersonal support: self-reported performance; other-reported performance (e.g., supervisory ratings, teacher or parent evaluations); and objective performance (e.g., GPA, test scores). We further differentiated objective performance into two more specific categories: that taken directly from records and that which was self-reported (e.g., self-reported GPA), so that we could take into account the lower construct validity of objective metrics when self-reported (Kuncel et al., 2005). Finally, we calculated overall meta-analytic associations with performance by statistically aggregating across all performance criteria. Full results for performance can be found in Supplemental Table S1.

Results showed that correlations with overall performance were weak for autonomy support ($k = 155$, $N = 112{,}578$, $\rho = .19$, CI [.17, .21]), moderate for relatedness support ($k = 23$, $N = 18{,}209$, $\rho = .25$, CI [.19, .31]), but, interestingly, were negligible yet significant for competence support ($k = 24$, $N = 17{,}573$, $\rho = .14$, CI [.06, .22]). Although these correlations differed in magnitude according to Gignac and Szodorai (2016) benchmarks, it is worth noting that there is overlap in the CIs for each of these effects, suggesting that they are not significantly different from each other. Notably, correlations with self-reported performance (autonomy support: $k = 23$, $N = 6{,}590$, $\rho = .28$, CI [.23, .34]; relatedness support: $k = 4$, $N = 1{,}902$, $\rho = .38$, CI [.17, .59]) were generally stronger than those observed for objective performance (autonomy support: $k = 69$, $N = 76{,}257$, $\rho = .20$, CI [.17, .22]; competence support: $k = 14$, $N = 12{,}045$, $\rho = .12$, CI [–.00, .24]; relatedness support: $k = 13$, $N = 13{,}040$, $\rho = .25$, CI [.17, .33]) or other-reported performance (autonomy support: $k = 23$, $N = 7{,}373$, $\rho = .18$, CI [.13, .23]), although this was only significant for autonomy support. We generally found minimal to small differences when objective performance was self-reported or taken from records.

As a final note, we observed substantial heterogeneity in our results, with significant Q-statistics, very high values for I^2 (typically exceeding 90%), and broad CVs. Results for heterogeneity can be found in Supplemental Table S1. This suggests that our main effect associations are generally heavily moderated, which is a possibility we examine next.

Aim 2: Moderator Analyses

Categorical Subgroups

Aligned with our second aim, we examined possible moderators of effects where sufficient heterogeneity was present. Again, for space reasons, we provide broad commentary on our categorical moderator analyses here, but full results can be found in Supplemental Table S2.

Operationalization. We first examined whether construct operationalizations moderated effects. For autonomy support, we tested both domain-general measures, including the autonomy-supportive climate questionnaires (WCQ, SCQ, LCQ, HCCQ), the Perceived Autonomy Support Scales, the Interpersonal Behaviors Questionnaire, and Interpersonal Behaviors Scale, and domain-specific measures, such as the TASC and the POPS. Results generally showed a pattern of weaker effects among domain-specific scales, such as the TASC and POPS.

However, because the use of these scales is confounded with the research domain, we conducted further hierarchical moderation analyses (see Schmidt, 2017) to assess if they yielded weaker effects while holding the research domain constant. In classroom contexts, analyses showed that the TASC produced weaker effects for autonomous motivation ($k = 10$, $N = 9{,}191$, $\rho = .26$, CI [.17, .36]) than the autonomy-supportive climate questionnaires ($k = 38$, $N = 58{,}041$, $\rho = .49$, CI [.44, .54]), which were the most commonly used scales. Similar results were observed for intrinsic motivation (TASC: $k = 5$, $N = 5{,}729$, $\rho = .17$, CI [.11, .22]; autonomy-supportive climate questionnaires: $k = 20$, $N = 40{,}009$, $\rho = .57$, CI [.53, .61]) and competence satisfaction (TASC: $k = 4$, $N = 3{,}092$, $\rho = .18$, CI [.11, .25]; autonomy-supportive climate questionnaires: $k = 44$, $N = 62{,}862$, $\rho = .57$, CI [.53, .62]).

For competence-supportive behaviors, we differentiated behaviors based on whether they were operationalized as *competence support* or *structure*. Across all basic needs and all types of motivation (except identified regulation), we observed smaller effects in studies that used measures of structure rather than competence support. This observation emerged for our pairwise comparison tests where the CIs of the subgroup difference did not encompass 0 (see $r_1 - r_2$ with corresponding CI in Supplemental Table S2). Similar effects were observed for the relatedness-supportive behaviors, which we differentiated according to whether studies operationalized behaviors as *relatedness support* or *involvement*. Measures of involvement showed weaker effects but were only significantly weaker for competence satisfaction and relatedness satisfaction. Of note, across all analyses, moderation detection influenced the strength of the corresponding relation, but not its direction.

Research Domain. We also explored whether the research domain moderated the observed associations. For autonomy support, we observed stronger effect sizes in PE than all other contexts for autonomy satisfaction, and most other contexts for autonomous motivation, intrinsic motivation, and identified regulation (see Supplemental Table S2). Similarly, while the PE context showed effect sizes that were generally stronger across the competence- and relatedness-supportive behaviors, this only reached significance in a small number of cases, especially for competence support. For instance, for competence support, PE yielded stronger effects than parenting on competence satisfaction (PE: $k = 9$, $N = 5{,}473$, $\rho = .62$, CI [.45, .78]; parenting: $k = 7$, $N = 1{,}494$, $\rho = .33$, CI [.22, .43]). Stronger effects were also observed in PE than classrooms on relatedness satisfaction (PE: $k = 8$, $N = 4{,}360$, $\rho = .66$, CI [.54, .78]; classrooms: $k = 12$, $N = 8{,}247$, $\rho = .34$, CI [.22, .46]). No other effects were significant. For relatedness support, PE showed stronger effects than classrooms for autonomy satisfaction (PE: $k = 8$, $N = 4{,}360$, $\rho = .68$, CI [.58, .77]; classrooms: $k = 8$, $N = 7{,}185$, $\rho = .42$, CI [.32, .52]). Similarly, as shown in Supplemental Table S2, PE ($k = 7$, $N = 3{,}068$, $\rho = .64$, CI [.54, .74]) observed stronger effects than classrooms ($k = 8$, $N = 7{,}220$, $\rho = .32$, CI [.17, .47]), parenting ($k = 6$, $N = 1{,}627$, $\rho = .33$, CI [.23, .42]), and sport ($k = 11$, $N = 3{,}715$, $\rho = .38$, CI [.28, .48]) on autonomous motivation. The same was observed for intrinsic motivation (PE: $k = 7$, $N = 3{,}192$, $\rho = .61$, CI [.52, .71]; classrooms: $k = 6$, $N = 8{,}224$, $\rho = .34$, CI [.23, .45]; parenting: $k = 3$, $N = 774$, $\rho = .32$, CI [.29, .35]; sport: $k = 7$, $N = 2{,}132$, $\rho = .46$, CI [.41, .51]). For identified regulation, PE ($k = 6$, $N = 2{,}906$, $\rho = .58$, CI [.47, .70]) showed a stronger effect than sport ($k = 5$, $N = 1{,}896$, $\rho = .39$, CI [.34, .43]). The effects of interpersonal supports on basic needs and autonomous forms of motivation were positive and in the moderate to strong range, even in the presence of moderation. The only exception was the effect of autonomy support on autonomy satisfaction in health care contexts, which fell just inside the weak range ($k = 11$, $N = 2{,}572$, $\rho = .23$, CI [.07, .39]).

Source of Support. We next examined whether the effects of autonomy-, competence-, and relatedness-supportive behaviors from lateral sources (e.g., peers, colleagues, siblings) would differ in magnitude from those received from vertical sources (e.g., teachers, managers, parents). Results showed some evidence of moderation (see Supplemental Table S2). Vertical sources of autonomy support yielded stronger effects than lateral sources on competence satisfaction (vertical: $k = 248$, $N = 153{,}472$, $\rho = .46$, CI [.43, .48]; lateral: $k = 23$, $N = 10{,}424$, $\rho = .37$, CI [.32, .43]), as well as autonomous motivation (vertical: $k = 305$, $N = 166{,}255$, $\rho = .44$, CI [.43, .46]; lateral: $k = 49$, $N = 16{,}180$, $\rho = .37$, CI [.32, .41]), yet all effects were in the strong range. These analyses were confirmed with the pair-wise comparison test, which showed 95% CIs that did not encompass 0 (see $r_1 - r_2$ with corresponding CI in Supplemental Table S2). Vertical versus lateral autonomy support did not significantly differ for any other variable. The opposite pattern emerged for competence support and relatedness support, yet these only reached significance using the less conservative pair-wise comparison tests. Specifically, vertical relatedness support was weaker than lateral relatedness support for relatedness satisfaction ($r_1 - r_2 = -.20$, CI [–.34, –.05]). It is worth mentioning that despite moderation being detected, all effects were in the strong range.

Continuous Moderators

We also studied whether the observed meta-analytic results changed as a function of continuous moderators, focusing specifically on the effects of culture, sample age, and time lag (in months) between the measurement of each interpersonal support and each basic need or motivation-based criterion. In line with best practice recommendations, we only completed these analyses when at least 10 effect sizes were available for an association (Higgins & Green, 2008). Again, for space reasons, we only report significant results here, but full results for each analysis can be found in Supplemental Tables S3–S5, and scatterplots for significant associations are available via our web-based software (see https://basic-psychological-needs.shinyapps.io/gen1/).

Culture. To examine the effects of individualism/collectivism on effect sizes, we coded the country in which the samples were recruited and subsequently used Hofstede's (2001) percentile rank for individualism as a continuous variable in a meta-regression. Using this procedure, our results did not yield evidence of moderation across any interpersonal support to basic psychological needs (see Supplemental Table S3). However, contrary to our expectation, we did find that culture moderates the relation between autonomy support and autonomous motivation (k = 327, β = −.0010, SE = .0004, CI [−.0017, −.0002]), which showed a slight downward trend as samples became more individualist. This suggests that, if anything, autonomy support had a greater impact on autonomous motivation in more collectivist cultures. In addition, contrary to our expectations, we also observed that culture moderates the relation between relatedness support and intrinsic motivation (k = 23, β = .0030, SE = .0012, CI [.0006, .0053]), which showed an upward trend as samples became more individualist. This suggests that relatedness support may exert a stronger impact on intrinsic motivation in individualist cultures. No other moderation analyses produced significant results using this procedure.

Age and Time Lag. In terms of age, as shown in Supplemental Table S3, we observed moderation effects of autonomy support to autonomous motivation (k = 309, β = −.0025, SE = .0007, CI [−.0039, −.0010]), as well as competence satisfaction (k = 218, β = −.0020, SE = .0008, CI [−.0036, −.0005]), which decreased slightly as a function of sample age. This suggests that these effects were typically stronger for younger participants. Similarly, in terms of time lag, relations of autonomy support to intrinsic motivation (k = 174, β = −.0133, SE = .0064, CI [−.0259, −.0008]), autonomy satisfaction (k = 230, β = −.0138, SE = .0052, CI [−.0240, −.0035]), and relatedness satisfaction (k = 250, β = −.0073, SE = .0036, CI [−.0143, −.0002]) decreased slightly with longer time lags, suggesting that effects weakened as the time between measuring the predictor and criterion grew longer. No other continuous moderator tests were significant.

Aims 3 and 4: Incremental Validity Estimations

Aim 3: Incremental Effects of the Competence- and Relatedness-Supportive Interpersonal Behaviors Over and Above Autonomy Support

In line with our third aim, we examined the incremental validity of competence- and relatedness-supportive behaviors after controlling for autonomy support in predicting the basic needs. The meta-analyzed correlations matrices for these analyses can be found in Table 1 and the results are displayed in Table 2. As shown in Table 2, comparisons of ΔR^2 are made relative to Model 1, which includes autonomy support as the sole predictor. Moreover, as noted earlier, because high intercorrelations among predictors might raise concerns about multicollinearity, we also report RWA for each criterion (Johnson, 2000; Tonidandel & LeBreton, 2015).

Results showed that when competence support is added after controlling for autonomy support (Model 4), a small increase in variance is observed in the satisfaction of the basic need for autonomy (ΔR^2 = .025), yet more substantial increases are observed in competence satisfaction (ΔR^2 = .058) and in relatedness satisfaction (ΔR^2 = .062). When relatedness support is added after controlling for autonomy support (Model 5), incremental variance is explained in autonomy satisfaction (ΔR^2 = .038), competence satisfaction (ΔR^2 = .039), and particularly in relatedness satisfaction (ΔR^2 = .191). Model 7 shows the joint effect of all three interpersonal supports. Results suggest that when all three supports are present, relative to just autonomy support, incremental variance is explained in all three basic needs: autonomy satisfaction (ΔR^2 = .044), competence satisfaction (ΔR^2 = .067), and relatedness satisfaction (ΔR^2 = .194). This is consistent with the relative weights for each criterion, which show each source of support contributing about equally to competence satisfaction (RW%: 31.43–38.64). However, autonomy support and relatedness support are the most dominant predictors for autonomy satisfaction and relatedness satisfaction, respectively, accounting for 42.82% and 58.16% of their total R^2 values. Still, the RWAs show that each interpersonal support contributes at least 18% of the total R^2 for each need.

Aim 4: Incremental Effects of Sources of Support

Table 3a–3c displays the meta-analyzed correlation matrices used for the analyses of the incremental benefit of different sources of interpersonal supports (i.e., vertical *and* lateral sources) for the satisfaction of basic psychological needs. The results of these analyses can be found in Table 4, addressing our fourth aim. We also report RWAs that reflect the proportional contribution of each source of support for basic needs. Results generally suggest that two sources of support are better than just one in isolation. That is, more incremental variance is explained in basic psychological needs when participants received *both* lateral and vertical forms of autonomy, competence, and relatedness support, relative to just one, although a few exceptions to this emerged. For instance, vertical relatedness support explained negligible incremental variance in relatedness satisfaction after controlling for lateral relatedness support (ΔR^2 = .008; see Table 4). Thus, in this case, lateral relatedness support appears to provide greater benefit and when it is present, vertical relatedness support exerts little additive effect. Similarly, lateral competence support and lateral relatedness support explained only small amounts of incremental variance in relatedness satisfaction (ΔR^2 = .016) and autonomy satisfaction (ΔR^2 = .024), respectively, after controlling for vertical competence support and vertical relatedness support. Nevertheless, the RW% suggested that all supports accounted for at least 25% of R^2 across all analyses, suggesting that each one plays an important role.

Robustness Assessment Results

Procedural details for our sensitivity analysis can be found in Supplemental Materials. An inspection of the sensitivity analysis results (see Supplemental Table S10) indicates that outliers rarely had a noticeable effect on the observed naïve meta-analytic mean effect sizes.[2] Although at least one outlier was detected in almost two thirds (65%; 39/60) of the meta-analytic distributions, a meaningful practical difference (i.e., $|\Delta| > 20\%$; Kepes & McDaniel, 2015) between the meta-analytic mean estimate before and after outlier removal was detected in six distributions only. For most distributions, the absolute magnitude of the meta-analytic mean

[2] We use the term "naïve" to denote that the meta-analytic results are unadjusted for publication and/or other bias, such as outliers (Copas & Shi, 2000).

Table 1
Meta-Analytically Derived Correlations Matrix Between Behavioral Supports for Autonomy, Competence, and Relatedness, With Basic Need Satisfaction

Variable	1	2	3	4	5	6
1. Autonomy support	—	73,950	74,492	106,858	165,388	147,276
2. Competence support	.67 (135)	—	51,306	22,058	24,414	21,558
3. Relatedness support	.68 (124)	.71 (92)	—	21,163	26,059	28,475
4. Autonomy satisfaction	.57 (235)	.50 (38)	.53 (40)	—	80,459	109,437
5. Competence satisfaction	.45 (274)	.48 (47)	.45 (47)	.72 (179)	—	109,097
6. Relatedness satisfaction	.44 (251)	.48 (42)	.62 (46)	.62 (175)	.61 (175)	—

Note. Within each cell, ρ (*k*) is in the lower diagonal. Within each cell, *N* is in the upper diagonal for each meta-analytic association.

remained unchanged (11/39, or 28% of cases) or was smaller (16/39, or 41% of cases) after outliers were removed. As such, although our results indicate that outliers were present in most distributions, it appears as if their effect did not rise to a level that threatens the robustness of the observed naïve meta-analytic means.

In contrast, our publication bias analyses revealed more varying levels of nonrobustness. An inspection of Supplemental Table S10 indicates that 41% of naïve meta-analytic mean effect size estimates may be threatened by publication bias (i.e., $|\Delta| > 20\%$; Kepes & McDaniel, 2015). For example, the average of our publication bias results for the *autonomy support–sport performance* distribution ($\bar{r}_{o_{RE}} = .20, k = 20$) suggests that the corresponding naïve meta-analytic mean effect size may be misestimated by 49%. Moreover, our results suggest that certain naïve meta-analytic means are overestimated (e.g., *autonomy support–introjected regulation*), whereas others are underestimated (e.g., *autonomy support–competence satisfaction*).

However, our average range estimate (ARE) results suggest that, broadly speaking, the literature on interpersonal supports for basic needs is robust to misestimation. This is noteworthy because the ARE is potentially the best way to combine all the sensitivity analysis results. Our ARE results suggest that 53 out of 59 (90%) meta-analytic distributions presented with a "negligible" practical difference (i.e., ≤20%; Kepes & McDaniel, 2015).[3] Furthermore, the ARE result for 42 out of 59 (71%) distributions indicated the respective naïve meta-analytic mean effect size was misestimated by 10% or less. According to our ARE results, only five (8%) of the naïve meta-analytic mean estimates were "severely" misestimated (i.e., $|\Delta| > 40\%$). Taken together, although we observed varying levels of nonrobustness, we conclude this literature is typically not threatened by outliers and/or publication bias.

Discussion

Our meta-analysis provides the most current and in-depth examination of the associations between interpersonal supports for autonomy, competence, and relatedness, with basic need satisfactions, motivation, well-being, and performance. We extend previous reviews and meta-analyses by broadening the focus of our review beyond autonomy support and across domains to comprehensively examine the independent and incremental effects of the three need-supportive interpersonal behaviors on motivational processes, well-being, and performance.

Aligned with our first aim of the current meta-analysis, which was to examine the associations of interpersonal supports for basic needs across motivational processes and associated outcomes, our results are largely supportive of SDT premises and consistent with the view that experiencing need supports facilitates basic psychological needs satisfaction, self-determined motivation, well-being, and performance across domains. Our second aim was to examine the extent to which these effects varied as a function of various moderating factors. Results showed effects of need-supportive interpersonal behaviors varied as a function of the source of support, the research domain, and the measures used. While moderation analyses showed general stability of effects across cultures, we also observed some instances of moderation as a function of culture. Specifically, the autonomy support to autonomous motivation association weakened slightly as a function of individualism, whereas the opposite pattern was observed for the correlation between relatedness support and intrinsic motivation. Some effects also declined as a function of sample age and lag in measurements. Our third aim was to examine the incremental effects of competence and relatedness support over and above autonomy support, and our fourth aim was to examine the incremental effects of lateral sources of interpersonal supports over vertical sources of support. Results showed that supports for competence and relatedness explained incremental variance in need satisfaction beyond the more established effects of autonomy support, especially when considering the competence and relatedness needs. Similarly, results showed that lateral need supports explained incremental variance in basic need satisfaction after controlling for vertical sources of support. Below, we provide commentary on these observations, including important theoretical and practical implications that can be delineated from our review. We conclude by offering directions for future research focusing on interpersonal supports for basic needs.

Theoretical Implications

Our review has several theoretical advances. First, our findings contribute to current knowledge concerning the independent and incremental role of need-supportive interpersonal behaviors on motivational processes and outcomes. Our review suggests that each of SDT's three disparate clusters of interpersonal behaviors—supports for autonomy, competence, and relatedness—offers comparable benefits as a source of environmental nourishment, with

[3] The denominator here is 59, not 60, because one distribution had fewer than 10 effects following outlier removal and, thus, is not included in these analyses. Moreover, the naïve meta-analytic mean effect size estimates for five of these distributions were .02, −.02, .07, .05, and .00. Given the small magnitude of these numbers, which serve as the base in the ARE calculation, it is not surprising that large ARE values were observed in these distributions.

Table 2

Incremental Validity Estimations and Relative Weights Analyses for Each Interpersonal Support, Using Meta-Analytic Intercorrelations Matrices

			Criteria													
			Autonomy satisfaction					Competence satisfaction					Relatedness satisfaction				
Model	*N*	Predictor	β	R^2	ΔR^2	RW	RW%	β	R^2	ΔR^2	RW	RW%	β	R^2	ΔR^2	RW	RW%
Model 1	113,363	Autonomy support	.570	.325				.450	.202				.440	.194			
Model 2	36,717	Competence support	.500	.250				.480	.230				.480	.230			
Model 3	39,610	Relatedness support	.530	.281				.450	.202				.620	.384			
Model 4	50,218			.350	.025				.260	.058				.256	.062		
		Autonomy support	.426					.233					.215				
		Competence support	.214					.324					.336				
Model 5	53,448			.363	.038				.241	.039				.385	.191		
		Autonomy support	.390					.268					.034				
		Relatedness support	.265					.268					.597				
Model 6	32,933			.312	.000				.254	.052				.388	.194		
		Competence support	.249					.324					.080				
		Relatedness support	.353					.220					.563				
Model 7	42,518			.369	.044				.269	.067				.388	.194		
		Autonomy support	.349			.158	42.82	.179			.085	31.43	.007			.071	18.27
		Competence support	.118			.095	25.66	.256			.104	38.64	.078			.091	23.57
		Relatedness support	.209			.116	31.51	.147			.081	29.93	.560			.223	58.16

Note. *N* refers to the harmonic mean of the sample sizes for each model tested. Comparisons of subsequent models are made against Model 1, which includes autonomy support as the sole predictor. RW = raw relative weight; RW% = rescaled relative weight, produced by the formula: RW/model R^2.

associations with motivation, well-being, and performance similar in magnitude and direction. Moreover, our incremental validity analyses revealed that interpersonal supports for competence and relatedness indeed provide unique contributions to basic need satisfaction above and beyond that observed from the more frequently studied effects of autonomy support, particularly when considering the competence and relatedness needs. Hence, if the goal is to explain variance in all three needs, all three need-supportive strategies should be considered as possible antecedents. As such, a useful direction for the future is to give greater consideration to supports for competence and relatedness in research. Several measures already integrate the three interpersonal supports into one scale (e.g., Parfyonova et al., 2019; Pulido et al., 2018; Rocchi, Pelletier, Cheung, et al., 2017), yet the use of such scales remains considerably outweighed by scales that measure autonomy support in isolation, such as the autonomy-supportive climate questionnaires. We hope that our results will encourage a change in direction so that greater balance in focus can be achieved.

Similarly, our results contribute to conceptual models of interpersonal supports that simultaneously consider multiple behaviors.

Table 3

Meta-Analytically Derived Correlation Matrices Between Vertical and Lateral Supports for (a) Autonomy, (b) Competence, and (c) Relatedness, With Basic Need Satisfaction

Variable	1	2	3	4	5
(a) Autonomy support					
1. Vertical autonomy support	—	9,113	97,542	153,472	135,827
2. Lateral autonomy support	.41 (27)	—	7,703	10,424	9,957
3. Autonomy satisfaction	.57 (210)	.54 (21)	—	80,459	109,437
4. Competence satisfaction	.46 (248)	.37 (23)	.72 (179)	—	109,097
5. Relatedness satisfaction	.43 (218)	.53 (30)	.62 (175)	.61 (175)	—
(b) Competence support					
1. Vertical competence support	—	673	17,035	20,687	17,957
2. Lateral competence support	.51 (3)	—	2,109	2,235	2,109
3. Autonomy satisfaction	.50 (32)	.57 (3)	—	80,459	109,437
4. Competence satisfaction	.47 (40)	.53 (4)	.72 (179)	—	109,097
5. Relatedness satisfaction	.49 (36)	.36 (3)	.62 (175)	.61 (175)	—
(c) Relatedness support					
1. Vertical relatedness support	—	5,824	17,652	22,167	19,186
2. Lateral relatedness support	.62 (2)	—	2,109	2,109	7,797
3. Autonomy satisfaction	.53 (34)	.45 (3)	—	80,459	109,437
4. Competence satisfaction	.44 (40)	.47 (3)	.72 (179)	—	109,097
5. Relatedness satisfaction	.55 (39)	.78 (4)	.62 (175)	.61 (175)	—

Note. Within each cell, ρ (*k*) is in the lower diagonal. Within each cell, *N* is in the upper diagonal for each meta-analytic association.

Table 4

Incremental Validity Estimations and Relative Weight Analyses for Vertical and Lateral Sources of Interpersonal Supports, Using Meta-Analytic Intercorrelations Matrices

			Criteria													
			Autonomy satisfaction					Competence satisfaction					Relatedness satisfaction				
Model	*N*	Predictor	β	R^2	ΔR^2	RW	RW%	β	R^2	ΔR^2	RW	RW%	β	R^2	ΔR^2	RW	RW%
Autonomy support																	
Model 1	109,364	Vertical autonomy support	.570	.325				.460	.212				.430	.185			
Model 2	16,811	Lateral autonomy support	.540	.292				.370	.137				.530	.281			
Model 3	20,376			.438	.113 (.146)				.251	.039 (.114)				.335	.150 (.054)		
		Vertical autonomy support	.419			.236	53.80	.371			.163	64.87	.256			.120	35.68
		Lateral autonomy support	.368			.202	46.20	.218			.088	35.13	.425			.216	64.32
Competence support																	
Model 1	31,014	Vertical competence support	.500	.250				.470	.221				.490	.240			
Model 2	4,206	Lateral competence support	.570	.325				.530	.281				.360	.130			
Model 3	3,252			.384	.134 (.059)				.335	.114 (.054)				.256	.016 (.126)		
		Vertical competence support	.283			.155	40.25	.270			.137	41.04	.414			.184	71.54
		Lateral competence support	.426			.230	59.75	.392			.197	58.96	.149			.073	28.46
Relatedness support																	
Model 1	32,449	Vertical relatedness support	.530	.281				.440	.194				.550	.303			
Model 2	5,419	Lateral relatedness support	.450	.202				.470	.221				.780	.608			
Model 3	6,977			.305	.024 (.103)				.257	.063 (.036)				.616	.313 (.008)		
		Vertical relatedness support	.408			.192	62.86	.241			.115	44.68	.108			.155	25.15
		Lateral relatedness support	.197			.113	37.14	.320			.142	55.32	.713			.461	74.85

Note. *N* refers to the harmonic mean of the sample sizes for each model tested. ΔR^2 change observed over and above vertical supports shown outside of parentheses; ΔR^2 change observed over and above lateral supports shown within parentheses. RW = raw relative weight; RW% = rescaled relative weight, produced by the formula: RW/model R^2.

For instance, researchers have recently used multidimensional scaling to support circumplex models as multidimensional frameworks to convey the complex interrelationships between autonomy support and structure (i.e., herein examined as competence-supportive behaviors), along with their conceptual opposites: controlling behaviors and chaos, respectively (e.g., laissez-faire interpersonal behaviors; e.g., Aelterman et al., 2019; Delrue et al., 2019). While circumplex models include a broad variety of interpersonal behaviors that encompass autonomy support and competence support, the results from our meta-analysis indicate that efforts could be made to incorporate relatedness-supportive dimensions, given their additive benefit. Such an inclusion may allow for a fuller and more integrative display of how all clusters of interpersonal supports, which also includes supports for relatedness, conceptually relate to one-another and may even allow for deconstructing more refined clusters of behaviors to support all basic needs.

Second, the overall pattern of our results supported SDT hypotheses that, across both individualistic and collectivist cultures, interpersonal supports for basic needs are associated with need satisfaction and the high-quality motivational and wellness relevant criteria. A search for moderation by culture (individualism and collectivism) produced only two significant findings out of 18 relationships that were tested. The first is that the effect of autonomy support on autonomous motivation became weaker in more individualistic samples, and the second is that the effect of relatedness support on intrinsic motivation became stronger in more individualistic samples. Because these were not specifically predicted we can only speculate as to their meaning, but interestingly these two findings surprisingly run counter to some cultural formulations in which autonomy support is thought to be less important within collectivist cultures and relatedness support less important in individualistic ones (e.g., Iyengar & DeVoe, 2003; Markus & Kitayama, 2003). Instead, these two findings suggest that with respect to motivation, if anything, the reverse is potentially true: autonomy support is even more important for autonomous motivational outcomes in collectivistic contexts and relatedness support is even more important in individualistic contexts. It may be that within collectivistic contexts, autonomy support is less commonly experienced, such that when support provision occurs it takes on added salience when predicting autonomous motivational processes. The same general pattern may apply to relatedness support, which could be less commonly observed in societies characterized by individualistic cultural norms, such that when support provision occurs it also takes on added salience. Notably, these effects do not modify SDT's claims concerning the importance of both supports across both cultural systems. Indeed, irrespective of moderation, effects were universally positive and strong in magnitude across all types of support and all criteria irrespective of culture.

Although our moderation analysis focused on one of the most theoretically relevant and debated dimensions of cultural difference, namely individualism/collectivism, it is possible that other aspects of culture such as vertical-versus-horizontal (Singelis et al., 1995), tight-versus-loose (Gelfand, 2019), or degree of materialism (Twenge & Kasser, 2013; Van Den Broeck et al., 2019) dimensions may moderate effects of the various need-supportive interpersonal behaviors. Establishing the boundaries of SDT's universality claims will, in fact, require continuing exploration of features of pervasive influences such as cultural, economic, and political systems that impact people's motivational processes, well-being, and performance (R. M. Ryan & Deci, 2017).

Importantly, similar to culture, our results show that the effects of interpersonal supports for basic needs are robust across domains of research, with all results converging in the same direction and are generally in the moderate to strong range. Although the research domain moderated certain relations, particularly those involving autonomy support, our results did not reveal a consistent pattern to suggest effects diminish in particular settings. Indeed, our results suggest that the effects of interpersonal supports for basic needs are likely to generalize across life domains. Future work could further investigate why the subtle moderation effects we found could have emerged.

A third way we advance theory is by revealing the importance of lateral sources of interpersonal support for basic needs, with our review contributing compelling evidence that both vertical and lateral interpersonal supports offer both independent and additive contributions to optimal motivational processes. This is an important finding insofar as the focus of much of the past SDT literature is on the impact of need-supportive behaviors of authority figures (e.g., teachers, managers, coaches, parents) to those under their care (e.g., students, employees, athletes, children; Forner et al., 2020; Mossman et al., 2022; Reeve, 2015). Although these are clearly important relationships, there is a growing body of research on the effects of interpersonal need supports within lateral relationships, such as between friends, team-mates, romantic partners, or colleagues (e.g., Gilbert et al., 2021; Knee & Browne, 2023; Moreau & Mageau, 2012; Wentzel et al., 2010). Our meta-analytic examination of these studies showed that in some instances, lateral sources of support exerted even stronger associations with motivational benefits than vertical sources. This was especially the case for satisfaction of the need for relatedness, where lateral sources of autonomy support and relatedness support showed the strongest effects, even after controlling for the effects of vertical sources of support. This is consistent with evidence that, as fundamentally social beings, caring relationships with peers, team-mates, colleagues, or siblings are inherent to well-being and healthy psychological adjustment (Bank et al., 1990; Biddle et al., 1980).

Likewise, it may be that lateral sources of support yield not only positive independent effects on motivational outcomes but may also serve to buffer the impacts of low vertical sources of need satisfaction or even need frustration, such as the imposition of controlling behavior. A direction for future research will be to examine this possibility and to study the underlying processes to enable deeper understanding of these effects. Similarly, while we examined vertical or lateral supports across broad domains of research, it would be interesting to further examine our findings within research domains. Indeed, much of the available literature to examine this question emerged from research on parents and teachers relative to siblings and peers, respectively. Yet there were also studies from sports and PE settings (involving coaches and teammates) and studies from workplaces (involving leaders and colleagues). As the literature develops, we hope that others will continue to explore this question, which may help to determine if domain-specific boundaries exist for this additive effect. In any case, our findings suggest that interpersonal supports for basic needs within lateral relationships can be a potent source of environmental nourishment and function to create holistic environments that

nurture basic needs, which in turn may affect motivational processes, well-being, and performance.

Practical Implications

Our findings also offer practical implications for interventions to foster need-supportive interpersonal behaviors, motivation, well-being, and performance across a range of settings. First, our findings confirm the potential of need-supportive interpersonal behaviors beyond autonomy support, particularly when considering all three basic needs as outcomes. Hence, we suggest that applied researchers and practitioners who design and implement SDT-based interventions deploy more holistic efforts to impart teachings that cut across all three interpersonal behaviors. While many interventions have historically focused on developing autonomy support (e.g., see the review by Su & Reeve, 2011), more recent efforts have trended toward incorporating other need-supportive interpersonal behaviors within intervention learning content (e.g., Gillison et al., 2019; Reeve et al., 2022; Slemp et al., 2021), which our data suggest are likely to offer additional benefits. Hence, taking steps to foster relatedness- and competence-supportive behaviors, alongside autonomy support, may augment an intervention's ability to yield desirable effects for need satisfaction, which SDT suggests should exert further positive downstream effects on motivation, well-being, and performance across contexts.

Second, our findings reveal important opportunities for interventions to draw on lateral sources of supportive behaviors. Specifically, while a lot of interventions are focused on vertical support (e.g., Cheon et al., 2012), our results showing positive effects of need supports from lateral sources point to an important complementary role that peers may play in facilitating need-supportive environments (Hein & Jõesaar, 2015). Hence, where possible, it may benefit interventions to include a focus on team members, colleagues, or peers. For instance, in the workplace, Jungert et al. (2018) empirically examined an intervention specifically aimed to engender need-supportive interpersonal behaviors within work teams through implementing peer-to-peer exercises that aimed to develop perspective-taking, effective communication, and collaboration. Results showed the intervention exerted benefits on need satisfaction and autonomous motivation. Our meta-analysis offers additional empirical support for such efforts. Indeed, as we have noted, in some instances our findings showed that lateral supports for basic needs exerted even more dramatic effects than vertical sources, suggesting peers represent a potential underutilized source of nourishment that could be more involved in intervention design, delivery, and maintenance.

Although previous studies have examined the extent to which people of varying ages perceive socializing agents to be more or less autonomy supportive (e.g., Gillet et al., 2012; Martinek et al., 2016; Matte-Gagné et al., 2013), few have empirically examined whether effects of autonomy support, or other need-supportive behaviors, vary in potency as a function recipient age. Our findings help to address this gap. Our exploratory moderator analyses suggest that while the effect of supports for basic needs is beneficial across age groups, effects were nevertheless stronger for younger participants, indicating that such behaviors exert greater potency during earlier stages of life. Although prior research has also shown that perceived autonomy support tends to decease as children age (Gille, Vallerand, & Lafrenière, 2012; Martinek et al., 2016; Matte-Gagné et al., 2013), our findings highlight its importance across domains such as in schools, parenting, and sport, which include a preponderance of younger participants.

Limitations and Future Research Directions

Our review highlights a number of areas that warrant future investigation. First, as displayed in Supplemental Materials (see Supplemental Table S6), our review revealed a considerable number of distinct scales used to measure all three interpersonal supports. Although imperfect citing practices across studies blur a clear understanding of the exact number of scales, we detected as many as 60 separate measures of autonomy support across the 768 records, as well as 32 for competence support (including structure) and 35 for relatedness support (including involvement). Although this heterogeneity was, at times, due to researcher efforts to capture different scale referents across contexts (e.g., managers, teachers, sport coaches), there were typically multiple heterogeneous measures used within research contexts. Other relatively common practices were to modify measures or to use items drawn across a range of different scales (e.g., Cronin et al., 2019; Escriva-Boulley et al., 2021; Griffith & Grolnick, 2014). It was also relatively common to develop an assortment of new items for the purpose of a study (e.g., Otis & Pelletier, 2005; Palo & Rothman, 2016). In some cases, it was unclear why existing known scales were not used. As we noted, we did not exclude studies because they failed to use measures that we identified a priori. This is because decisions to exclude studies due to the study's measures are often based on arbitrary grounds (see Schmidt & Hunter, 2015, Chapter 1). As noted in Schmidt and Hunter (2015), no study's measures are free from error and no study's measures contain perfect construct validity. Yet, this variability creates opportunities for scale integration and validation work.

To the extent that multiple measures yield similar results, they are thought to converge on the construct and thereby strengthen the conclusions of a meta-analysis (see Cooper, 2017, p. 42). Yet, at the same time, the existence of multiple measures may render results incommensurable across studies if one or more of them are lacking validity (Bergkvist, 2021; Steel et al., 2008). We expect that the high level of heterogeneity that we observed in the present meta-analysis is at least partially attributable to the variability in the observed measures used. Indeed, this was supported by our moderation analyses, which showed some potentially attenuated results for the TASC (Belmont et al., 1992), as well as the structure and involvement operationalizations of competence and relatedness support, respectively. For the TASC, attenuation was confirmed in our hierarchical moderation analyses that suggested it was unlikely a function of the research domain, but rather of the measure. Future research should pursue greater standardization in measurement so that issues with incommensurability can be avoided (Bergkvist, 2021). This might involve opting to use more general scales that are broad enough to capture all three interpersonal behaviors, yet can also be used across contexts (e.g., Rocchi, Pelletier, Cheung, et al., 2017). The use of such scales remains considerably outweighed by scales such as the climate questionnaires that capture autonomy support alone, potentially contributing to the multiplication of distinct measures to overcome their more limited scope. If scales are adapted for broader use, we also recommend using best-practice

procedures to ensure that threats to validity are minimized (see Heggestad et al., 2019, for recommendations).

The majority (>70%) of our included studies were cross-sectional. Similarly, few of the lagged studies we included used appropriate designs and statistical models to allow for the detection of potential causal effects (see Diener et al., 2022; Hamaker et al., 2015; Zyphur et al., 2020, for a discussion). Consequently, we were unable to examine directionality and our interpretation of need-supportive behaviors as the antecedent was based purely on theoretical grounds (see Deci et al., 2017; R. M. Ryan & Deci, 2017; Williams et al., 2002). A possibility that we could not rule out, for example, is that socializing agents convey higher levels of need-supportive behaviors when they observe need-satisfying experiences in others (Ng et al., 2012; Slemp et al., 2018). Likewise, it may be that different types of motivation or levels of observed performance will prompt particular styles of behavior in socializing agents. While much of the literature assumes a causal process in which need-supportive behaviors influence outcomes in beneficiaries, interpersonal phenomena often involve simultaneous causal processes in which causality runs both ways, raising the possibility of endogeneity (see Güntner et al., 2020). Nevertheless, our review is consistent with experimental work demonstrating that need-supportive interpersonal behaviors yield positive motivation and well-being-based outcomes in others (e.g., Gillison et al., 2019; Ntoumanis et al., 2021; Reeve & Cheon, 2021). Moreover, the available lagged studies we did examine were consistent in treating need-supportive behaviors as the antecedent rather than an outcome. On these grounds, our assumed directionality is supported theoretically and by some empirical literature. Future research could expand upon these results to examine whether reversed causation or reciprocal effects may arise.

We note that our moderation analyses demonstrated some attenuation as a function of time lag in measurement, indicating a possible upward bias in cross-sectional effects. This is likely because cross-sectional research is prone to bias due to common methods or transient influences (Brannick et al., 2010; Podsakoff et al., 2003; Spector, 2019), leading to inflated covariation between constructs (MacKenzie & Podsakoff, 2012). To overcome such issues, researchers should make efforts to deploy more longitudinal and experimental designs (MacKenzie & Podsakoff, 2012; Podsakoff et al., 2003). This will also be important to provide further support for our conclusions. That is, while our findings suggest all three need-supportive behaviors (and different sources of support) offer some unique benefit for motivational processes, a direction for future work will be to confirm this, and the mechanisms through which such effects operate, using longitudinal and experimental methods that allow stronger causal inferences. For example, the incremental benefit of involving peers or incorporating competence- or relatedness-supportive behaviors into training programs remains untested and thus present ongoing directions for future work.

Another limitation with our approach involved coding the culture of each sample based on Hofstede (2001) dimensions. Although this practice is common (e.g., Cheng et al., 2013; Curran et al., 2015; Mossman et al., 2022), it assumes homogeneity of cultural values within samples that is unlikely to fully reflect the reality (Fiske, 2002). Indeed, heterogeneity of cultural values within nations is likely to attenuate the cultural differences that could emerge in research, and thus ongoing efforts to allow more homogeneity in sample cultures should be considered when testing for cultural differences, especially when testing claims of universality. Nevertheless, evidence suggests that over time people acculturate toward the setting in which they reside and, thus, it is reasonable to assume that the cultural orientation of each sample is consistent with the prevailing cultural system of the nation in which participants were sampled (Kagitcibasi, 2005; Yamada & Singelis, 1999). As we also noted, additional dimensions of cultural difference could be examined for moderation effects.

While our meta-analysis corrected effect sizes for both sampling and measurement error, other statistical artefacts that can bias effect sizes were not accounted for, such as range restriction (Schmidt & Hunter, 2015; Wiernik & Dahlke, 2020). Theoretically, we did not expect range restriction to present a substantial issue, yet it is nevertheless possible that some studies may have truncated variability in the relations we examined. For instance, some samples were based on elite participants (Adie et al., 2012), which may attenuate effects due to range restriction. We were unable to correct for range restriction in our meta-analysis due to a lack of normative data and the observed variability in measures used by researchers, but future research may be able to estimate the level of range restriction that is present in our meta-analytic database.

Despite observing incremental contributions for both the types of interpersonal support as well as sources of support, we also observed high covariation between different interpersonal supports. As shown in Table 1, our disattenuated meta-analyzed intercorrelations ranged from .67 to .71, which is very strong. Still, as we have noted, this is not unexpected under SDT. Moreover, our relative weights analyses suggest that, despite these strong intercorrelations, each type of support and source of support plays an important role in predicting need satisfaction. Future work could further examine the reason for such strong intercorrelations between the interpersonal supports and establish whether this is a function of the measures, or due to within-person dynamics that make it more likely that socializing agents will use multiple behaviors simultaneously to support different needs.

Although we focus on direct effects and incremental effects in our meta-analysis, it is possible—perhaps likely—that mediated effects exist between the interpersonal supports and the associated outcomes we examined herein. An opportunity for future work is to establish cross-domain meta-analytic data that could be tested via a structural equation model (see Bureau et al., 2022; Ng et al., 2012; Slemp et al., 2018; Vasconcellos et al., 2020, for examples within specific domains). Such an analysis was beyond the scope of our research questions and, hence, our search strategy. However, we argue that focusing on literature across domains could provide a generalized and high-powered combined sample to further confirm or disconfirm SDT's proposed causal sequence (displayed visually in Figure 2) and further determine whether mediation is full or partial (e.g., Ng et al., 2012). We make available our data via the Open Science Framework so that further research can tap into this issue.

It is worth noting that despite the combined sample sizes in the present meta-analysis typically being very large, there were some analyses that were nevertheless based on relatively small sample sizes, such as those examining lateral effects of competence support and relatedness support. Hence, these relationships are likely to be more affected by second-order sampling error. As a final note, our aggregation across domains should not suggest there are not between-domain differences in the forms or importance of need-supportive behaviors. Both qualitative and observational analyses can help to unveil such differences, which are especially important

for applied practices where specific behaviors may play central roles in support provision (e.g., Reeve et al., 2022).

Conclusion

Our results suggest that interpersonal supports for basic needs are associated with greater basic psychological need satisfaction, autonomous forms of motivation, well-being, and performance across domains. There was considerable heterogeneity in these effects, but notably this was generally not explained as a function of whether participants were sampled from individualist or collectivist cultural settings, consistent with SDT's universality claims. An exception to this, however, was the relation between autonomy support and autonomous motivation, as well as the relation between relatedness support and intrinsic motivation. Moreover, in some instances, effects were moderated by the measures used, the source of need-supportive behavior, and research context, as well as participants' age, with generally stronger results observed for children and young people.

A general conclusion from this meta-analysis is that basic psychological needs for autonomy, competence, and relatedness are strongly related to interpersonal supports, a phenomenon apparent across cultures, domains of activity, and age of participants, despite some differences emerging. Our results also indicate that the most variance in basic needs is explained when efforts are made to measure autonomy-, competence-, and relatedness-supportive behaviors, across both vertical and lateral origins, which is a practice we encourage future research and practice to adopt to yield the most benefit.

For space reasons, the full list of 768 records included in the current meta-analysis are available in Supplemental Materials (see Supplemental Appendix B) and on web-based software (https://basic-psychological-needs.shinyapps.io/gen1/).

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