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A META-ANALYSIS OF AUTONOMOUS AND CONTROLLED FORMS OF TEACHER MOTIVATION

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Highlights

- A meta-analysis of teacher motivation is performed
- Autonomous motives predict teacher wellbeing and student supportive teaching styles
- Controlled motives predict teacher distress
- Autonomous motives underlie the optimal psychological functioning of teachers

Abstract

Self-determination theory (SDT) is one of the most extensively applied frameworks to understand relations involving autonomous and controlled motivations in educational settings. However, a cumulative assessment of SDT's predictive validity for important teacher outcomes has never been conducted. Our study presents an analysis of the antecedents and consequences of autonomous and controlled teacher motivation by drawing on an overall database of 1,117 correlation coefficients across 102 independent samples. Regarding antecedents, psychometric meta-analysis results indicate that workplace context and individual difference variables were generally positively and negatively associated with autonomous and controlled teacher motivation, respectively. Similar results were observed for relations involving basic need satisfaction and both forms of teacher motivation. Regarding outcomes, results indicate that autonomous teacher motivation is positively associated with teacher well-being, job satisfaction, and autonomy-supportive in-role functioning and negatively associated with teacher distress and burnout. In contrast, results for controlled teacher motivation were generally in the opposite direction. Exploratory moderator analyses showed that results were generally not moderated by educational setting or the type of teaching occupation, but some associations were moderated by teacher age and career tenure. Meta-analytic path analyses further showed that teachers' psychological need satisfaction was associated with teacher well-being, distress, and autonomy-supportive teaching indirectly through autonomous motivation. Substantially attenuated indirect effects were observed when controlled teacher motivation was the intervening variable. Overall, our results add credence to the claim that SDT may offer a fruitful perspective for predicting teacher- and student-related outcomes. Limitations, implications, and recommendations for future research are discussed.

Keywords: Autonomous motivation, controlled motivation, teacher, well-being, distress, self-determination theory, basic needs, meta-analysis

A META-ANALYSIS OF AUTONOMOUS AND CONTROLLED FORMS OF TEACHER MOTIVATION

Teachers represent one of the largest global workforces. Some estimates indicate that more than 80 million teachers currently exist across all sectors (i.e., pre-primary to higher education and vocational training; Roser, 2019). However, the teaching profession is one of the most stressful in developed nations (Gallup, 2014). In Australia, for example, 41% of teachers report high levels of occupational stress (Safe Work Australia, 2013). Likewise, almost half of the teachers in the U.S. report feeling stressed daily (Gallup, 2014) and 57% of teachers in the U.K. have indicated that they often consider leaving the profession (Savill-Smith, 2018). Despite these challenges, it is estimated that more than 68 million new teachers will join the profession by 2030 (Kim et al., 2019; UNESCO, 2016). Thus, an understanding of the antecedents and consequences of (sub)optimal forms of teacher motivation will benefit approximately 150 million teachers and their students, inform education policy, and guide future education research.

The basic self-determination theory (SDT) model (see Deci et al., 2017; Figure 1) suggests that two sets of independent variables—workplace context and individual differences—can either satisfy or frustrate an individual's psychological needs (i.e., autonomy, competence, and relatedness). In addition, the model suggests that these workplace context (e.g., leadership style) and individual (e.g., personality) nutriments may promote or thwart autonomous and controlled forms of motivation. The former type of motivation is characterized by intrinsic motivation and fully internalized extrinsic motivation and the latter by externally and internally controlled extrinsic motivation. Indeed, SDT is an extensively applied framework in the social sciences. Yet, our cumulative scientific knowledge regarding the validity and generalizability of its proposed relations is relatively underdeveloped. Consequently, recent narrative (e.g., Deci et al., 2017) and meta-analytic reviews (e.g., Howard et al., 2017; Van den Broeck et al., 2016) of SDT's nomological network have called for future researchers to more closely examine how autonomous and controlled motivation is influenced by situational- and individual-specific nutriments across different domains. Our study seeks to answer these calls by addressing the following question: What workplace and individual nutriments promote (or thwart) autonomous and controlled forms of teacher motivation?

The importance of teacher motivation has long been recognized in education research. Indeed, teacher motivation is a known correlate of student motivation and thus offers a potential way to nurture high-

quality student learning, engagement, and achievement (Hattie, 2008; Miller, Murnane, & Willett, 2008; Pelletier, Séguin-Lévesque, & Legault, 2002; Roth et al. 2007). SDT guides much of the research on motivational conditions that foster versus undermine students' positive functioning. According to the dialectical assumption of SDT (see Deci & Ryan, 2000; Reeve, 2006), a student's functioning, engagement, social development, and well-being is shaped by a dynamic interaction between their inner motivational resources and the holistic classroom environment, which includes teachers' motivation and motivational styles. Likewise, SDT proposes that a teacher's motivation for their work has consequences for their own mental and physical well-being (Deci et al., 2017; Ryan & Deci, 2000). Although primary research has helped to highlight the benefits of specific forms of teacher motivation under certain conditions (Collie et al., 2016; Fernet et al. 2012b, 2016), to our knowledge, a quantitative synthesis that examines the differential validity of autonomous and controlled forms of teacher motivation for important student- and teacher-related outcomes does not exist in the published literature. Our study seeks to address this gap by addressing the following general question: What motivational processes underly optimal teacher functioning?

To address these broad research questions, we quantitatively organize and synthesize the literature on teacher motivation according to the SDT perspective. Specifically, using an overall database of 1,117 correlation coefficients from 102 independent samples (N = 40,253), we perform a series of psychometric meta-analyses (Schmidt & Hunter, 2015) to ascertain if there is cumulative support for the use of SDT in future studies on teacher motivation. Indeed, given that scholars often rely on meta-analyses to provide the building blocks for knowledge creation and theory building (Schmidt, 1992) and practitioners often use their results to guide evidence-based practice (Rousseau & McCarthy, 2007), the present study makes several important contributions to the literature on teacher motivation. For example, our study represents the first attempt to synthesize the literature on autonomous and controlled forms of teacher motivation. We contend that our application of psychometric meta-analysis in this endeavor will help us to determine the likely location of the "true" underlying mean estimate for important "antecedent-motivation" and "motivation-outcome" relations and, thus, serve as a signpost for future research and practice. For example, our results will help to identify which correlates hold the most and least promise for predicting autonomous or controlled teacher work motives, information that can then be used by practitioners to promote healthy interpersonal nutriments (e.g., leadership style), as well as career guidance and counseling or in-service or

pre-service teachers. Thus, our findings may facilitate ways to promote teacher psychological need satisfaction as well as in-role functioning and well-being. Similarly, the observed summary estimates and corresponding variance statistics can be used to inform lower and upper bound utility analysis estimates (e.g., Hunter & Schmidt, 1983), which may help to yield more trustworthy predictions regarding student- and teacher-related outcomes and, as such, narrow the science-practice gap.

The remainder of our paper is arranged as follows. First, we provide a basic overview of the types of motivation described by SDT and examine evidence regarding their antecedents and consequences. Second, we examine underlying motivational processes that underlie (sub)optimal teacher functioning, and possible moderators of effects. Third, after describing our database and analytic approach, we report the results of the meta-analysis, separating antecedents from consequences of teacher work motives. Finally, we describe the contributions of the study, implications for teaching, and we provide directions for future research.

Conceptual Framework: Self-Determination Theory

Self-determination theory (SDT; Ryan & Deci, 2000, 2017) is a broad theory of human motivation that focuses on innate growth tendencies, basic psychological needs, and distinguishes different types of motivation by the degree to which they are autonomous or controlled (see Figure 1 for the self-determination continuum of motivation).

Insert Figure 1

Towards the left-hand side of the continuum is *amotivation,* which reflects a state of non-regulation whereby there is no intention or motivation to enact a behavior (Ryan & Deci, 2000). This differs from motivated behavior, which SDT distinguishes into two broad subtypes. Both subtypes contain several more refined motivation regulations that differ by the degree to which they are internalized. The first broad subtype is *controlled motivation*, which involves engaging in behavior due to a perceived pressure to do so (Rigby & Ryan, 2018). When this pressure is fully external to the self (e.g., seeking contingent rewards or avoiding punishments) the behavior is entirely regulated by external forces—referred to as *external regulation*—the most controlled form motivation. When the pressure is experienced internally (e.g., motivation to avoid shame or guilt), it reflects *introjected regulation,* another controlled form of motivation, albeit slightly more internal.

Towards the right-hand side of the continuum and distinct from controlled motivation is *autonomous motivation*, which encompasses behaviors that emanate from within the self and thus entail a full sense of willingness, volition, and choice (Deci et al., 2017). In *identified regulation*, which is the least internal form of autonomous motivation, behavior is motivated because one finds value or importance in it. Even more internal is *integrated regulation*, which involves complete integration of the regulation into one's identity, where the motivated behavior becomes an outward expression of the inner self (Sheldon & Elliot, 1999). Finally, *intrinsic motivation* is the most internal and fullest form of autonomous motivation and involves behavior motivated simply due to interest or enjoyment in the activity itself (Ryan & Deci, 2017). SDT categorizes the external and introjected regulations as *controlled* (i.e., non-volitional) motivation, whereas the identified, integrated, and intrinsic regulations represent *autonomous* (i.e., volitional) forms of motivation (Howard et al., 2017; Ryan & Deci, 2017).

An important part of the motivation continuum is the process of *internalization*, which refers to a natural human tendency to move towards fuller integration of behavior (Ryan et al., 1985; Ryan, 1995). It reflects a natural growth process through which one "takes in" beliefs, values, or behavioral regulations from external sources and transforms them into one's own (Ryan & Deci, 2017). Thus, to the extent that environmental conditions support the integrative process, people naturally find value in their behavior and begin to transform controlled motivation into more autonomous forms of motivation, creating harmony with other aspects of the authentic self, including personality or deeply held values (Ryan, 1995; Deci et al., 1994). Indeed, this suggests that even externally regulated and, thus, highly controlled behavior can, over time, be internalized such that the underlying motivation shifts towards more identified, integrated, or potentially intrinsic motives (Ryan et al., 1985).

Evidence suggests that internalization is enhanced when people satisfy their basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2017; Van Den Broeck et al., 2016). Autonomy requires the experience of choice and the perception that one's behavior is self-endorsed and self-initiated. Competence requires feelings of mastery, succeeding at challenging tasks, and attaining desired outcomes. Relatedness involves a sense of mutual caring and meaningful relationships with relevant others. A considerable body of research suggests that the satisfaction of the three needs is important for internalization, wellness, and self-functioning (Deci & Ryan 2000; Van Den Broeck et al., 2016), the

frustration of which tends to lead to stagnation and ill-being (Chen et al., 2015; Vansteenkiste & Ryan, 2013). Because need satisfaction tends to beget intrinsic enjoyment, satisfaction, and value in the activity itself, it is understood to be essential for fuller internalization, and, thus, autonomous motivation (Gagné, 2003; Ryan, 1995). As noted by Gagné (2003), people are likely to experience intrinsic motivation to the extent that they have choice about what to do (autonomy), they feel capable at what they are doing (competence), and they feel connected and supported by important others (relatedness). Hence, need satisfaction is understood to be a central motivational antecedent for fuller internalization, and therefore autonomous motivation.

Antecedents and Consequences of Autonomous and Controlled Teacher Motivations

Figure 1 displays key antecedents and outcomes of autonomous and controlled forms of teacher motivation according to the SDT, which are the main focus of investigation in the current study. With regard to antecedents, the figure suggests that there exist proximal and distal predictors of autonomous and controlled motives. Specifically, the SDT framework suggests that autonomy, competence, and relatedness satisfaction are proximal antecedents to the autonomous motivation of behavior and should exhibit smaller associations with controlled motivation (Deci et al., 2017). Although evidence from the published literature generally adds credence to the claim that need satisfaction supports autonomous motivation (Van den Berghe et al., 2014), there are some mixed findings regarding the nature of the relation between psychological need satisfaction and controlled motivation, with correlations varying from moderately negative to moderately positive (e.g., Abós et al., 2018; Carson & Chase, 2009; Van den Berghe et al., 2014). Indeed, an assessment of our cumulative scientific knowledge on teacher motivation may bring clarity to the nature of these relations and help to identify boundary conditions under which relations between psychological need satisfaction and autonomous and controlled teacher motivations differ.

SDT also proposes that workplace context (e.g., leadership style) and individual difference (e.g., goal pursuit; personality) variables are distal antecedents to autonomous and controlled motivation (see Figure 1). These factors are considered distal antecedents because they are thought to provide the requisite conditions for need satisfaction to occur, which, in turn, leads to more autonomous than controlled motivation (Deci et al., 2017; Ryan & Deci, 2017; Vansteenkiste et al., 2020). For example, evidence suggests that leader autonomy support (Nie et al., 2014; Slemp et al., 2018) and transformational leadership (Fernet et al., 2015; Hetland et al., 2011) are associated with both need satisfaction and autonomous work motivation. However,

a cumulative assessment of the differential predictive validity of these sets of interpersonal (e.g., workplace context) and intraindividual (e.g., individual differences) nutriments has never been conducted in the teacher motivation literature. In the current study, we intend to bring clarity to the aggregate strength of these associations. Indeed, our results may offer information that policy makers can use to evaluate the relative effectiveness of various types of motivation nutriments, informing policy and structural interventions to support autonomous work motives.

Research also supports the beneficial consequences of autonomously motivated behavior for psychological functioning and wellness across a broad range of contexts (see Ryan & Deci, 2017; Deci & Ryan, 2000). In general, autonomously motivated employees are likely to be more satisfied with their work, less burned out, and more engaged (Deci, Connell, & Ryan, 1989; Deci et al., 2001; Deci et al., 2017), which are consequences that extend to those working in teaching careers (see Fernet et al., 2012a, 2012b, 2016, 2017; Soenens et al., 2012). For example, recent research has demonstrated that more autonomous forms of teacher motivation are related to less teacher burnout (Cuevas et al., 2018; Fernet et al., 2008), as well as greater teaching self-efficacy (Dybowski & Harendza, 2015), job satisfaction (Collie et al., 2016; Nie et al., 2014), and well-being (Pauli et al., 2018). Hence, like in other literatures, autonomous motivation tends to coincide with indicators of positive mental health as well as reduced levels of teacher distress. Given that teachers tend to experience high-levels of stress and disorder (Gallup, 2014), establishing motivational mechanisms in teacher mental health will yield valuable insight about ways to promote healthier and more productive teaching workforces.

In addition to associations with enhanced teacher mental health, autonomous motivation may engender favorable student outcomes by facilitating in teachers a more supportive motivating style that nurtures student autonomy (Reeve et al., 2004). *Teacher autonomy support* is an example of such a style and involves teachers taking steps to identify and support students' interests, as well as taking action to help students to internalize value and enjoyment from learning itself (Reeve, Bolt, & Cai, 1999). Teacher autonomy supportive behaviors include offering students with meaningful choices, providing a rationale for tasks, acknowledging student feelings, and avoiding the use of external rewards or sanctions to prompt desired behaviors, which is typically experienced as controlling (Núñez & León, 2015; Reeve, Bolt & Cai, 1999). In contrast, a controlling style establishes a teacher-centered agenda that lays out how students ought

to think, feel, and behave, thus undermining student autonomy (Reeve et al., 2004). By facilitating the autonomous motivation of student behavior, teachers can yield favorable student outcomes, including student engagement (Jang, Reeve, & Deci, 2010; Reeve, 2009; Reeve et al., 2004), learning and development (Furtak & Kunter, 2012; Shen et al., 2009), performance and achievement (Diseth, Danielsen, & Samdal, 2012; Shen et al., 2009), and well-being (Chirkov & Ryan, 2001). Yet, despite the reported benefits, there is evidence to suggest that controlling styles of teaching that emphasize reward and punishment contingencies are more common in classrooms (Newby, 1991; Reeve, 2009). Thus, an understanding of the motivational antecedents to autonomy supportive teaching may yield insight into ways to enhance favorable student outcomes.

The last 15 years has seen a marked increase in the study of teacher motivation, likely attributable in part to the development, validation, and publication of several scales with which it can be measured along the SDT continuum (see Fernet et al., 2008; Fernet, 2011; Gagné et al., 2015; Roth et al., 2007 as examples). Yet, despite this rapid growth, the magnitude of the associations between teacher motivation and important outcomes has not been established due to a lack of an existing cohesive review of this literature. The increasing popularity, along with the importance of teacher motivation for the well-being and functioning of both teachers and students (Pelletier et al., 2002; Roth et al., 2007), highlights the need for an empirical and conceptual review of this literature. Such a review will take great strides toward organizing the scattered array of correlates that are present in this literature and establishing aggregate strength of associations between teacher motivation and important teacher outcomes. Establishing the extent to which autonomous relative to controlled teacher motivations predict important consequences may have important implications in teacher professional development, as well as attraction and retention policies. In particular, it may create an emphasis on cultivating intrinsic incentives for a teaching career (e.g., learning, growth), which meta-analytic work has consistently shown to predict performance and well-being (Cerasoli et al., 2014; Li et al., 2013). Similarly, given the high levels of distress in the profession, establishing the motivation-based predictors to such conditions will be informative in guiding paths to intervention and career counseling for in-service and pre-service teaching populations (Olsen, 2008).

Moderators of Meta-Analytic Associations

Moderator effects play a central role in social science research because they highlight boundary conditions of a theory (Aguinis, Gottfredson, & Wright, 2011). As such, an assessment of the conditions under which particular nutriments are more or less important to autonomous or controlled motivation in a given setting, as well as their corresponding outcomes (e.g., in-role functioning), may present an opportunity to augment and develop future hypotheses that better explain SDT-related phenomena.

It is possible that the meta-analytic mean effect size estimates observed in the current study are moderated by boundary conditions such as the sector in which the study took place (e.g., primary, secondary, higher education), the occupational status of the participants (e.g., general teachers, physical education teachers, principals) as well as the age or years of experience of the study participants. For example, there is evidence to suggest that the workload pressures (e.g., student demands, administrative responsibilities) that teachers experience are more acute during the early career stages (Billingsley et al., 2004; Gallant & Riley, 2014; Zabel & Zabel, 2001). Thus, it is possible that autonomous motivation may better protect early career stage teachers from negative outcomes (e.g., burnout) than mid- and late-stage career teachers.

Taken together, although we do not offer *a priori* hypotheses regarding our moderator tests, these exploratory analyses may help to explain when and why SDT is a suitable framework for making predictions in educational settings. Indeed, a context-dependent understanding of autonomous and controlled forms of teacher motivation should allow future researchers and policy makers to make more refined predictions regarding teacher- and student-related outcomes.

Hypothesized Theoretical Model of Teacher Motivation

In addition to establishing a cumulative scientific knowledge base on teacher motivation, another aim of the present study is to examine the motivational processes that underlie the (sub)optimal psychological functioning of teachers. In particular, we examine the pattern of indirect effects by which autonomous or controlled motivation are related to favorable and unfavorable work outcomes. Testing a model in this way will help to establish whether indeed autonomous motivation, rather than controlled motivation, is the central intermediary variable through which teacher basic needs exert their beneficial effects on teacher outcomes. The theoretical model is derived from SDT and depicted in Figure 2, displaying our hypothesized indirect associations for each motivation type.

Insert Figure 2

The model is based on the sequential theoretical process described by Deci et al. (2017). Specifically, the model proposes that autonomy, competence, and relatedness needs are substantially more positively associated with autonomous than controlled motivation. Autonomous and controlled motivations are then proposed to differentially predict important behavioral and mental health teacher consequences. Put differently and more specifically, although both autonomous and controlled motives provide a strong energetic force for work-related behavior (Pinder, 2008; Van den Broeck et al., 2016), it is only in autonomous motivation where teachers fully self-endorse and value their work, which, in turn, should foster wellness and increased behavioral engagement (Roth et al., 2007; Pelletier et al., 2002). Thus, while autonomous motivation should be positively associated with enhanced well-being and autonomy-supportive teaching, this process should be relatively absent for controlled motivation. Similarly, because autonomous motivation reflects a state where teachers engage in their tasks due to enjoyment, satisfaction, or value-alignment, it should render them less vulnerable to burnout or distress. By contrast, engaging in work due to a perceived obligation to do so, as reflected in controlled motivation, should render teachers more vulnerable to burnout or distress (see Fernet et al., 2017).

Although individual studies have examined various direct associations displayed in Figure 2 (e.g., Collie et al., 2016; Fernet et al., 2016, 2017), no study has examined the full range of indirect motivational processes through which teacher basic needs are likely to exert their beneficial effects on wellness and behavioral outcomes. In the current study, we employ meta-analytic structural equation modeling (see Viswesvaran & Ones, 1995) to examine patterns of indirect associations hypothesized under SDT (see Figure 2), which will help to establish whether internalization of motivation is a process through which teachers' basic need satisfaction for autonomy, competence, and relatedness is associated with favorable teacher outcomes.

The Present Review

A growing literature exists on the antecedents and consequences of different forms of teacher motivation, yet no attempt has yet been made to systematically locate, organize, and aggregate the findings in this literature. Thus, there has been no attempt to establish the aggregate strength of associations with important antecedents and consequences of different forms of motivation, whether relations are moderated

by various factors, and whether findings are consistent with theoretical premises of SDT. We address this gap in the present review, focusing broadly on the teaching occupation and encompassing studies of teaching-focused occupations at different stages of a teaching career, and across different contexts where teaching takes place.

In conducting our meta-analysis, we had three primary aims. First, we aimed to establish the strength of associations between teacher motivation with potential empirical antecedents of motivation (e.g., individual differences, leadership and climate, goals and aspirations, basic psychological needs) and consequences of motivation (e.g., job attitudes, well-being, distress, in-role behavior). In doing so, we aim to provide broad descriptive evidence and thematic organization of the types of correlates studied, as well as establishing the strength of these associations after correcting for both sampling and measurement error. Second, we aimed to examine whether correlations in the literature are moderated by various factors, including the mean age and years' experience of the study samples, as well as the educational context of the study, and the nature of the teaching occupation studied. Third, we aimed to examine indirect motivational pathways shown in Figure 2 – testing our prediction that basic psychological needs will exhibit indirect associations with favorable teacher outcomes primarily through autonomous motivation, and not through controlled motivation.

METHOD

Search Strategy

Following best practice guidelines (e.g., Appelbaum et al., 2018), we employed a number of search techniques to systematically search the literature for published and unpublished samples on autonomous and controlled forms of teacher motivation, which was completed in March 2020. First, we began by entering a variety of terms related to both forms of motivation into three electronic databases (i.e., *PsycINFO*, *ERIC*, and *Web of Science*). Our searches relied on two different word sets designed to capture empirical studies that examined the continuum of self-determined motivation in teaching- or teaching-related samples. The first word set consisted of the following keywords: "autonomous motivat*", "controlled motivat*" "intrinsic* motivat*", "extrinsic* motivat*", "external regulation", "introjected regulation", "identified

regulation", "integrated regulation", "amotivation", and "self-determination theory."[1] The second word set consisted of "teacher," "educat*," "school," and "principal." The database searches consisted of all combinations of words from both word sets. We used the Boolean operation "OR" to separate words within each set and the "AND" operator to combine each set. This ensured that any study with at least one word from each set would be captured. To identify unpublished studies in the form of dissertations and theses, this search protocol was also used to query the *ProQuest Dissertations* and *Theses Global* databases. As displayed in Figure 1 of our Supplementary Materials (SM), which illustrates our four-stage process (see Moher et al., 2009), these searches identified 3,286 records after duplicates were removed.

Second, we identified relevant review articles (Deci et al., 2017; Howard et al., 2017; Slemp et al., 2018; Van den Broeck et al., 2016) and examined the reference lists for relevant studies, which yielded an additional 707 potential records. Third, using *Google Scholar*, we prospectively searched the citations of articles in which measures of teacher or principal motivation were validated, including the Work Tasks Motivation Scale for Teachers (WTMST; Fernet et al., 2008), the Work-Role Motivation Scale for School Principals (WRMS-SP; Fernet 2011), and those developed by Roth et al. (2007). We used the same procedure for general work motivation scales, including the Motivation at Work Scale (MAWS; Gagné et al., 2010), the Multidimensional Work Motivation Scale (MWMS; Gagné et al., 2015), and the Work Extrinsic and Intrinsic Motivation Scale (WEIMS; Tremblay et al., 2009). Where necessary, we used key words (e.g., "teacher") to refine these prospective searches. These efforts identified 1,786 further records.

Finally, in an attempt to curate relevant records from the "grey literature" (see Kepes et al., 2013), calls for unpublished papers were posted on the *Academy of Management* OB division ListServs. Additional records were not produced by this call, which likely provides support for the thoroughness of our systematic literature search. In sum, we identified 5,779 records relevant to autonomous and controlled teacher motivation.

Eligibility Criteria

All 5,779 records in our database were assessed for relevance based on their title and abstract. These practices reduced our database to 682 potentially relevant records. The remaining records were subjected to a

[1] Asterisks indicate wildcards (i.e., any characters) and were used to increase the probability of locating relevant

full-text analysis to ascertain if the following two inclusion criteria were met. The first provision was that articles needed to be empirical and quantitative. No stipulations on publication date, nationality of sample, or language were imposed. However, the study had to report a zero-order correlation coefficient between an overall or facet dimension of motivation along the continuum described by SDT (i.e., autonomous motivation, controlled motivation, intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation) and at least one of the following correlate categories: (a) workplace context (e.g., transformational leadership), (b) individual differences (e.g., personality), (c) basic need satisfaction, (d) well-being, (e) job attitudes, (f) in-role behavior/functioning. In operationalizing these variables, we included individual-level data only. We included both cross-sectional and time-lagged studies.

Our second decision rule was that the study had to include adult participants who were broadly working in the teaching profession at any career stage. Indeed, given that teaching-related work occurs beyond K-12 contexts, our analysis includes effect sizes drawn from a broad range of educational settings, sectors, and teaching-related occupations that share challenges comparable to those in K-12 contexts. Thus, we included those working in general K-12 settings, physical education, higher education, pre-service teachers, vocational training, and teaching administration (e.g., principals), across all educational sectors. We included pre-service teachers on the basis that, like in-service teachers, their motivation to study could be autonomous or controlled in nature (Kaldi & Xafakos, 2017). This broad inclusion of teachers across multiple sectors is commonly used in other systematic reviews and meta-analyses of the profession (e.g., Kim et al., 2019; Lomas et al., 2017). Although we included all types of teachers, we excluded psychiatric or other healthcare patients, community-samples, general workplace samples, and general student samples.

A total of 580 records were removed for failing to meet our eligibility criteria. In addition, given that meta-analytic procedures are sensitive to an assumption of sample independence (Schmidt & Hunter, 2015), the final step of our process was to review the remaining studies for evidence of duplicate sampling (see Wood, 2008). This process revealed four potential duplicate samples, which were closely inspected for inclusion in our meta-analytic database. Specifically, we followed recommended procedures to extract

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terms.

independent information from potential duplicate samples as to not to violate important meta-analysis assumptions (e.g., input independence). For example, Wood's (2008) procedure for detecting duplicate samples indicated that studies by Fernet (2011) and Trepanier et al. (2012) were potentially based on the same sample. However, these two studies reported zero-order correlations pertaining to different autonomous and controlled motivation relations. Thus, in this case, data from both studies were included in our analysis because there was no duplication regarding variables studied. Taken together, we were left with an overall database of 98 sources, nine of which were unpublished, reflecting data from 102 independent samples (N = 40,253) for inclusion in the present study.

Data Coding, Transformations, and Statistical Method

Coding. All 102 independent samples that satisfied our inclusion criteria were initially coded by the third author using a systematic coding template that was developed by the first author, who has extensive experience with meta-analysis coding. A subset of 35 of these were then recoded by the first author to establish coding accuracy via interrater agreement across the coding categories. The full interrater reliability results are displayed in Table 1 of our SM. Overall agreement was 89.38%. After disagreements were identified, the first and third author met to discuss and resolve each one. Disagreements were typically the result of unclear reporting in the original primary study. Agreement with regard to coded nominal variables (e.g., occupational status, education context of the study) was estimated using Cohen's (1960) Kappa. The observed Kappa values suggested high agreement (Kappa = .82 to .92). For continuous variables (e.g., r, r_{xx}, r_{yy}), we computed a two-way, absolute, single measures intraclass correlation coefficient (ICC; McGraw & Wong, 1996). The observed ICCs indicated relatively high agreement across coders (ICCs ranged from .82 to .99).

Manually coded database fields in the coding template included (a) sample size, (b) the correlation coefficient (r) between each type of motivation and the relevant correlate variables, (c) the reliability of motivation scores (R_{xx}), (d) the scale used to measure motivation, (e) the reliability of the correlate scores (R_{yy}), (f) the name of the correlate variable (i.e., antecedent or outcome of ATM and CTM), (g) the publication status of the study (published vs. unpublished), (h) the time lag between the measurement of motivation and the correlate variables (in months, if any), (i) year of publication, (j) occupational status of the teaching participants (i.e., general, physical education, principals, pre-service, higher education,

vocational trainer, mixed), (k) the educational context (i.e., early childhood, primary, secondary, higher education, mixed, pre-service, or other), (l) mean sample career tenure (in years), and (m) mean sample age (in years).

Although our research questions centered on relations involving autonomous and controlled motivation, at times, data pertaining to the respective sub-scales of these motivation types only (e.g., intrinsic and/or identified motivation, but not autonomous motivation) were reported in the original primary studies. In such cases, the sub-scale data were recorded and later aggregated so that the information could be included in the current analysis (discussed further in the next section). We did not include integrated regulation since this facet of autonomous motivation is rarely measured in this literature (see Gagné et al., 2015). In addition, consistent with the SDT literature (see Chemolli & Gagné, 2014; Howard et al., 2017; Ryan & Connell, 1989), some studies reported correlations using the relative autonomy index (RAI; e.g., Fernet et al., 2010), also known as the self-determination index (SDI; Vallerand & Pelletier, 2008). This index offers a scoring rubric that assigns weights to motivation subscale scores to establish a relatively parsimonious metric for self-determined (autonomous) motivation (Vallerand & Pelletier, 2008). When this occurred (n = 9), we recorded these data as autonomous motivation.

Transformations. As previously mentioned, at times, study authors reported relations involving one or more sub-scales of autonomous or controlled motivation, but did not report the corresponding aggregates of these sub-scales. Thus, where necessary, we used procedures outlined by Schmidt and Hunter (2015) to statistically aggregate individual correlations to create composite correlations for the respective higher order variables for autonomous and controlled motivation. This meant that relations involving intrinsic and identified regulations were aggregated using their intercorrelation to establish composite correlations for autonomous motivation. Likewise, where necessary, the same procedure was used to establish composite correlations for controlled motivation by aggregating relations with external and introjected regulations. In instances where only one relation involving a sub-scale of autonomous or controlled motivation was reported, on the basis of its theoretical position within the autonomous or controlled motivation taxonomy, we treated the sub-scale as a proxy for the corresponding overall regulation (e.g., identified regulation → autonomous motivation; Collie et al., 2016). Combining divergent scales and subscales in this way to represent an overall construct is common practice in meta-analytic studies (e.g., Landay et al., 2019; Young et al., 2018). In some

studies, relations involving the sub-scales *and* corresponding composite of autonomous and controlled motivation were reported. In such cases, we only included the relevant composite effect size in our analysis. Finally, because some studies used different scales to measure similar correlates to autonomous and controlled motivation of relevance to the current study (e.g., illness symptoms, work stress; Nie et al., 2014). If multiple effects were reported for substantively similar variables, we aggregated the correlations between these measures to obtain the composite effect size with the overall correlate (e.g., distress) (Schmidt & Hunter, 2015). In the interest of scientific transparency and to facilitate the reproducibility of the results, we make available on our project page all study materials on the open science framework (e.g., data-sets, coding, analytic scripts; see osf.io/XXX[2]).

Meta-Analytic Procedures. Schmidt and Hunter's (2015) psychometric approach to meta-analysis was used in the current study. All analyses were conducted in R (Version 3.5.0) using the R-Studio interface (version 1.1.453). For each analysis, we used the "psychmeta" package (Dahlke & Wiernik, 2018) and the unbiased sample variance estimator. We first estimated a sample size-weighted mean correlation for relations involving autonomous and controlled teacher motivation. Following this, we estimated a meta-analytic mean correlation that was corrected for both sampling and measurement error (i.e., ρ). To do this, we used the reliability coefficients that were reported in the available studies to construct artifact distributions for reliability coefficients (see SM Table 1 for descriptive statistics for reliability distributions).

Schmidt and Hunter's (2015) approach to meta-analysis is based on the random effects model, which allows for differences in parameters across studies and also provides an estimate of the variance in effect sizes. Use of random effect meta-analytic models tend to yield more accurate results in applied literatures and generalize beyond the studies included in the meta-analysis (Field 2003; Hunter & Schmidt 2000; Kisamore & Brannick 2008; Schmidt 2010). We calculated a meta-analytic correlation whenever at least three studies were available, and also constructed a 95% confidence interval (CI) around each point estimate. When the CI encompassed zero, we concluded that the correlation between the two constructs was of no substantive significance. To evaluate the size of each meta-analytic correlation, we used the distributions reported in Bosco et al. (2015), which were derived from a database of almost 150,000 research findings and

[2] Link to project page has been hidden to preserve anonymity during the peer review process.

thus have greater empirical support than Cohen's (1988) benchmarks. According to Bosco et al. (2015), correlations of $|r|$ = .07, .16, and .32 reflect the 25th, 50th and 75th percentiles, respectively, which we used as benchmarks for small, moderate, and strong effect size magnitudes.

Heterogeneity was evaluated with SD_ρ and the 80% credibility interval (CV). SD_ρ serves as an indicator of cross-study heterogeneity, with higher values indicating greater heterogeneity. Similarly, the CV provides an indicator of heterogeneity around each meta-analytic mean effect size. It is interpreted such that 80% of the values in the distribution of true-score correlations lie within this range. Categorical moderators were explored by conducting a series of sub-group analyses (e.g., PE teacher vs. principal). We examined moderators whenever at least three studies were available for at least two sub-groups and concluded that the moderating effect was statistically significant if the sub-group CIs did not overlap (Borenstein et al., 2009). For continuous moderators (e.g., age), we used meta-regression to examine whether the moderator was related to study-level effect sizes. We concluded that effects depended on a moderator if the 95% CIs for regression coefficients did not encompass zero (Borenstein et al., 2009).

To minimize the effect of common method variance in our analyses (Podsakoff et al., 2003), when studies provided both cross-sectional and time-lagged correlations, we only used the lagged correlations consistent with the causal direction implied by our hypothesized path model (see Figure 2), which shows basic psychological needs as antecedents of autonomous and controlled teacher motivation. Figure 2 also shows both forms of motivation serving as endogenous antecedents to well-being, distress, and autonomy supportive teaching. We summarize the meta-analytic findings with seven pieces of information: (a) k = number of studies used to calculate meta-analytic estimates, (b) N = combined sample size used to calculate each estimate, (c) r_{obs} = sample size-weighted mean correlation, (d) ρ = estimate of the true score correlation, (e) SD_ρ = standard deviation of the true score correlations, (f) 95% CI = 95% confidence interval, (g) 80% CV = 80% credibility interval.

Meta-Analytic Path Analyses for Patterns of Direct and Indirect Effects

Meta-analytic path analysis examines how well a proposed model explains the observed true correlations among the constructs included the model (Viswesvaran & Ones, 1995). In the present study, we evaluate patterns of potential direct and indirect effects that are consistent with Deci et al.'s (2017) sequential process model (Figure 2). Specifically, following the recommendations of Viswesvaran and Ones

(1995), we examined a path model in which autonomous and controlled motivation fully mediated the effects of psychological need satisfaction (i.e., autonomy, competence, and relatedness) on teacher well-being, distress, and functioning. Direct and indirect effects were evaluated on the basis of their confidence interval; those that encompassed zero we considered not significant. The harmonic mean of the sample sizes (N = 2,144) was used as the input sample as it offers a smaller and more conservative approach to estimating model parameters than the standard mean (N = 4,662).

RESULTS

Table 1 displays the results of our meta-analysis on the antecedents and consequences of autonomous teacher motivation (left-side) and controlled teacher motivation (right-side). Following our discussion of the omnibus meta-analytic findings, we report results from a series of sub-group analyses and meta-regressions, which assess the moderating effects of categorical and continuous variables, respectively. Next, aligned with APA's Meta-Analysis Reporting Standards (Appelbaum et al., 2018) and best practice recommendations (Field et al., in press) we report comprehensive sensitivity analyses that assess the robustness of the observed meta-analytic results. We conclude this section with a description of the meta-analytic structural equation modeling results from our assessment of Deci et al.'s (2017) sequential process model.

Insert Table 1

Research Question 1: Antecedents of Autonomous and Controlled Forms of Teacher Motivation

Workplace context. An assessment of Table 1 shows relatively strong meta-analytic associations between autonomous teacher motivation and transformational leadership (ρ = .44, CI = [.11, .77]) and perceived autonomy support (ρ = .30, CI = [.17, .43]). The respective CIs for both meta-analytic distributions did not include zero, which suggests they are statistically significant (Shan et al., 2019, Whitener, 1990). However, the broad width of the CVs suggests these relations may be moderated (Geyskens et al., 2009). In contrast, negligible meta-analytic associations were observed between controlled teacher motivation and both transformational leadership (ρ = -.07, CI = [-.26, .13]), and perceived autonomy support (ρ = .08, CI = [-.07, .23]), with corresponding CIs including zero.

Individual Differences. As shown in Table 1, autonomous motivation showed small, non-significant meta-analytic associations with demographic variables, including gender (ρ = .05, CI = [-.06, .17]), age (ρ

= .04, CI = [-.05, .14]), tenure (ρ = .00, CI = [-.06, .05]), and years' experience (ρ = .05, CI = [-.10, .20]). Likewise, controlled motivation showed negligible meta-analytic associations with gender (ρ = .05, CI = [-.10, .20]), age (ρ = .05, CI = [-.10, .20]) and years' experience (ρ = .05, CI = [-.10, .20] and, like autonomous motivation, all corresponding CIs encompassed zero, indicating non-significance.

Although autonomous motivation showed virtually no association with neuroticism (ρ = .02, CI = [-.35, .38]), it showed moderate-to-large associations with other personality traits. Specifically, it showed the strongest relationship with extraversion (ρ = .38, CI = [.29, .48]), followed by conscientiousness (ρ = .32, CI = [.17, .46]), agreeableness (ρ = .27, CI = [-.02, .56]), and openness (ρ = .11, CI = [-.25, .48]). By contrast, all five personality traits displayed weak associations with controlled motivation. Interestingly, neuroticism, which displayed the weakest association with autonomous motivation, showed the strongest association with controlled motivation (ρ = .08, CI = [.04, .12]). Taken together, our results suggest that demographic variables have negligible associations with autonomous and controlled teacher motivations. Finally, our findings suggest that personality, in general, is more strongly associated with autonomous than controlled teacher motivation.

Motivation and Basic Psychological Needs. Table 1 shows large and significant meta-analytic associations between autonomous teacher motivation and autonomy satisfaction (ρ = .48, CI = [.39, .57]), competence satisfaction (ρ = .53, CI = [.45, .62]), and relatedness satisfaction (ρ = .38, CI = [.33, .43]). By contrast, the relation between controlled motivation and autonomy satisfaction was moderately negative (ρ = -.25, CI = [-.41, -.09]). Similarly, we found weak negative associations between controlled motivation and competence satisfaction (ρ = -.09, CI = [-.18, -.01]) and relatedness satisfaction (ρ = -.11, CI = [-.22, -.01]). Autonomous motivation showed a strong negative association with amotivation (ρ = -.47, CI = [-.58, -.36]), whereas controlled motivation and amotivation were moderately positively associated (ρ = .27, CI = [.17, .37]). Finally, autonomous and controlled motivation showed a weak, positive association with each other (ρ = .14, CI = [.06, .22]).

Research Question 2: Consequences of Autonomous and Controlled Forms of Teacher Motivation

Well-Being and Job Attitudes. Results reported in Table 1 show a strong positive association between autonomous teacher motivation and well-being (ρ = .46, CI = [.35, .57]). Results also show strong negative associations between autonomous teacher motivation and burnout (ρ = -.45, CI = [-.53, -.38]) and

distress (ρ = -.40, CI = [-.49, -.31]). In addition, Table 1 suggests that there is a moderate negative association between autonomous teacher motivation and turnover intentions (ρ = -.21, CI = [-.62, .20]) and a practically nonexistent association between autonomous teacher motivation and stress (ρ = -.01, CI = [-.37, -.35]). By contrast, controlled teacher motivation generally displayed smaller associations that were in the opposite direction. For example, it showed positive, albeit weaker, associations with burnout (ρ = .18, CI = [.09, .27]), distress (ρ = .16, CI = [.09, .24]), and turnover intentions (ρ = .08, CI = [-.30, .46]). Controlled teacher motivation also showed a near zero association with well-being (ρ = .02, CI = [-.15, .19]) and a moderate positive association with work stress (ρ = .19, CI = [.07, .31]).

Similar patterns of results were observed with regard to attitudinal outcomes of autonomous and controlled teacher motivations (see Table 1). That is, associations between controlled motivation and job satisfaction (ρ = -.07, CI = [-.34, .21]) organizational commitment (ρ = .03, CI = [-.18, .23]), and work engagement (ρ = -.25, CI = [-.78, .28]), were in the opposite direction and noticeably smaller than the associations for the corresponding autonomous motivation distributions (job satisfaction: ρ = .56, CI = [.44, .67]; organizational commitment: ρ = .51, CI = [.36, .66]; work engagement: ρ = .58, CI = [.52, .85]).

Behavior and Functioning. Table 1 also shows divergent patterns of associations between autonomous and controlled teacher motivations with regard to teacher behavior and functioning. Specifically, autonomous motivation showed strong, positive, and statistically significant associations with teacher self-efficacy (ρ = .47, CI = [.39, .55]) and autonomy supportive teaching (ρ = .31, CI = [.22, .41]). A smaller, non-significant association was observed for the relation between autonomous motivation and performance (ρ = .15, CI = [-.04, .34]). By contrast, the corresponding controlled teacher motivation distributions showed small and non-significant associations (teacher self-efficacy: ρ = .04, CI = [-.17, .25]; autonomy supportive teaching: ρ = -.03, CI = [-.08, .03]; performance: ρ = -.01, CI = [-.21, .19]).

Summary of Meta-Analytic Results

Autonomous motivation was, in general, positively associated with antecedents, including workplace context variables (e.g., transformational leadership), individual differences (e.g., personality), and basic psychological needs. In addition, autonomous motivation was typically positively related to consequences like teacher behavior and functioning (e.g., teacher self-efficacy) and general well-being (except for distress, burnout, and stress, which were negatively related to autonomous motivation). In contrast, associations

involving controlled motivation were generally in the opposite direction. Moreover, our findings indicate that relations involving autonomous motivation typically presented with larger absolute effects than relations involving controlled motivation. With regard to statistical significance, an inspection of the 95% CIs (see Table 1 and SM Figures 2 and 3) suggests that 65% (17/26) of the autonomous motivation meta-analytic associations were significant[3]. In contrast, our results suggest that only 35% (9/26) of the controlled motivation associations were significant. Furthermore, 50% (13/26) of the autonomous and controlled motivation meta-analytic mean estimates were statistically different from each other (i.e., the respective 95% CIs did not overlap). Table 1 also shows that we observed relatively high levels of effect size heterogeneity, as indicated by large SD_ρ values and broad CVs, which suggests that the observed meta-analytic associations are likely to be moderated. In the following section, we explore this possibility and examine potential moderators of the observed relations.

Exploratory Moderator Analyses

Another aim of our study was to examine if the observed meta-analytic results were moderated by certain factors when sufficient studies were available. For autonomous motivation, we examined if effects were moderated for autonomy, competence and relatedness satisfaction, teacher distress and burnout, and teacher self-efficacy. We first considered whether correlations were moderated by (a) the educational context: primary/elementary, secondary, higher education, or mixed contexts; and (b) the teaching occupation: general/K-12 teachers, pre-service teachers, PE teachers, principals, academic staff, or mixed samples. The observed results did not show evidence of moderation for autonomy, competence, relatedness satisfaction, distress, or burnout across either moderator, with all moderator sub-group CIs overlapping (Shan et al., 2019). For controlled motivation, we could examine moderation for competence satisfaction, teacher distress and burnout, as well as teacher self-efficacy. We generally found no evidence of moderation in these distributions. The only exception was the relation between controlled motivation and competence satisfaction, which was moderately negative in general teachers (k = 3, ρ = -.21, CI = [-.32, -.10]) and near zero in pre-service teachers (k = 3, ρ = -.02, CI = [-.08, .04]). However, given the small k in each sub-group,

[3] Although 27 controlled motivation distributions were included in our study, we were able to assess the statistical significance of the meta-analytic mean effect size estimate in 26 distributions only because the "tenure-controlled motivation"

this observation could be an artifact of second-order sampling error and, thus, should be interpreted with caution (Schmidt & Hunter, 2015).

We also used meta-regressions to examine whether or not the aforementioned correlations were related to career tenure or the age of the study samples. Consistent with Cochrane guidelines (Higgins & Green, 2011) we conducted these analyses when there were at least 10 effect sizes for each variable. Our results indicate that the relation between competence satisfaction and autonomous motivation decreased as a function of age (k = 10, SE = .010, β = -.015, CI = [-.025, -.005]). Moderation was also observed for the associations between controlled motivation and distress (k = 15, SE = .004, β = .012, CI = [.005, .019]) and burnout (k = 14, SE = .004, β = .014, CI = [.006, .022]), which both increased as a function of age. The association between controlled motivation and distress also increased as a function of career tenure (k = 10, SE = .009, β = .018, CI = [.0001, .0362]). All other results did not show evidence of moderation as all regression coefficient CIs encompassing zero.

Meta-Analytic Path Analyses

To evaluate the pattern of direct and indirect effects specified in Figure 2, we subjected a meta-analytically derived correlations matrix to path analysis (see Table 2). Path analyses were conducted with the "lavaan" package in R (Rosseel, 2012). In evaluating effects, we used the harmonic mean of the sample sizes (N = 2,144). All regression coefficients are displayed in Table 3, and the model with regression paths is shown in Figure 3.

Insert Tables 2 and 3, and Figure 3

As expected, the satisfaction of autonomy, competence and relatedness needs explained a considerable amount of variance in autonomous motivation (R^2 = .331; see Table 3). In comparison, these three psychological needs satisfaction variables explained minimal variance in controlled motivation (R^2 = .068; see Table 3). Teacher autonomous motivation was, in turn, positively associated with teacher well-being (.487) and autonomy supportive teaching (.320), yet negatively associated with teacher distress (-.421).

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distribution did not satisfy our inclusion criteria (i.e., k < 3). We excluded the corresponding autonomous motivation distribution so that meaningful comparisons between motivation types could be made with regard to statistical significance.

Controlled motivation showed minimal associations with teacher well-being (-.048) and autonomy supportive teaching (-.075) and, interestingly, showed a positive relationship with teacher distress (.219). Aligned with our hypotheses, the observed indirect effects through autonomous motivation were substantially stronger than the observed indirect effects through controlled motivation. The exception was for the autonomy satisfaction → controlled motivation → distress path, which was higher (-.067) and significant, but still weaker than when autonomous motivation was the intervening variable.

Comprehensive Sensitivity Analysis

To assess the robustness of our meta-analytic and path analysis results, we performed a variety of sensitivity analyses using Meta-Sen (see https://metasen.shinyapps.io/gen1/; Field et al., in press). Specifically, we followed recommendations outlined by Field et al. to examine whether or not the trustworthiness of our results may be threatened by outliers and/or publication bias. Supplemental Materials (SM) Tables 3 and 4 display our sensitivity analysis results for all autonomous motivation and controlled motivation meta-analytic distributions that had 10 or more effect sizes, respectively. Thus, comprehensive sensitivity analyses were conducted on 30% (15/50) of the distributions included in our study. Sections D and E of the SM contain figures for the respective sensitivity analyses (e.g., cumulative meta-analysis by precision forest plot).

An assessment of SM Tables 3 and 4 suggests that outliers did not threaten the observed meta-analytic findings. Specifically, Meta-Sen did not detect outliers in 53% (8/15) of the analyzed autonomous and controlled motivation meta-analytic distributions. Although at least one outlier was removed from 47% (7/15) of the distributions, the adjusted meta-analytic mean estimate was typically similar to the corresponding original mean estimates before outlier removal. That is, absolute differences between original and adjusted estimates were typically not greater than 20% (i.e., $|\Delta| \leq 20\%$; Field et al., in press). With regard to publication bias, the sensitivity analyses suggest that meta-analytic results on autonomous motivation were not threatened by data suppression (see SM Table 3). Interestingly, when bias was detected (i.e., $|\Delta| \geq 20\%$), the adjusted estimates suggested that the absolute magnitude of the original estimate was underestimated. Put differently, autonomous motivation effects were typically stronger, not weaker, after accounting for the effect of publication bias. In contrast, publication bias was more frequently detected in the controlled motivation distributions (see SM Table 4). Yet, similar to the autonomous motivation, the bias

detection results indicate that the absolute magnitude of the original meta-analytic mean estimates on controlled motivation were typically underestimated.

Taken together, our comprehensive sensitivity analysis results suggested that outliers did not threaten our observed meta-analytic and path analysis results. Although publication bias was detected in both sets of autonomous and controlled motivation distributions, our results suggest that the absolute magnitude of the corresponding original meta-analytic mean effect sizes was, if anything, underestimated. As such, henceforth we refer to the original meta-analytic results only (i.e., those unadjusted for outliers and/or publication bias) as our sensitivity analysis results indicate that they represent the most conservative estimates of the observed phenomena in the present study.

DISCUSSION

The aim of the present study was to synthesize the literature on teacher motivation. To this end, we examined the cumulative scientific knowledge on the antecedents and consequences of autonomous and controlled forms of motivation in education settings and used meta-analytic path analysis to assess the cumulative validity of Deci et al.'s (2017) basic self-determination theory (SDT) model. In the following sections, we summarize our key results and discuss implications for research and practice that can be delineated from our observed findings. We conclude with a discussion of the limitations of our study and directions for future research.

Our study contributes to the literature in several ways. First, our meta-analytic results (see Table 1) revealed the distinct benefits of autonomous forms of teacher motivation. For example, autonomously motivated teachers tend to be more satisfied, committed, and engaged than teachers who are guided by controlled motivation. In addition, our results suggest that the former group of teachers experience greater well-being and less burnout and distress than those in the latter group. Indeed, these observations add credence to the claim that facilitating autonomous teacher motivation is an effective way to foster better teacher mental health (Guay et al., 2001; Roth et al. 2007), which is important given the high levels of stress present in the occupation internationally (Gallup, 2014; Safe Work Australia, 2013; Savill-Smith, 2018). Likewise, our results indicate that autonomously motivated teachers display more self-efficacy and autonomy supportive behavior in their teaching, which is noteworthy because improved teacher functioning and behavior may help to foster student basic needs, and thus lead to better student-related outcomes

(Pelletier et al. 2002). Second, our assessment of the cumulative validity of Deci et al.'s (2017) basic SDT model revealed that patterns of indirect effects are consistent with those postulated in this literature (see Table 3). That is, autonomy, competence, and relatedness satisfaction are proximal predictors of well-being, distress, and autonomy-supportive teaching primarily through autonomous, rather than controlled motivation. Indeed, this is consistent with the sequential motivational process by which basic needs facilitate beneficial teacher outcomes. Thus, our findings can be used to inform the evidence-based practice on the benefits of cultivating teacher psychological needs (Ng et al., 2012, Slemp et al., 2018) and, in turn, more autonomous forms of teacher motivation.

Theoretical and Research Implications

Our results have important implications for future research on autonomous and controlled motivation in a variety of ways. First, our study took steps towards creating a taxonomy of the types of correlates that have been examined in the teacher motivation literature. Indeed, this descriptive and thematic organization of antecedents and consequences of teacher motivation revealed several interesting insights. We observe, for example, that autonomous motivation typically yielded larger meta-analytic effect sizes than the controlled motivation across most antecedents and consequences, which may suggest a more nuanced understanding of the former type of motivation than the latter (Bosco et al., 2015). Consistent with this view is the comparatively smaller number of studies containing strong conceptual predictors of controlled teacher work motives (e.g., extrinsic reward contingencies, transactional leadership) in this literature. Indeed, a comparison of the number of independent samples across all autonomous and controlled motivation analyses in Table 1 indicates that controlled teacher motivation is a relatively understudied phenomenon. Hence, an implication of our study is that future researchers should consider incorporating more variables that may exhibit greater predictive validity of controlled forms of teacher motivation, so that greater clarity can be achieved in its strong antecedents and consequences.

Second, we observed positive associations between personality traits – in particular, extraversion – and autonomous motivation, but not controlled motivation. This observed variance becomes less surprising when one considers evidence that suggests positive affect is an established attribute of extraversion (e.g., Lucas, Le, & Dyrenforth, 2008; Pavot, Diener, & Fujita, 1990; Smillie, DeYoung, & Hall, 2015), which is also a known correlate of intrinsic motivation (e.g., Isen & Reeve, 2005. Similarly, extraversion is associated

with approach motivation towards rewarding stimuli (Depue & Collins, 1999; Wilmot et al., 2019), and approach motivation typically co-occurs with intrinsic motivation (see Dysvik & Kuvaas, 2010, 2013; Elliot & Harackiewicz, 1996). Taken together, these observations may suggest that theoretically relevant control variables have been omitted from past research on teacher motivation. Indeed, our findings may prompt future researchers to consider best practice recommendations regarding incorporating control variables (see Carlson & Wu, 2012) to avoid potential misinterpretation of future teacher motivation studies.

Third, while our exploratory moderator analyses did not indicate a substantial amount of moderation in the observed meta-analytic associations, there were some exceptions. Specifically, the association between competence satisfaction and autonomous teacher motivation significantly decreased as a function of teacher age. A possible reason for this observation might be that the need for competence tends to be prominent at younger ages when teachers are learning how to navigate their profession (Chan et al., 2008; Klassen et al., 2011; Rots et al., 2007). For controlled motivation, meta-analytic associations with distress and burnout significantly increased as a function of teacher age and career tenure, such that effects were stronger in older and more experienced teacher samples than younger and less experienced samples. This finding might be explained by research consistently showing the importance of autonomous as opposed to controlled work motives among older employees (see Kooij et al., 2011 for a review). This finding also goes against the notion of an age-related increase in the importance external work motives (e.g., job security) (e.g., Baltes et al., 1999; Kooij et al., 2011), suggesting that older teachers are potentially less motivated by external factors and are instead just as motivated—potentially more so—than younger teachers by factors such as learning, growth, and enjoyment. Still, the corresponding regression coefficients for these moderators were small and we reiterate that these were exploratory findings that emerged inductively. Thus, we encourage others to replicate our results in future work.

Practical Implications

Our meta-analysis and path analysis results revealed the motivational processes that are likely to support optimal teaching functioning. Thus, we suggest that educational institutions would benefit from adopting leadership training or structural interventions that target ways to facilitate teacher basic needs, which our results indicate are likely to be effective in promoting wellness, positive functioning, and thriving teaching workforces.

Training interventions, for example, typically cover the active promotion of behaviors or leader strategies to cultivate autonomy-supportive (e.g., providing choices; avoiding means-end incentives), competence-supportive (e.g., provision of feedback & challenge), or relatedness-supportive (e.g., opportunities for social connection) practices. Intervention studies have shown such practices to have promise in yielding beneficial health- and motivation-based outcomes in healthcare settings (Gillison et al., 2019; Ntoumanis et al., 2020), and in mixed populations (Su & Reeve, 2011), and work organisations (Slemp et al., 2020). In work organizations, training typically ranges from a few hours (Hardré & Reeve, 2009; Su & Reeve, 2009; Yong et al., 2019) to several days (Deci et al., 1989) and generally yields moderate benefits in basic need satisfaction, internalization, and positive functioning, with some studies showing some lasting effects (Forner, 2019; Pederson et al., 2018, 2019). Similar results have been observed for structural interventions that embed autonomy, competence, and/or relatedness support mechanisms into structural organizational initiatives and policy (e.g., Smith et al., 2017). Thus, it is possible that comparable benefits may arise if similar interventions are rolled out with teachers. Although we cannot definitively infer causality with the correlational nature of the data in our included studies, our recommendations are consistent with the causal direction implied by the SDT literature (See Deci et al., 2017; Ryan, 1995; Ryan & Deci, 2017) as well as longitudinal and experimental studies from related literatures (see Gillison et al., 2019; Gnambs & Hanfstingl, 2016; Sheldon & Filak, 2008; Su & Reeve, 2011) that allow for stronger causal inferences. That is, basic needs are nurtured by autonomy, competence, or relatedness supportive mechanisms from the social context, and basic needs serve as antecedents to autonomous motivation.

Our findings could also be used to inform career advice and counseling for in-service and pre-service teachers. For example, our results are consistent with the premise that teachers motivated by identified or intrinsic factors (e.g., making a difference, love of the job) are more likely to adopt productive teaching strategies, are more committed, and exhibit more favorable mental health outcomes. By contrast, those who are motivated by more external and controlled motives, such as generous starting salaries in some countries (OECD, 2017), job security, or incentives to enter the profession (Sutcher et al., 2016), are less likely to be high functioning. Thus, the latter group might be well-served if steered towards alternative career paths, or towards finding ways they can inject more intrinsic enjoyment into their role, potentially through proactive job redesign strategies (Slemp, 2017; Slemp & Vella-Brodrick, 2014; Wrzesniewski & Dutton, 2001).

Limitations and Future Directions

Although our findings support what is postulated in Deci et al.'s (2017) basic SDT model, some limitations must be addressed. First, many of the studies included in our study are cross-sectional, which limits our ability to infer causality. It is possible that the relations observed in Figure 3 are bidirectional. For example, the experience of autonomous motivation could induce greater levels of basic need satisfaction. Similarly, teachers may be more likely to experience autonomous motivation when they experience favorable well-being outcomes or when they display autonomy supportive teaching. Nonetheless, our results are consistent with the causal direction implied by SDT. Specifically, we observed that basic needs are motivational precursors to autonomous motivation, which then leads to positive well-being and behavioral outcomes (Deci et al., 2017). We recommend that future research establish the causal direction of these paths by using methods that allow for stronger causal inferences, such as randomized experiments and longitudinal studies.

Second, it is important to recognize that for some analyses in the present study, as well as some moderator subgroups, there were only a few studies available to compute the meta-analytic association, which increases the likelihood of variance caused by second-order (residual) sampling error (Schmidt & Hunter, 2015; Schmidt & Oh, 2013). Given that we used the unbiased sample variance estimator in running our analyses, this also generated more conservative CIs when *k* was small (Dahlke & Wiernik, 2018), which may have hampered our ability to detect moderation effects.

Third, several of the studies included in our meta-analytic dataset reported only composites of autonomous or controlled motivations (e.g., Abós et al., 2018; Cuevas et al., 2018), or the relative autonomy index (e.g., Fernet et al., 2010; Nordhall & Knez, 2018), which limited the number of studies that reported correlations at the level of each individual regulation (e.g., identified, introjected) within each motivation composite. Although we only included composites of the broader autonomous and controlled motivations in the present study, it is possible that more nuanced findings would emerge had analyses been carried out across specific regulations. We note that the focus of the current study was on composite-level phenomena. Still, we acknowledge that some information can be lost when aggregating variables into the composites (Chemolli & Gagné, 2014; Howard et al., 2016, 2017). Thus, we recommend that future studies report data

at the level of each specific regulation so that future meta-analyses can model variance for each specific regulation.

Finally, another limitation of our study is that we brought together research conducted in different educational settings, which involves a variety of educational contexts and participants that are broadly captured within the teaching profession (e.g., teachers, pre-service teachers, principals). We concede that this may introduce residual heterogeneity into certain meta-analytic distributions. It may also mean that results found in one context might not necessarily generalize to others. However, we note that results from a series of exploratory analyses indicated that the observed meta-analytic mean estimated are, in general, unlikely to be moderated. Moreover, aligned with the APA's Meta-Analytic Reporting Standards (Appelbaum et al., 2018), we have provided details regarding our meta-analysis by making available our open science framework project website, containing all relevant project materials (e.g., data sets, analytic scripts; see http://osf.io/XXX) so that readers can judge the transferability of findings to different education settings as well as replicate and extend our observed findings.

Conclusion

In sum, the present study provides meta-analytic support for the theoretical benefits of autonomously motivated teacher behavior, showing clear links with enhanced well-being, lower distress, and autonomy supportive in-role teaching behavior, which is likely to benefit students. Controlled motivation, in contrast, demonstrated unfavorable relations with teacher mental health. Teachers are more likely to be autonomously motivated to the extent that their basic psychological needs are satisfied. Our results support the value of environments that nurture teacher psychological needs and, in turn, autonomous forms of work motivation for teacher wellness and functioning. We suggest that need supportive leadership training interventions that garner support for teacher autonomy, competence, and relatedness needs may yield favorable motivation-based outcomes, wellness, and more effective teaching strategies that support student autonomy.

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Tables

Table 1 Meta-analytic results for teacher autonomous and controlled forms of motivation

Variable	Teacher Autonomous Motivation									Teacher Controlled Motivation								
	k	*N*	r_{obs}	ρ	SD_ρ	95% CI		80% CV		*k*	*N*	r_{obs}	ρ	SD_ρ	95% CI		80% CV	
						LB	UB	LB	UB						LB	UB	LB	UB
Antecedents																		
Workplace context																		
Transform. leadership	4	1,046	.39	.44	.20	.11	.77	.12	.76	4	1,046	-.06	-.07	.10	-.26	.13	-.23	.10
Autonomy support	8	2,190	.27	.30	.14	.17	.43	.10	.50	6	1,479	.07	.08	.12	-.07	.23	-.10	.26
Individual differences																		
Demographics																		
Gender (0 = male, 1 = female)	9	4,332	.05	.06	.14	-.06	.17	-.14	.26	4	1,964	.01	.01	.14	-.22	.25	-.21	.24
Age	9	3,097	.04	.05	.10	-.05	.14	-.10	.19	4	1,493	-.08	-.09	.06	-.22	.05	-.19	.01
Tenure	3	1,350	.00	.00	.00	-.06	.05	.00	.00	--	--	--	--	--	--	--	--	--
Years experience	6	1,719	.05	.05	.13	-.10	.20	-.14	.24	3	393	-.19	-.22	.12	-.61	.18	-.45	.02
Personality																		
Agreeableness	5	1,709	.20	.27	.22	-.02	.56	-.08	.61	3	1,009	-.04	-.05	.10	-.36	.25	-.24	.14
Conscientiousness	5	1,709	.26	.32	.09	.17	.46	.17	.46	3	1,009	-.01	-.01	.11	-.32	.31	-.21	.20
Extraversion	5	1,709	.30	.38	.04	.29	.48	.32	.44	3	1,009	.01	.01	.09	-.28	.30	-.17	.19
Neuroticism	5	1,709	.01	.02	.28	-.35	.38	-.42	.45	3	1,009	.07	.08	.00	.04	.12	.08	.08
Openness	5	1,709	.09	.11	.29	-.25	.48	-.33	.55	3	1,009	-.03	-.03	.28	-.74	.68	-.56	.49
Motivation and basic needs																		
Autonomy satisfaction	20	7,961	.42	.48	.19	.39	.57	.23	.73	7	4,289	-.21	-.25	.16	-.41	-.09	-.49	-.01
Competence satisfaction	22	12,511	.45	.53	.18	.45	.62	.30	.77	9	8,839	-.08	-.09	.10	-.18	-.01	-.24	.05
Relatedness satisfaction	24	9,467	.33	.38	.11	.33	.43	.23	.52	10	5,720	-.10	-.11	.14	-.22	-.01	-.31	.08
Controlled motivation	43	18,554	.12	.14	.26	.06	.22	-.20	.48	--	--	--	--	--	--	--	--	--
Amotivation	23	10,988	-.39	-.47	.24	-.58	-.36	-.78	-.15	22	10,880	.22	.27	.22	.17	.37	-.03	.56
Consequences																		
Well-being and job attitudes																		
General well-being	10	2,591	.41	.46	.13	.35	.57	.28	.65	6	1,945	.02	.02	.15	-.15	.19	-.20	.24
Job satisfaction	8	2,509	.50	.56	.12	.44	.67	.38	.73	4	1,581	-.06	-.07	.16	-.34	.21	-.33	.20

Variable	Teacher Autonomous Motivation									Teacher Controlled Motivation								
	k	*N*	r_{obs}	ρ	SD_{ρ}	95% CI		80% CV		*k*	*N*	r_{obs}	ρ	SD_{ρ}	95% CI		80% CV	
						LB	UB	LB	UB						LB	UB	LB	UB
Org. commitment	6	2,855	.46	.51	.13	.36	.66	.32	.70	5	2,535	.02	.03	.16	-.18	.23	-.22	.27
Turnover intentions	4	1,494	-.18	-.21	.25	-.62	.20	-.62	.20	3	1,236	.07	.08	.14	-.30	.46	-.19	.35
Work engagement	6	2,900	.58	.69	.14	.52	.85	.48	.89	3	1,659	-.23	-.25	.21	-.78	.28	-.64	.14
Distress	26	8,676	-.36	-.40	.21	-.49	-.31	-.68	-.12	19	6,647	.15	.16	.14	.09	.24	-.02	.35
Burnout	21	7,286	-.40	-.45	.15	-.53	-.38	-.66	-.25	15	5,493	.16	.18	.15	.09	.27	-.03	.38
Stress	4	1,422	-.01	-.01	.22	-.37	.35	-.37	.35	3	888	.14	.19	.00	.07	.31	.19	.19
Behavior and functioning																		
Teacher self-efficacy	19	8,068	.42	.47	.15	.39	.55	.27	.67	12	3,608	.04	.04	.32	-.17	.25	-.40	.48
Aut. Supportive teaching	10	3,929	.25	.31	.12	.22	.41	.15	.47	5	1,836	-.02	-.03	.00	-.08	.03	-.03	-.03
Performance	7	2,279	.13	.15	.20	-.04	.34	-.14	.43	4	1,615	-.01	-.01	.11	-.21	.19	-.20	.17

Note. *k* = number of independent effect sizes; *N* = cumulative sample size; r_{obs} = sample size-weighted meta-analytic mean effect size estimate; ρ = meta-analytic mean effect size estimated corrected for sampling and measurement error; CI = confidence interval; CV = credibility interval; LB = lower bound; UB = upper bound; transform. = transformational; org. = organizational; aut. supportive teaching = autonomy supportive teaching.

Table 2

Meta-analytically derived correlations for variables in the path analysis

	Variable	1	2	3	4	5	6	7	8
1	Autonomy satisfaction	**0.55**							
2	Competence satisfaction	.59 (17), 6,664	**0.46**						
3	Relatedness satisfaction	.52 (17), 6,664	.46 (18), 6,972	**0.35**					
4	Teacher autonomous motivation	.48 (20), 7,961	.53 (22), 12,511	.38 (24), 9,467	**0.42**				
5	Teacher controlled motivation	-.25 (7), 4,289	-.09 (9), 8,839	-.11 (10), 5,720	.14 (43), 18,554	**0.19**			
6	Teacher well-being	.54 (4), 988	.45 (4), 988	.48 (4), 988	.48 (9), 2,524	.02 (5), 1,878	**0.60**		
7	Teacher distress	-.56 (5), 2,059	-.46 (5) 2,059	-.40 (5), 2,059	-0.39 (26), 10,038	.16 (17), 6,465	-.71 (3) 947	**0.59**	
8	Autonomy supportive teaching	.30 (3), 948	.35 (5), 1,449	.21 (5) 1,449	.31 (10), 3,929	-.03 (5) 1836	.31 (3), 1,064	-.41 (4), 1,217	**0.21**

Note. Within each cell is ρ (*k*), *N*; Squared multiple correlations are shown in the diagonal; Harmonic mean of the sample sizes, *N* = 2,144.

Table 3

Standardized regression coefficients for direct and indirect effects in meta-analytic path analysis

Effect	β	*SE*	95% CI		R^2
			Lower	Upper	
Direct effects					
Autonomy satisfaction → Autonomous motivation	.217	.023	.172	.262	
Competence satisfaction → Autonomous motivation	.354	.022	.312	.396	
Relatedness satisfaction → Autonomous motivation	.104	.021	.063	.146	
Autonomy satisfaction → Controlled motivation	-.306	.027	-.358	-.253	
Competence satisfaction → Controlled motivation	.086	.026	.034	.138	
Relatedness satisfaction → Controlled motivation	.009	.025	-.040	.058	
Autonomous motivation → Well-being	.487	.017	.454	.520	
Autonomous motivation → Distress	-.421	.018	-.456	-.386	
Autonomous motivation → Autonomy Supportive Teaching	.320	.020	.282	.359	
Controlled motivation → Well-being	-.048	.019	-.086	-.011	
Controlled motivation → Distress	.219	.019	.181	.256	
Controlled motivation → Autonomy Supportive Teaching	-.075	.021	-.115	-.034	
Indirect effects					
Autonomy satisfaction → Autonomous motivation → Well-being	.106	.012	.082	.129	
Autonomy satisfaction → Autonomous motivation → Distress	-.091	.010	-.112	-.071	
Autonomy satisfaction → Autonomous motivation → Autonomy Supportive Teaching	.069	.009	.053	.086	
Autonomy satisfaction → Controlled motivation → Well-being	.015	.006	.003	.026	
Autonomy satisfaction → Controlled motivation → Distress	-.067	.008	-.083	-.050	
Autonomy satisfaction → Controlled motivation → Autonomy Supportive Teaching	.023	.007	.010	.036	
Competence satisfaction → Autonomous motivation → Well-being	.172	.012	.148	.197	

Effect	β	*SE*	95% CI		R^2
Competence satisfaction → Autonomous motivation → Distress	-.149	.011	-.171	-.127	
Competence satisfaction → Autonomous motivation → Autonomy Supportive Teaching	.113	.010	.094	.133	
Competence satisfaction → Controlled motivation → Well-being	-.004	.002	-.008	.000	
Competence satisfaction → Controlled motivation → Distress	.019	.006	.007	.031	
Competence satisfaction → Controlled motivation → Autonomy Supportive Teaching	-.006	.003	-.012	-.001	
Relatedness satisfaction → Autonomous motivation → Well-being	.051	.010	.030	.071	
Relatedness satisfaction → Autonomous motivation → Distress	-.044	.009	-.062	-.026	
Relatedness satisfaction → Autonomous motivation → Autonomy Supportive Teaching	.033	.007	.020	.047	
Relatedness satisfaction → Controlled motivation → Well-being	.000	.001	-.003	.002	
Relatedness satisfaction → Controlled motivation → Distress	.002	.005	-.009	.013	
Relatedness satisfaction → Controlled motivation → Autonomy Supportive Teaching	-.001	.002	-.004	.003	
Variance Explained					
Autonomous motivation					.331
Controlled motivation					.068
Well-being					.233
Distress					.199
Autonomy Supportive Teaching					.102

Note: Harmonic mean of the sample sizes (N = 2,144). Results reported to three decimals to show 95% CI proximity to zero. β = regression coefficient, *SE* = standard error.

Figure

Amotivation	**Extrinsic Motivation**				**Intrinsic Motivation**
Non-regulation	**External Regulation**	**Introjected Regulation**	**Identified Regulation**	**Integrated Regulation**	**Intrinsic Regulation**
	External	Slightly internalized	Somewhat internalized	Internalized	Internalized
	Controlled motivation ←		Autonomous motivation →		
Antecedents Autonomy, competence, relatedness frustration Interpersonal controls in work climate or leadership Personality, goal-striving & individual differences			Antecedents Autonomy, competence, relatedness satisfaction Need supportive work climate or supportive leadership (e.g., autonomy support, transformational leadership) Personality, goal-striving, & individual differences		
Consequences Psychological distress: Burnout, work stress Functioning: Lower self-efficacy, effort, and performance Behavior: Controlling behavior and teaching			Consequences Wellness and job attitudes: Well-being, job satisfaction, work engagement, organizational commitment Functioning: Teacher self-efficacy, effort, and performance Behavior: Autonomy supportive behavior and teaching		

Figure 1. Types of autonomous and controlled motivation described by self-determination theory, with associated degree of internalization and expected relation with key teacher correlates (Figure adapted from Ryan & Deci, 2000).

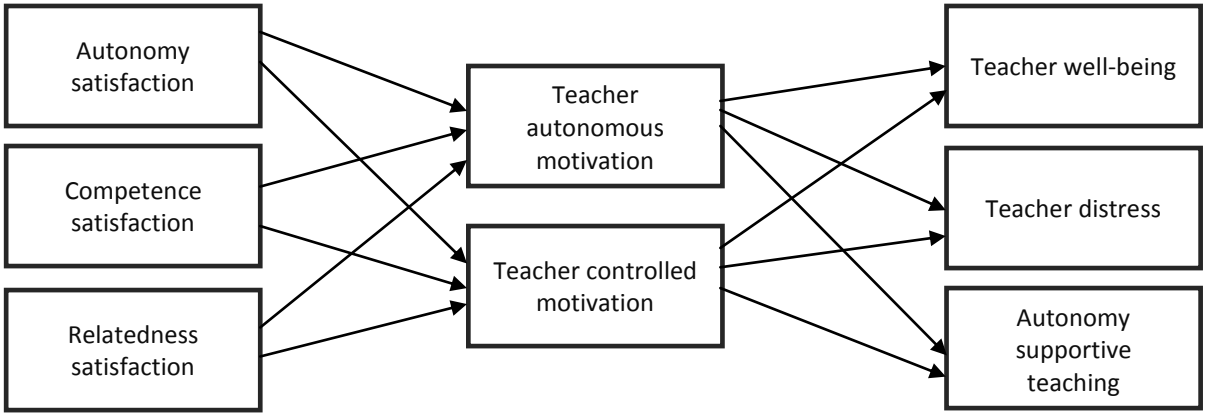

Figure 2. Path diagram showing indirect paths through autonomous and controlled forms of teacher motivation

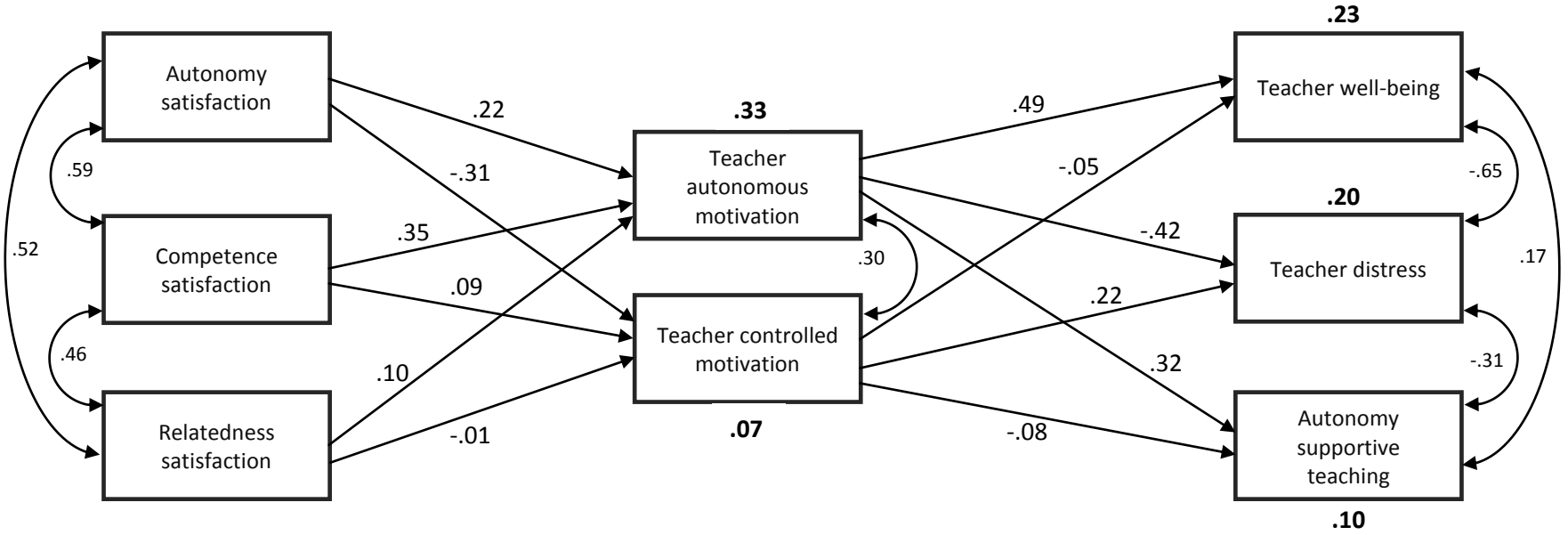

Figure 3. Path diagram of the hypothesized associations amongst the study variables. All paths are significant except relatedness satisfaction to controlled motivation. % variance explained in each endogenous variable shown in bold. Harmonic mean of the sample sizes (N = 2,144).

Supplementary Material

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Credit Author Statement

Gavin R. Slemp: Study conceptualization, systematic search and screening, method, data coding, data analyses, writing reviewing and editing initial and revised manuscript

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Conflict of Interest Statement

This research was partially funded by an internal research development award funded by the Melbourne Graduate School of Education (MGSE). The authors declare that they had no conflict of interest in conducting the present study;