Université de Montréal

# A Multilevel Meta-Analysis of the Relationship Between Basic Psychological Needs and Autonomous Motivation at Work

Par

Bianca Christine Lallitto

Département de psychologie, Faculté des arts et des sciences

Essai présenté en vue de l'obtention du grade de doctorat en psychologie (D.Psy.), option psychologie du travail et des organisations

Décembre 2020

**Résumé**

La théorie de l'autodétermination (TAD) affirme que la motivation autodéterminée est influencée par trois besoins psychologiques fondamentaux : l'autonomie, la compétence et l'appartenance sociale. L'objectif de cette revue systématique était de tester l'hypothèse de la TAD que chacun des trois besoins psychologiques à une influence égale sur la motivation autodéterminée au travail, à la fois lorsque satisfait et frustré. Les bases de données Business Source Premier, CINAHL, MEDLINE, PsycINFO et Scopus ont été consultées le 14 juin 2019 à la recherche d'articles examinant l'effet de satisfaire et/ou frustrer les besoins d'autonomie, de compétence et/ou d'appartenance sociale sur la motivation autodéterminée dans un contexte de travail. Au total, 98 articles répondaient aux critères d'éligibilité; de ces articles, 97 sur la satisfaction des besoins ont fait l'objet d'une méta-analyse multiniveaux. Les estimations de la taille de l'effet pour l'autonomie ($r$ = 0.38; 95% CI [0.34, 0.41]; $p < .0001$), la compétence ($r$ = 0.41; 95% CI [0.35, 0.46]; $p < .0001$), et l'appartenance sociale ($r$ = 0.37; 95% CI [0.31, 0.43]; $p < .0001$) ne différaient pas significativement les uns des autres en termes de leur corrélation avec la motivation autodéterminée au travail. Cependant, les résultats de l'analyse de poids relatif ont indiqué que l'appartenance sociale était le prédicteur le plus important de la motivation autodéterminée, intrinsèque et identifiée, expliquant ~ 49% de la variance prédite de ces résultats. Ces résultats remettent en question le principe de la TAD que les besoins d'autonomie, de compétence et d'appartenance sociale exercent une influence égale sur la motivation autodéterminée lorsqu'ils sont satisfaits. Les résultats sont limités au domaine du travail et doivent être interprétés avec prudence en raison de la nature indirecte des preuves analysées. Des recommandations pour satisfaire les besoins psychologiques au travail sont fournies.

**Mots clés :** appartenance sociale, autonomie, besoins psychologiques, compétence, méta-analyse, motivation autodéterminée, théorie de l'autodétermination

**Abstract**

Self-determination theory (SDT) argues that autonomous motivation is influenced by three basic psychological needs: autonomy, competence, and relatedness. The purpose of this systematic review was to test SDT's assumption that all three basic psychological needs influence levels of autonomous work motivation equally, both when satisfied and when frustrated. Business Source Premier, CINAHL, MEDLINE, PsycINFO, and Scopus databases were searched as of June 14th, 2019 for articles examining the effect of satisfying and/or frustrating the needs for autonomy, competence, and/or relatedness on autonomous motivation in a work context. A total of 98 articles met eligibility criteria; of these articles, 97 reporting on need satisfaction underwent multilevel meta-analysis. Effect size estimates for autonomy ($r$ = 0.38; 95% CI [0.34, 0.41]; $p < .0001$), competence ($r$ = 0.41; 95% CI [0.35, 0.46]; $p <$ .0001), and relatedness ($r$ = 0.37; 95% CI [0.31, 0.43]; $p < .0001$) did not differ significantly from one another in terms of their association with autonomous work motivation. However, relative weight analysis results pointed to relatedness as the most important predictor of autonomous motivation, intrinsic motivation, and identified regulation, explaining ~ 49% of the predicted variance in these outcomes. These results call into question SDT's tenet that autonomy, competence, and relatedness exert equal influence on autonomous motivation when satisfied. Findings are limited to the work domain and should be interpreted with caution due to the indirect nature of the evidence analyzed. Recommendations for satisfying basic psychological needs in the workplace are provided.

**Keywords:** autonomous motivation, autonomy, basic psychological needs, competence, meta-analysis, relatedness, self-determination theory

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## List of Abbreviations

BPNT: Basic Psychological Needs Theory

RWA: Relative Weight Analysis

SDT: Self-Determination Theory

**Acknowledgements**

I would first like to thank Daniel Sznycer for his guidance and support throughout the process of writing this doctoral essay. I appreciate your willingness to challenge my thought process and to ask the oft-unasked questions. I will forever remain grateful that you accepted to supervise my doctoral research.

I would next like to recognize Celine Coletta and Claudia Delle Grazie for their contributions to this project. You made the tedious parts less tedious. Thank you for being so ready and willing to help me in whatever way I needed.

I would also like to extend my thanks to Richard Menzies, Mireille Joussemet, Kaspar Philipp Schattke, and Véronique Dagenais-Desmarais for their suggestions and advice freely given at various stages of this project. This doctoral essay is better because of it.

Lastly, I would like to thank my parents, Carroll Kerner and Marco Lallitto, and my brother, Matthew Lallitto, for their love and unconditional support, which has been a constant in my life amidst much change. At long last, you will be able to say that you have a doctor in the family.

# A Multilevel Meta-Analysis of the Relationship Between Basic Psychological Needs and Autonomous Motivation at Work

In North America, work is assigned greater importance than other activities, taking up the lion's share of our time. In 2019, Americans spent 8 hours a day engaged in work-related activities, roughly 1.5 times the number of hours spent performing any other social activity (U.S. Bureau of Labor Statistics, 2020). Canadians, in turn, worked an average of 1,670 hours that year, just 109 hours behind their American counterparts (OECD, 2020). As a consequence of so much time spent at work, many social interactions between people living in North America occur in the workplace.

In today's world of work, highly competent and committed employees are essential to the optimal functioning and success of an organization (Sushil, 2014). Employee turnover is consequently a major concern for organizations. Employee turnover is associated with high costs for organizations, which must spend large sums of money to hire and train replacement employees. For example, the median cost of turnover in the United States was found to be 21.4% of an employee's annual salary when considering all employment positions (Center for American Progress, 2012). This would represent a cost of just over $16,000 to replace an employee with a salary of $75,000. Furthermore, very highly paid jobs that require higher levels of education and specialized training, along with senior or executive level jobs, can result in a turnover cost of up to 213% of an employee's annual salary (Center for American Progress, 2012). This means that an organization would potentially have to spend $191,700 to replace an employee with a salary of $90,000. Absenteeism is another costly factor to organizations. According to the Centers for Disease Control and Prevention (CDC),

absenteeism costs employers $225.8 billion annually, which equates to $1,685 per employee (CDC Foundation, 2015).

Organizations can seek to reduce turnover and absence rates by creating conditions that increase the likelihood of employees becoming engaged in their work. Employee engagement can lead to lower turnover rates and absenteeism, as well as higher productivity and profitability (Sushil, 2014), factors which play a significant role in organizational effectiveness. Given the high costs associated with employee turnover and absenteeism, the question of what keeps an employee engaged in his or her work becomes an important one to address.

Self-Determination Theory (SDT; Ryan & Deci, 2017) is a motivational theory which emphasizes the role of autonomy, competence, and relatedness in influencing an employee's level of autonomous work motivation. Although many studies have assessed the effect of satisfying or frustrating the needs for autonomy, competence, and relatedness on autonomous work motivation (e.g., Glaser et al., 2015; Graves & Luciano, 2013; Hagger et al., 2015), there are presently few studies comparing the strength of each effect with those of the other basic psychological needs. As such, it remains unknown whether one basic psychological need influences levels of autonomous work motivation more than another. If all three basic psychological needs do not indeed affect autonomous work motivation equally, then knowing which basic psychological need has the stronger effect on autonomous work motivation is an important question to answer. From a theoretical standpoint, determining how each basic psychological need influences autonomous work motivation can shed light on the structure of human motivation and its evolutionary origins. From an applied perspective, the finding that one basic psychological need has a stronger effect on autonomous work motivation than do the

others could inform organizational practices aimed at increasing employee engagement, a current interest of managers and organizational development practitioners (Anderson, 2017).

The purpose of this review is to close this knowledge gap with regard to SDT by examining the literature on autonomy, competence, and relatedness meta-analytically in order to answer the following questions: (1) Does one basic psychological need increase autonomous work motivation more than another when satisfied; and (2) Does one basic psychological need decrease autonomous work motivation more than another when frustrated?

## Theoretical Context

### Self-Determination Theory

SDT posits that different types of motivation exist along a continuum from controlled to autonomous motivation. Autonomous motivation is characterized by a sense of volition, whereas controlled motivation occurs in response to internal or external pressures. Both types of motivation differ from amotivation, or a lack of motivation, in that they energize and direct behaviour (Ryan & Deci, 2017). The effect of autonomous and controlled motivation on available energy, however, differs over time. Whereas controlled motivation depletes energy available for self-regulation, autonomous motivation actually increases it (Deci & Ryan, 2008).

Three types of motivation fall on the autonomous end of the SDT continuum: identified regulation, integrated regulation, and intrinsic motivation. According to Ryan and Deci (2017), identified regulation occurs when the importance of a behaviour or activity is recognized and personally accepted. When that behaviour or activity is congruent with personal values or goals, integrated regulation results. Intrinsic motivation, the most autonomous form of motivation, stems from inherent interest in an activity. This interest

translates into positive behavioural outcomes. For example, intrinsic motivation has been associated with increased participation in the motivating task, increased effort toward task completion, and greater task persistence (Cerasoli et al., 2014). Furthermore, engaging in intrinsically motivated behaviours has been shown to have a positive effect on vitality, conceptual learning, and creativity (Vansteenkiste & Ryan, 2013). These are qualities that are indicative of optimal human functioning.

SDT is primarily concerned with the satisfaction and frustration of three basic psychological needs: those for autonomy, competence, and relatedness. Broadly speaking, autonomy can be conceptualized as a sense of volition or self-endorsement when performing an action, competence as a sense of mastery in the face of optimal challenge, and relatedness as a sense of interpersonal connectedness or purpose (Ryan & Deci, 2017). SDT argues that autonomy, competence, and relatedness do not exist in a hierarchy; that is to say, it is not necessary for one need to be satisfied in order for another to become motivating. Instead, each need is of equal importance to a person's psychological well-being (Ryan & Deci, 2017). For example, if an employee's need for competence is satisfied at work through professional development workshops, but his or her need for autonomy is frustrated through excessive controls on the manner in which his or her work is performed, then that employee will suffer a cost to his or her well-being. Autonomy, competence, and relatedness are highly intercorrelated within a given domain, lending support to their non-hierarchical nature (Ryan & Deci, 2017). That being said, the hypothesis that one basic psychological need increases levels of autonomous motivation more than another when all three needs are satisfied has yet to be empirically tested. Also awaiting testing is the hypothesis that one basic psychological

need decreases levels of autonomous motivation more than another when all three needs are frustrated.

**Self-Determination Theory Applied to Industrial-Organizational Psychology**

SDT can be applied in the workplace as an approach to increasing employees' autonomous work motivation. Autonomous motivation relates to many positive work-related variables. For example, autonomous forms of motivation have been positively associated with occupational commitment, task performance, job performance, organizational citizenship behaviour, proactive and innovative work behaviour, and the ability to cope with change effectively, while they have been negatively associated with burnout, turnover intention, and work absences (Guo et al., 2014; Kim, 2015; Lazauskaite-Zabielske et al., 2015; Manganelli et al., 2018; Yousaf et al., 2015). Furthermore, intrinsic motivation stimulates employees' curiosity, interest, and satisfaction, while driving them to seek challenge in their work (Wang, Huang, & Zheng, 2015). As such, organizations should consider making their respective work environments conducive to autonomous motivation.

When implementing workplace practices, organizations may neglect autonomous motivation in favour of less autonomous forms of extrinsic motivation. This is the case, for example, with long-term pay-for-performance incentive plans, which undervalue company executives' intrinsic motivation (Gosling, 2016). Such a decision would be unwise, given recent meta-analytic findings comparing intrinsic motivation to extrinsic incentives. These findings indicate that intrinsic motivation better predicts (1) the quality of performance; and (2) performance when incentives are indirectly salient to performance. Furthermore, although not as strong of a predictor as extrinsic incentives, intrinsic motivation also moderately predicts quantity of performance. Overall, intrinsic motivation was determined to be a

moderate to strong predictor of performance whether incentives were present or not, with the relationship between intrinsic motivation and performance being positive (Cerasoli et al., 2014). These findings imply that employees who experience personal enjoyment in performing a given task are likely to perform well, making intrinsic motivation an important quality to promote in the workplace. Intrinsic motivation likewise contributes to a myriad of positive work-related outcomes beyond traditional conceptions of performance. Indeed, Cerasoli et al. (2014) also suggest that intrinsic motivation enhances creativity, teamwork, autonomy, well-being, learning, and ethical behavior, constructs which have been negatively associated with extrinsic motivation.

In order to promote autonomous forms of motivation such as intrinsic motivation in the workplace, organizations should focus on satisfying employees' basic psychological needs. Autonomy, competence, and relatedness were positively correlated with intrinsic motivation and identified regulation in a recent meta-analysis of basic psychological needs at work (Van den Broeck et al., 2016). Furthermore, satisfaction of the needs for autonomy, competence, and relatedness has been positively associated with autonomous motivation in a number of different working populations. For example, autonomy, competence, and relatedness satisfaction related positively to autonomous motivation in a sample of entrepreneurs (Olafsen & Frølund, 2018); autonomy and competence satisfaction had a positive effect on autonomous motivation in a sample of volunteers (Haivas et al., 2013); and relatedness satisfaction directly predicted autonomous motivation in a sample of development coaches (Alcaraz et al., 2015). Thus, employees from a variety of work contexts may benefit from having their basic psychological needs satisfied.

**Self-Determination Theory and the Role of Social Context**

SDT highlights the significance of need satisfying and need frustrating social contexts in influencing human functioning. Within the framework of SDT, autonomy, competence, and relatedness embody fundamental human needs. Ryan and Hawley (2016) argue that these needs represent an underlying structure of the psychological system, with need satisfaction and need frustration constituting basic inputs of this system. When autonomy, competence, and relatedness are satisfied, we experience increased self-development, which contributes to our being socially engaged, effective, and healthy. Furthermore, need satisfaction increases our capacity for self-regulation, allowing us to mediate resource acquisition by managing our motives and urges in order to fit within our social world. In environments which support need satisfaction, thriving and sociality result, whereas in environments which thwart need satisfaction, competitiveness and aggression result (Ryan & Hawley, 2016).

SDT's exploration of need satisfying and need frustrating social contexts can provide a more nuanced understanding of common workplace phenomena such as organizational citizenship behaviour and counterproductive work behaviour. Organizational citizenship behaviour consists of employee behaviours aimed at increasing the organization's welfare and that are not required as part of the employee's job; as such, organizational citizenship behaviour is often referred to as prosocial behaviour (Muchinsky & Culbertson, 2016). Satisfaction of SDT's three basic psychological needs produces internalization of social norms and values; thus, in need-satisfying contexts, employees are more likely to display prosocial behaviour (Ryan & Hawley, 2016). Counterproductive work behaviour, on the other hand, consists of employee behaviours aimed at harming the organization and its employees (Muchinsky & Culbertson, 2016). Frustration of SDT's three basic psychological needs results

in more instances of greed, divisiveness, and interpersonal aggression; thus, in need-frustrating contexts, employees are less likely to display prosocial behaviour (Ryan & Hawley, 2016). Work context therefore exerts a powerful influence over employee motivation and behaviour. Indeed, in work settings in particular, an association has been found between need satisfaction and enhanced employee engagement (Vansteenkiste & Ryan, 2013).

**The Present Review**

Despite autonomous motivation being a widely studied concept, there remains a dearth of meta-analyses and systematic reviews on this topic. Few researchers, for example, have subjected the relationship between intrinsic motivation and performance to meta-analysis; this absence of a quantified relationship is particularly felt for work contexts (Cerasoli et al., 2014). Furthermore, autonomy, competence, and relatedness, the three basic psychological needs purported to influence autonomous motivation, have rarely been examined meta-analytically, and have even more rarely been compared with one another. Only two meta-analyses were found which analyzed the effect of basic psychological need satisfaction on levels of autonomous work motivation: (1) Van den Broeck et al. (2016), which reported effect sizes for the relationship between satisfaction of the needs for autonomy, competence, and relatedness and two forms of autonomous motivation (i.e., identified regulation and intrinsic motivation); and (2) Slemp et al. (2018), which reported effect sizes for the relationship between satisfaction of the needs for autonomy, competence, and relatedness and autonomous work motivation, although the focus of this meta-analysis was leader autonomy support and its correlates. What these two meta-analyses share in common is that neither examined the question of whether one basic psychological need influences autonomous work motivation more than another.

A gap in the literature such as this one is problematic; without such a comparison, it is impossible to determine whether one basic psychological need has a greater impact on autonomous work motivation than another. A review of the literature on the needs for autonomy, competence, and relatedness is necessary to test SDT's assumption that all three basic psychological needs influence autonomous motivation equally. The purpose of this systematic review is therefore to determine whether autonomy, competence, or relatedness has a greater influence on autonomous work motivation by comparing the impact of satisfying or frustrating each basic psychological need on autonomous work motivation. Considering the importance placed on employee engagement with regard to organizational development (Anderson, 2017), establishing whether or not autonomy, competence, and relatedness play an equal role in sustaining autonomous work motivation is called for. Organizations would benefit from knowing how the satisfaction or frustration of each of an employee's basic psychological needs influences his or her level of autonomous work motivation. Given the limited nature of time, money, and other salient resources, trade-offs are unavoidable. This means that organizational practices designed to better satisfy one of an organization's employees' basic psychological needs may compromise that organization's ability to satisfy its employees' remaining two basic psychological needs. As such, organizations are faced with an important question: What is the most cost-effective way of investing limited resources so that employees are more autonomously motivated to perform their work? The present review directly addresses this question.

**Research Questions and Predictions**

This review is concerned with evaluating two research questions. The first question involves the relative importance of each of SDT's basic psychological needs in explaining autonomous motivation in work contexts which support need satisfaction.

*RQ1*: Does one basic psychological need (autonomy, competence, or relatedness) increase autonomous work motivation more than the others when all three needs are satisfied?

Since need satisfaction mediates the relationship between social context and intrinsic motivation (Sheldon & Gunz, 2009), social context should determine which needs produce the greatest increase in autonomous motivation. Given that the social context examined here is work, it was predicted that satisfaction of the need for competence would produce the greatest increase in autonomous work motivation. Indeed, when participants were faced with autonomy threat in the work domain, they reported the largest desire for competence-enhancing experiences (Sheldon & Gunz, 2009), suggesting that competence is the most salient need in this social context. Two studies concerning the teaching profession provide some evidence in support of this notion. The first, which examined university teachers' motivation to continue to use e-learning technology with their students, found that satisfaction of the need for competence explained more of the variance in teachers' intrinsic motivation than autonomy or relatedness (20% for competence vs. 10% for autonomy, relatedness being nonsignificant; Sørebø et al., 2009). The second reported that competence ($\beta = 0.57$) was more influential than autonomy ($\beta = 0.10$) or relatedness ($\beta = 0.12$) in terms of secondary school teachers' autonomous motivation (Abós et al., 2018).

This review's second question relates to the relative importance of each of SDT's basic psychological needs in explaining autonomous motivation in work contexts which contribute to need frustration.

*$RQ_2$*: Does one basic psychological need (autonomy, competence, or relatedness) decrease autonomous work motivation more than the others when all three needs are frustrated?

Taking into account the relationship between need satisfaction, social context, and intrinsic motivation (Sheldon & Gunz, 2009), it was also predicted that frustration of the need for competence would lead to the greatest decrease in levels of autonomous motivation in a work context.

## Method

### Search Strategy and Inclusion Criteria

The following databases were searched on June 14th, 2019 for eligible publications: Business Source Premier, CINAHL, MEDLINE, PsycINFO, and Scopus (see Appendix A for search terms). Studies published in any language were eligible for inclusion, including dissertations appearing in indexed databases. In order to be included in this review, studies had to meet several criteria. Studies had to report a correlation between the satisfaction or frustration of at least one basic psychological need (i.e., autonomy, competence, or relatedness) and at least one form of autonomous motivation (i.e., autonomous motivation, intrinsic motivation, integrated regulation, or identified regulation). Furthermore, studies had to report separate correlations for each basic psychological need; studies which only reported basic psychological need satisfaction or frustration as a composite variable and for which separate correlations could not be obtained were excluded from this review. Finally, the

context for evaluating the relationship between basic psychological need satisfaction or frustration and autonomous motivation had to be work-related. For example, a study assessing participants' autonomous motivation to search for jobs would be included in this review, whereas a study assessing autonomous motivation to exercise in a workplace gym would be excluded from this review.

With regard to exclusion criteria, several research designs were excluded from this review. Qualitative studies were excluded, along with case studies, conference and symposium abstracts, meta-analyses and systematic reviews, and any other publication which did not report original human data (e.g., animal studies, cell studies). Studies which only evaluated the relationship between need satisfaction or need frustration and forms of controlled motivation (i.e., introjected regulation or external regulation) were likewise excluded. Finally, studies which measured the following constructs were excluded from this review if they did not also measure the relationship between basic psychological need satisfaction or frustration and autonomous work motivation: need strength, autonomy support, autonomy orientation, competence support, achievement goals, intrinsic need satisfaction, and intrinsic job satisfaction.

All search results were stored using the citation management database RefWorks (RefWorks-COS, Bethesda, MD, USA). First, duplicate citations were removed using the RefWorks duplication check. Next, citations were searched manually to remove any additional duplicate citations. Following this, all remaining citations were uploaded into DistillerSR (Evidence Partners, Ottawa, Canada) and were run through the duplicate detection function. Once duplicate citation removal was completed, all remaining publications were reviewed for eligibility by two independent reviewers. If either reviewer considered a publication to be

potentially eligible based on title/abstract review, then a full-text review was completed. Study authors were contacted whenever a full-text publication could not be obtained. Publications written in a language other than English or French were translated using Google Translate. Any disagreements after full-text review were resolved by consensus.

**Data Extraction**

Data from all eligible full-text publications were extracted and recorded separately by two independent reviewers; discrepancies were resolved by consensus. Multiple publications of the same study were identified by cross-referencing authors and co-authors, sample characteristics, and countries. If more than one publication reported data on the same study, then data for that study were extracted as a unit, incorporating information from all related publications. The following demographic variables were extracted from each publication: the country in which the study took place, the year of publication, the type of publication (e.g., journal article, dissertation), and the industry being examined (e.g., educational services, healthcare and social assistance).

The remaining data extracted related to the calculation of effect sizes for the relationship between basic psychological need satisfaction or frustration and autonomous work motivation. First, studies were coded for the presence of need satisfaction and/or need frustration. Second, studies were coded for the presence of autonomy, competence, and/or relatedness. The following variables were coded as satisfaction of the need for autonomy in cases in which no variable clearly labelled as autonomy satisfaction was reported: job autonomy, schedule autonomy, location autonomy, user autonomy, job control, perceived control, perceived choice, autonomy-promoting job design, and individual influence on work. Control was coded as frustration of the need for autonomy when it referred to the extent to

which employees felt controlled by others. The following variables were coded as satisfaction of the need for competence in cases in which no variable clearly labelled as competence satisfaction was reported: safety competence, entrepreneurial competence, perceived competence mobilization, and sense of competence. Third, studies were coded based on whether they measured autonomous motivation, intrinsic motivation, integrated regulation, and/or identified regulation. Finally, correlation coefficients between variables of interest along with the number of participants analyzed for each correlation coefficient were extracted. Correlations corrected for attenuation were extracted in lieu of raw correlations when both forms were reported. For studies which reported both between-person and within-person correlation coefficients, only between-person correlation coefficients were extracted for analysis.

**Data Analysis**

In order to determine whether a sufficient number of studies evaluating the satisfaction and frustration of each of the three basic psychological needs were available to perform a meta-analysis, studies were grouped according to six conditions: autonomy satisfaction, competence satisfaction, relatedness satisfaction, autonomy frustration, competence frustration, and relatedness frustration. Given the risk of obtaining inaccurate results when meta-analyzing a limited number of studies, only groups which contained a minimum of ten studies were subjected to meta-analysis (Guolo & Varin, 2017). As such, studies evaluating frustration of the need for autonomy, the need for competence, and the need for relatedness were not meta-analyzed. Their results were reported descriptively.

Prior to meta-analysis, the Fisher z-transformation was applied to study correlation coefficients. Sampling variances were calculated using the compute.es package in R (R

Development Core Team. R: A Language and Environment for Statistical Computing. Vienna, Austria: The R Foundation for Statistical Computing. Available online at http://www.R-project.org/). Sampling variances of 0 were coded as 0.001 to allow for the calculation of heterogeneity statistics.

For the primary analysis, three multilevel meta-analyses were performed using the rma.mv function of the metafor package in R. Considering that eligible studies were not required to measure the relationship between basic psychological need satisfaction and autonomous work motivation in the same way or to evaluate the same employee population, a random-effects model was adopted (Hedges & Olkin, 1985). First, effect size estimates were calculated for autonomy, competence, and relatedness, respectively. Correlation coefficients quantifying the relationship between need satisfaction and all forms of autonomous work motivation were included in the analysis. However, when a study reported correlation coefficients for autonomous motivation in addition to its composites (i.e., intrinsic motivation, integrated regulation, and/or identified regulation), only the correlation coefficient for autonomous motivation was included in the analysis. Next, homogeneity was estimated by calculating two separate statistics: (1) Cochran's heterogeneity statistic ($Q$), which, when significant, denotes the presence of heterogeneity stemming from between-study and sampling error; and (2) the $I^2$ statistic, which is expressed as a percentage ranging from 0% (no heterogeneity) to 100% (high heterogeneity; Higgins et al., 2003; Lipsey & Wilson, 2001). Furthermore, 95% confidence intervals (CIs) were calculated for each effect size estimate. To determine whether effect size estimates for autonomy, competence, and relatedness were significantly different from each other, CIs were first examined to see whether or not they overlapped (Sánchez-Meca & Marín-Martínez, 2008). A Wald-type test was then used to

compare the three effect size estimates (see Viechtbauer, 2020 for an example of how to perform this test in R).

In cases where significant heterogeneity was present, subgroup analyses were performed to detect potential moderators of the relationship between basic psychological need satisfaction and autonomous work motivation. Two variables were examined as potential moderators: industry and type of motivation. Given that the Cochrane Handbook recommends a minimum of 10 studies per category of moderator examined through subgroup analyses (Higgins et al., 2020), studies measuring integrated and identified regulation were combined into the category *extrinsic motivation*. As such, three categories were examined for the moderator *type of motivation*: autonomous motivation, intrinsic motivation, and extrinsic motivation. Similarly, the only industry category which included enough studies to conduct a subgroup analysis across all three basic psychological needs was *educational services*. Therefore, studies evaluating employees in the educational services industry were compared to studies evaluating other or multiple industries.

Finally, a relative weight analysis (RWA) was performed on a sample of studies measuring all three basic psychological needs to determine the relative importance of autonomy, competence, and relatedness in explaining autonomous work motivation. RWA is recommended in cases where multiple predictor variables are correlated as it addresses the problem of multicollinearity in regression analysis (Tonidandel & LeBreton, 2015). As issues with multicollinearity have previously been documented regarding the assessment of basic psychological need satisfaction at work (e.g., Greguras & Diefendorff, 2009), RWA was performed to address these issues following the procedure outlined in Tonidandel and LeBreton (2015). Relative weights representing the proportion of variance in autonomous

work motivation accounted for by each basic psychological need and rescaled relative weights representing the percentage of predicted variance in autonomous work motivation accounted for by each basic psychological need were calculated.

Resulting effect size estimates were back-transformed to Pearson correlations to facilitate interpretation of results. Correlation coefficients were interpreted according to Cohen (1988), whereby a correlation between .10 and .30 indicates a small association, a correlation between .30 and .50 indicates a moderate association, and a correlation between .50 and 1.00 indicates a large association.

## Results

### Search Results

The database search yielded a total of 5266 unique citations. Of the 5266 citations obtained, 4964 were excluded after title and abstract review, and an additional 203 were excluded after full-text review, resulting in 99 eligible publications. Eight of these publications were related (i.e., multiple publications reporting on the same study), leaving a total of 95 unique publications. An additional 3 publications were included after scanning lists of references for potentially relevant studies, resulting in a final sample of 98 eligible publications (see Figure 1 for publication selection details).

### Characteristics of Eligible Publications

Tables 1 to 6 present the characteristics of all publications included in this review. Of the 98 publications included in this review, 94 (96%) were published in English, 2 (2%) in Spanish, 1 (1%) in Hungarian, and 1 (1%) in Korean. Fifty-four publications (55%) studied employees in Europe, 34 (35%) in North America, 16 (16%) in Asia, 4 (4%) in Oceania, 1 (1%) in Africa, and 1 (1%) in South America. Thirty-three publications (34%) studied

employees working in multiple industries, 19 (19%) in educational services, 11 (11%) in healthcare and social assistance, 11 (11%) in professional, scientific and technical services, 7 (7%) in arts, entertainment and recreation, 5 (5%) in public administration, 4 (4%) in manufacturing, 2 (2%) in finance and insurance, 2 (2%) in utilities, 1 (1%) in other services, 1 (1%) in retail trade, 1 (1%) in transportation, 1 (1%) in information and cultural industries, 1 (1%) in mining, quarrying, and oil and gas extraction, 1 (1%) in accommodation and food services, and 1 (1%) in construction. Four studies (4%) were published prior to the year 2000, 19 (19%) between 2000 and 2009, 42 (43%) between 2010 and 2015, and 33 (34%) in 2016 or later. Out of 98 publications, 16 (16%) were published only as dissertations or master's theses and did not appear in a peer-reviewed journal.

Of the 98 publications included in this review, 50 (51%) measured only one basic psychological need, 10 (10%) measured two basic psychological needs, and 38 (39%) measured all three basic psychological needs. Thirty-nine publications (40%) assessed the need for autonomy exclusively, 8 (8%) assessed the need for competence exclusively, and 3 (3%) assessed the need for relatedness exclusively. Nine publications (9%) assessed both the need for autonomy and the need for competence, and 1 (1%) assessed both the need for competence and the need for relatedness.

**Need Frustration.** Out of 98 publications, 4 (4%) measured basic psychological need frustration. All 4 publications (4%) measured autonomy, 2 (2%) measured competence, and 2 (2%) measured relatedness. With regard to studies measuring frustration of the need for autonomy, eight correlation coefficients were extracted, with 50% reported as nonsignificant. Five of these correlation coefficients related to autonomous motivation, while one each related to intrinsic motivation, integrated regulation, and identified regulation. Correlation coefficients

ranged from $r$ = -0.32 to 0.13. As for studies measuring frustration of the need for competence, six correlation coefficients were extracted, with 83% reported as nonsignificant. Three of these correlation coefficients related to autonomous motivation, while one each related to intrinsic motivation, integrated regulation, and identified regulation. Correlation coefficients ranged from $r$ = -0.23 to 0.06. Finally, among studies measuring frustration of the need for relatedness, six correlation coefficients were extracted, with 67% reported as nonsignificant. Three of these correlation coefficients related to autonomous motivation, with one each related to intrinsic motivation, integrated regulation, and identified regulation. Correlation coefficients ranged from $r$ = -0.32 to 0.05.

There were two studies which measured the frustration of all three basic psychological needs. In Wang (2018), negative correlations between frustration of the need for autonomy and autonomous motivation ($r$ = -0.30, -0.19, -0.32) were larger on average than those for competence ($r$ = -0.03, -0.05, -0.23) and relatedness ($r$ = -0.32, 0.05, -0.20). Furthermore, all correlation coefficients for frustration of the need for autonomy were significant at $p < .05$, which was not the case for either competence or relatedness. That being said, the study did not test for significant differences between correlations for each basic psychological need. In Pulido et al. (2017), intrinsic motivation was most negatively associated with frustration of the need for competence ($r$ = -0.14) compared to the need for autonomy ($r$ = -0.03) and the need for relatedness ($r$ = -0.06). Surprisingly, correlations between the frustration of all three basic psychological needs and integrated and identified regulation were positive. None of the correlation coefficients reported in this study, however, were statistically significant. Once again, the study did not evaluate whether the correlations for frustration of the needs for autonomy, competence, and relatedness differed significantly.

**Primary Analysis**

**Autonomy.** To obtain an effect size estimate of the relationship between satisfaction of the need for autonomy and autonomous work motivation, a three-level random-effects meta-analysis was performed. This meta-analysis included 132 correlation coefficients from 85 studies. The mean number of participants analyzed per correlation coefficient was 607. The results of the meta-analysis are reported in Table 7. The effect size estimate was $r = 0.38$ (95% CI [0.34, 0.41], $p < .0001$). A significant amount of heterogeneity was present among studies ($Q(131) = 2826.45$, $p < .0001$; $I^2 = 95.4\%$). Heterogeneity was significant both at Level 2 within study ($\sigma^2 = 0.0126$, $LRT = 220.76$, $p < .0001$) and Level 3 between study ($\sigma^2 = 0.0352$, $LRT = 21.03$, $p < .0001$); therefore, subgroup analyses were performed.

**Competence.** To obtain an effect size estimate of the relationship between satisfaction of the need for competence and autonomous work motivation, a second three-level random-effects meta-analysis was performed. This meta-analysis included 102 correlation coefficients from 55 studies. The mean number of participants analyzed per correlation coefficient was 608. The results of the meta-analysis are reported in Table 7. The effect size estimate was $r = 0.41$ (95% CI [0.35, 0.46], $p < .0001$). A significant amount of heterogeneity was present among studies ($Q(101) = 3112.68$, $p < .0001$; $I^2 = 96.8\%$). Heterogeneity was significant both at Level 2 within study ($\sigma^2 = 0.0189$, $LRT = 348.82$, $p < .0001$) and Level 3 between study ($\sigma^2 = 0.0511$, $LRT = 27.46$, $p < .0001$); therefore, subgroup analyses were performed.

**Relatedness.** To obtain an effect size estimate of the relationship between satisfaction of the need for relatedness and autonomous work motivation, a third three-level random-effects meta-analysis was performed. This meta-analysis included 74 correlation coefficients from 41 studies. The mean number of participants analyzed per correlation coefficient was

751. The results of the meta-analysis are reported in Table 7. The effect size estimate was $r$ = 0.37 (95% CI [0.31, 0.43], $p < .0001$). A significant amount of heterogeneity was present among studies ($Q(73) = 853.61$, $p < .0001$; $I^2 = 91.4\%$). Heterogeneity was significant both at Level 2 within study ($\sigma^2 = 0.0073$, $LRT = 120.00$, $p < .0001$) and Level 3 between study ($\sigma^2 = 0.0405$, $LRT = 24.58$, $p < .0001$); therefore, subgroup analyses were performed.

Effect size estimates of the relationship between autonomous work motivation and satisfaction of each of the three basic psychological needs were moderate. While the effect size estimate for competence was larger than that for autonomy, which was itself larger than the effect size estimate for relatedness, the 95% confidence intervals for all three effect size estimates overlapped. Therefore, a Wald-type test was performed to test for significant differences between effect size estimates. The test of moderators was nonsignificant, $QM(2) = 0.806$, $p = .668$. Competence and relatedness did not differ significantly from autonomy ($r = 0.38$, $SE = 0.02$, $z = 16.673$, $p < .001$). Thus, it cannot be concluded that the effect size estimates are significantly different from each other.

**Subgroup Analyses**

Subgroup analyses were performed to test for potential moderators of the relationship between basic psychological need satisfaction and autonomous work motivation. The following moderating variables were evaluated: (1) industry (educational services vs. other); and (2) type of motivation (autonomous motivation, intrinsic motivation, and extrinsic motivation). The results of the different subgroup analyses performed are presented in Table 8.

**Industry.** Among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for autonomy, there was a significant moderating effect for *industry*, $F(1, 130) = 7.441$, $p = .007$. The effect size estimate was larger for studies

evaluating employees working in the educational services industry ($r$ = 0.48, 95% CI [0.40, 0.55], $p$ < .01) compared to studies evaluating employees working in other or multiple industries ($r$ = 0.35, 95% CI [0.31, 0.40], $p$ < .0001).

Similarly, among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for competence, there was a significant moderating effect for *industry*, $F(1, 100) = 4.547$, $p$ = .035. The effect size estimate was larger for studies evaluating employees working in the educational services industry ($r$ = 0.50, 95% CI [0.40, 0.59], $p$ < .05) compared to studies evaluating employees working in other or multiple industries ($r$ = 0.37, 95% CI [0.30, 0.43], $p$ < .0001).

Among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for relatedness, no significant moderating effect was found, $F(1, 72)$ = 1.56, $p$ = 0.216. The effect size estimate for the educational services industry ($r$ = 0.42, 95% CI [0.32, 0.51], $p$ = .216) did not differ from other industries ($r$ = 0.34, 95% CI [0.27, 0.41], $p$ < .0001).

As was the case with the primary analysis, the effect size estimate for competence ($r$ = 0.50) was larger than that for autonomy ($r$ = 0.48) and relatedness ($r$ = 0.42) in the educational services industry. However, the 95% confidence intervals for all three effect size estimates overlapped. Thus, it cannot be concluded that the effect size estimates are significantly different from each other.

**Type of Motivation.** Among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for autonomy, there was a significant moderating effect for *type of motivation*, $F(2, 153) = 11.733$, $p$ < .0001. The effect size estimate was larger when intrinsic motivation was the type of motivation measured ($r$ = 0.40, 95% CI [0.36, 0.45],

$p < .05$) compared to both autonomous motivation ($r = 0.33$, 95% CI [0.27, 0.39], $p < .0001$) and extrinsic motivation ($r = 0.30$, 95% CI [0.24, 0.35], $p < .0001$).

Among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for competence, there was a significant moderating effect for *type of motivation*, $F(2, 119) = 4.521$, $p = .01$. The effect size estimate was larger when intrinsic motivation was the type of motivation measured ($r = 0.44$, 95% CI [0.38, 0.50], $p < .05$) compared to both autonomous motivation ($r = 035$, 95% CI [0.26, 0.43], $p < .0001$.) and extrinsic motivation ($r = 0.36$, 95% CI [0.28, 0.43], $p < .0001$).

Among studies evaluating the relationship between autonomous work motivation and satisfaction of the need for relatedness, there was a significant moderating effect for *type of motivation*, $F(2, 91) = 5.274$, $p = .007$. The effect size estimate was larger when intrinsic motivation was the type of motivation measured ($r = 0.39$, 95% CI [0.32, 0.45], $p < .01$) compared to extrinsic motivation ($r = 0.31$, 95% CI [0.24, 0.38], $p < .0001$). However, intrinsic and extrinsic motivation did not differ significantly from autonomous motivation ($r = 0.35$, 95% CI [0.28, 0.42], $p < .0001$).

Similar to the previous subgroup analysis, the effect size estimate for competence ($r = 0.44$) was larger than that for autonomy ($r = 0.40$) and relatedness ($r = 0.39$) when intrinsic motivation was the type of motivation measured. However, the 95% confidence intervals for all three effect size estimates overlapped. Thus, it cannot be concluded that the effect size estimates are significantly different from each other.

**Relative Weight Analysis**

RWA was performed on a sample of 37 studies measuring the relationship between autonomous work motivation and the satisfaction of all three basic psychological needs to

determine the relative importance of each need in explaining autonomous work motivation. Given that the subgroup analyses demonstrated that each basic psychological need correlated differently with the different types of motivation assessed, studies measuring autonomous motivation as a composite variable ($n$ = 16), intrinsic motivation ($n$ = 29), and identified regulation ($n$ = 13) were analyzed separately. The results of the RWA are presented in Table 9. Taken together, autonomy, competence, and relatedness explained only 2% of the variance in autonomous and intrinsic motivation, and only 3% of the variance in identified regulation. Relatedness was the most important predictor, explaining ~ 49% of the predicted variance in all three types of motivation. Autonomy explained more of the predicted variance in intrinsic motivation compared to competence (~ 36% vs. ~ 14%), whereas competence explained more of the predicted variance in identified regulation compared to autonomy (30% vs. ~ 21%).

## Discussion

This systematic review sought to answer two research questions. The first question pertained to the relative importance of satisfying each basic psychological need in increasing autonomous work motivation. The current meta-analysis found moderate effect size estimates of the relationship between autonomous work motivation and the satisfaction of each of SDT's three basic psychological needs. Although the effect size estimate for competence ($r$ = 0.41) was larger than the effect size estimate for both autonomy ($r$ = 0.38) and relatedness ($r$ = 0.37), these three effect size estimates did not differ significantly from each other. However, RWA identified relatedness as the most important predictor of autonomous work motivation, with relatedness accounting for ~ 49% of the predicted variance in this outcome. These results provide preliminary evidence in support of the argument that relatedness increases

autonomous work motivation more than do autonomy and competence when all three needs are satisfied.

Satisfying the need for relatedness explained the same percentage of the predicted variance in all three types of motivation assessed, whether autonomous motivation was treated as a composite variable or broken down into intrinsic motivation and identified regulation. Van den Broeck et al. (2016) also found that relatedness explained the same percentage of the predicted variance in intrinsic motivation and identified regulation in their meta-analysis. These results suggest that relatedness plays a similar role in contributing to all types of autonomous work motivation, which may relate to the evolutionary importance of being a member of a group and in harmony with group members (Vansteenkiste et al., 2020).

Although the need for relatedness has been characterized as less important than the needs for autonomy and competence (Van den Broeck et al., 2016), several studies have reported the opposite result. Carson and Chase (2009) reported that relatedness showed the strongest positive association with intrinsic motivation of all three basic psychological needs in a sample of physical education teachers. Similarly, Alcaraz et al. (2015) found that satisfying the need for relatedness directly predicted self-determined motivation in a sample of development coaches, whereas autonomy and competence did not. They concluded that coaches placed more importance on satisfying the need for relatedness than autonomy and competence. The relative importance of relatedness in increasing autonomous work motivation in these samples as well as others may stem from a desire for meaningful work. Models of meaningful work include the opportunity to benefit others in one's community or society (Steger, 2017), which can be interpreted as satisfying the need for relatedness. It is plausible that coaches and physical education teachers see their work as directly benefiting the

athletes and students they serve. Finding work meaningful is predicted by high-quality relations with one's supervisor, which can be seen as a form of relatedness support. Furthermore, employees who find their work meaningful report greater intrinsic motivation than those who do not (Steger, 2017). The relationship between relatedness, meaningful work, and autonomous work motivation is worth exploring further.

Effect size estimates of the relationship between (1) satisfaction of the need for autonomy and autonomous motivation, and (2) satisfaction of the need for competence and autonomous motivation, were larger for studies evaluating employees working in the educational services industry compared to studies evaluating employees working in other or multiple industries. As for the need for competence, the effect size estimate went from moderate to large. This was not the case for relatedness, which did not differ by industry. Several studies in the educational services domain have reported more influential relationships between autonomous motivation and satisfaction of the needs for autonomy and competence compared to relatedness. Jensen and Bro (2018), for example, found that only autonomy and competence were directly related to teachers' levels of intrinsic motivation when satisfied; the relationship between satisfaction of the need for relatedness and intrinsic motivation was nonsignificant. Similarly, Van den Berghe et al. (2014) found that physical education teachers who experienced more autonomous motivation and less controlled motivation at work reported higher need satisfaction for autonomy and competence, whereas there were no significant differences in the level of need satisfaction reported for relatedness between teachers who experienced autonomous motivation compared to controlled motivation. The larger effect size estimates for autonomy and competence in the educational services industry might be explained by perceived locus of causality. A recent systematic review on teachers'

causal attributions described teachers as attributing their students' success to their teaching methods, which would correspond to an internal perceived locus of causality (Wang & Hall, 2018). An internal perceived locus of causality is positively associated with satisfaction of the need for autonomy and perceived competence in one's performance (Lechuga, 2014; Ryan & Deci, 2017). The majority of employees included in those studies evaluating the educational services industry being teachers, this may be a plausible explanation for the above-mentioned results.

In this meta-analysis, effect size estimates of the relationship between autonomous motivation and satisfaction of the needs for autonomy and competence were larger when intrinsic motivation was the type of motivation measured. This result seems intuitive, given that intrinsic motivation is the most autonomous form of motivation described by SDT. Furthermore, effect size estimates for intrinsic motivation differed significantly from effect size estimates for extrinsic motivation in the case of all three basic psychological needs. These results add further evidence in support of the distinction made between intrinsic and extrinsic forms of motivation on the SDT continuum (Ryan & Deci, 2017). The increase in the strength of the association between basic psychological need satisfaction and autonomous work motivation from extrinsic motivation to intrinsic motivation mirrors the linear trend in the correlations between SDT's types of motivation and employee outcomes reported in Van den Broeck et al. (2021). These results, along with those from the RWA, support the authors' argument against treating autonomous motivation as a composite variable. Autonomy and competence explained differing amounts of the variance in intrinsic motivation compared to identified regulation; by treating autonomous motivation as a composite variable, these important nuances in need satisfaction would be missed.

Effect size estimates of the relationship between autonomous work motivation and satisfaction of the needs for autonomy and competence differed from those reported in Slemp et al. (2018)'s meta-analysis on leader autonomy support in the workplace. In the current meta-analysis, effect size estimates for autonomy ($r$ = 0.38) and competence ($r$ = 0.41) were smaller than Slemp et al. (2018)'s findings ($r$ = 0.48 and 0.45, respectively). As Slemp et al. (2018) focused on meta-analyzing data related to leader autonomy support, their sample of studies measuring the effect of need satisfaction on autonomous work motivation likely differed from the one included in the current meta-analysis. Interestingly, the effect size estimate for relatedness reported here ($r$ = 0.37) closely resembled Slemp et al. (2018)'s correlation ($r$ = 0.36).

Effect size estimates for all three basic psychological needs in relation to intrinsic motivation differed from those reported in a recent meta-analysis on basic psychological need satisfaction at work. In their meta-analysis, Van den Broeck et al. (2016) reported the following effect size estimates for the relationship between intrinsic motivation and satisfaction of the need for autonomy, the need for competence, and the need for relatedness, respectively: $r$ = 0.54 (95% CI [0.51, 0.58]), $r$ = 0.28 (95% CI [0.25, 0.31]), and $r$ = 0.36 (95% CI [0.34, 0.38]). The effect size estimates for competence ($r$ = 0.44) and relatedness ($r$ = 0.39) were larger in the current meta-analysis, while the effect size estimate for autonomy ($r$ = 0.40) was smaller. Furthermore, all three effect size estimates in the current meta-analysis fell outside of the 95% confidence intervals reported in Van den Broeck et al. (2016). This discrepancy can be accounted for by the greater number of effect sizes included in the current meta-analysis. Whereas Van den Broeck et al. (2016) included 34 effect sizes for each of the three basic psychological needs, the current meta-analysis included 95 for autonomy, 63 for

competence, and 43 for relatedness. Furthermore, the current meta-analysis used a multilevel approach, whereas Van de Broeck et al. (2016) did not.

RWA results also differed from those reported in Van den Broeck et al. (2016), in which relative weights were larger for all three basic psychological needs. As for rescaled relative weights, autonomy explained less of the predicted variance in intrinsic motivation (~ 36% vs. ~ 68%) and identified regulation (~ 21% vs. ~ 50%) in the current meta-analysis, whereas relatedness explained more of the predicted variance in these same outcomes (~ 49% vs. ~ 22%) compared to Van den Broeck et al. (2016). Interestingly, competence explained a similar percentage of the predicted variance in intrinsic motivation (~ 14% vs. ~ 10%) and identified regulation (30% vs. ~ 28%) in both meta-analyses. Compared to Van de Broeck et al. (2016), the RWA in the current meta-analysis included more effect sizes for intrinsic motivation and fewer effect sizes for identified regulation.

This review's second research question pertained to the relative importance of frustrating each basic psychological need in decreasing autonomous work motivation. Due to the small number of studies assessing the relationship between basic psychological need frustration and autonomous work motivation, this question could not be examined meta-analytically. Research on basic psychological need frustration has become more prevalent only in the last decade (Vansteenkiste et al., 2020), and as such, there may not be a significant number of studies examining the impact of need frustration on autonomous motivation in the work domain. Indeed, no study on need frustration included in this review was published before 2013. A second factor which may have played a role in the small number of studies found on need frustration in the work domain is the high percentage of nonsignificant correlations between autonomous forms of work motivation and satisfaction of each of the

three basic psychological needs reported in this review. If this is a trend in the need frustration literature, then potentially relevant studies may not have been published due to nonsignificant findings.

**Limitations and Future Directions**

While this review provides preliminary answers to a research question which has yet to be examined empirically, it is not without its limitations. First, correlational data was meta-analyzed in the context of this review. This means that causal conclusions about the effect of satisfying each of the three basic psychological needs on autonomous work motivation cannot be drawn from its findings. Relatedly, the studies included in this review did not directly compare autonomy, competence, and relatedness in terms of their ability to increase autonomous work motivation when satisfied, or to decrease autonomous work motivation when frustrated. Consequently, the effect size estimates reported in this review were based on each need's individual association with autonomous work motivation, unrelated to the other needs. Furthermore, not all studies reviewed measured all three basic psychological needs. In future, experimental studies which directly assess the impact of each basic psychological need on autonomous motivation in a work context should be conducted to more accurately determine whether one basic psychological need increases or decreases autonomous work motivation more than another when all three needs are satisfied or frustrated, respectively.

Second, the relatively small number of studies assessing the frustration of each of the three basic psychological needs prevented this review's second research question from being examined meta-analytically. A focus of future research on SDT should be to assess the effect of need frustration on autonomous work motivation in a variety of industries. These future studies should assess autonomy, competence, and relatedness frustration separately rather than

as a composite variable to facilitate comparisons between each need's effect size. Relatedly, several moderator categories could not undergo subgroup analysis due to a small number of studies examining that category. For example, only the *educational services* category could be meta-analyzed for the moderator *industry*. The relationship between basic psychological need satisfaction and autonomous work motivation should continue to be evaluated in a variety of industries in order to draw conclusions as to whether effect size estimates vary by industry.

Third, although the RWA indicated that each basic psychological need predicts unique variance in autonomous forms of work motivation, the amount of variance explained by satisfying all three basic psychological needs was negligible (between 2% and 3% for each type of motivation assessed). The meaningfulness of this result is debatable; therefore, RWA results should be interpreted with caution.

Fourth, the results of this review are restricted to a work context, as they pertain to the effect of satisfying and frustrating the needs for autonomy, competence, and relatedness on autonomous work motivation. These results may not apply to other contexts such as academic or parenting contexts, in which different needs may be more influential. Future meta-analyses should examine whether autonomy, competence, and relatedness demonstrate a hierarchical relationship in terms of their impact on levels of autonomous motivation in other social contexts.

**Recommendations for Practice**

Although relatedness emerged as the strongest predictor of autonomous work motivation, findings from this review indicate the importance of satisfying all three basic psychological needs in the workplace to promote autonomous work motivation. The beneficial effects of satisfying the needs for autonomy, competence, and relatedness extend beyond

fostering autonomous work motivation. Need-supportive work climates positively influence other desirable work-related outcomes, such as the degree to which employees internalize work rules, standards, and procedures (Stone et al., 2009). There are many ways in which organizations can create conditions conducive to basic psychological need satisfaction. Suggestions are provided for satisfying autonomy, competence, and relatedness at work.

**Autonomy.** In order to satisfy the need for autonomy, organizations might consider offering their employees meaningful choices whenever possible. For example, an organization might allow employees to make choices about how to perform their job tasks or about which responsibilities they will take on (Deci et al., 2017; Manganelli et al., 2018; Stone et al., 2009). When choice cannot be offered, providing a meaningful rationale as to why this is the case helps to satisfy employees' need for autonomy (Deci et al., 2017). Another option for organizations to consider is encouraging employees to participate in decision-making, which signals the opportunity to take initiative at work (Deci et al., 2017; Manganelli et al., 2018; Stone et al., 2009). One way of doing so would be to directly solicit an employee's point of view during a meeting in which possible decisions are being discussed. Organizations might also attempt to adopt the perspective of their employees as a third way of satisfying their need for autonomy. This means making an effort to listen to employees' ideas with the goal of understanding them, asking for their opinions, imagining what it would be like to be in their position, and giving them space to express their emotions during challenging times (Deci et al., 2017).

**Competence.** As a way to satisfy the need for competence, organizations may want to assign their employees work that is optimally challenging; this means that tasks should not be made too easy nor too hard, but rather should match the employee's skill level (Lyness et al.,

2013; Orsini et al., 2015). Should employees lack the skills needed to master work-related tasks, it is recommended that organizations provide their employees with opportunities to develop these skills in order to foster a sense of competence (Lyness et al., 2013). Organizations may also want to provide employees with specific and timely feedback on their job performance, which is an integral part of satisfying their need for competence. It is recommended that feedback be given close in time to the incidence of the event and that it be direct, clear, constructive, task- or behaviour-oriented, and meaningful (Lyness et al., 2013; Manganelli et al., 2018; Orsini et al., 2015; Stone et al., 2009). If we take the example of an employee who must give a presentation, informing that employee that she delivered her content in a concise manner is a more specific feedback statement than simply telling her that she did a good job. Another option for organizations to consider is to encourage their employees to adopt mastery goals. Mastery goals emphasize the importance of learning as a means of increasing knowledge or feelings of competence, in contrast to performance goals, which emphasize performing well relative to others (Ryan & Deci, 2017). Continuing with the example above, a mastery goal for this employee would be *to give a presentation to a prospective client without relying on cue cards*, whereas an example of a performance goal would be *to give a better presentation to a prospective client than my coworkers*.

**Relatedness.** Organizations can satisfy their employees' need for relatedness by acknowledging their feelings. Validating an employee's emotional experience conveys empathy and helps to build trust (Lyness et al., 2013; Manganelli et al., 2018). Another strategy that organizations may want to employ is to highlight the meaning derived from the work that their employees perform. An understanding of how one's work benefits others contributes to the satisfaction of the need for relatedness (Deci et al., 2017; Manganelli et al.,

2018). For instance, an employee who manufactures control valves might be reminded that he is helping to reduce water waste. A third way of satisfying the need for relatedness is to help employees to build interpersonal connections in the workplace. Facilitating regular interactions between employees can take the form of mentoring or onboarding programs, or collaborative projects that involve employees from different departments within the organization (Lyness et al., 2013; Manganelli et al., 2018).

**Conclusion**

This systematic review calls into question the long-held assumption of SDT that the needs for autonomy, competence, and relatedness are of equal importance to a person's autonomous motivation. Relatedness emerged as a stronger predictor of autonomous work motivation than autonomy and competence. Organizations with limited resources may want to consider prioritizing satisfaction of the need for relatedness if unable to satisfy all three basic psychological needs simultaneously. Organizations which do manage to support their employees' needs for autonomy, competence, and relatedness can look forward to the benefits of fostering autonomous motivation in the workplace.

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**Figure 1**

*PRISMA Flow Diagram of Selection of Eligible Publications*

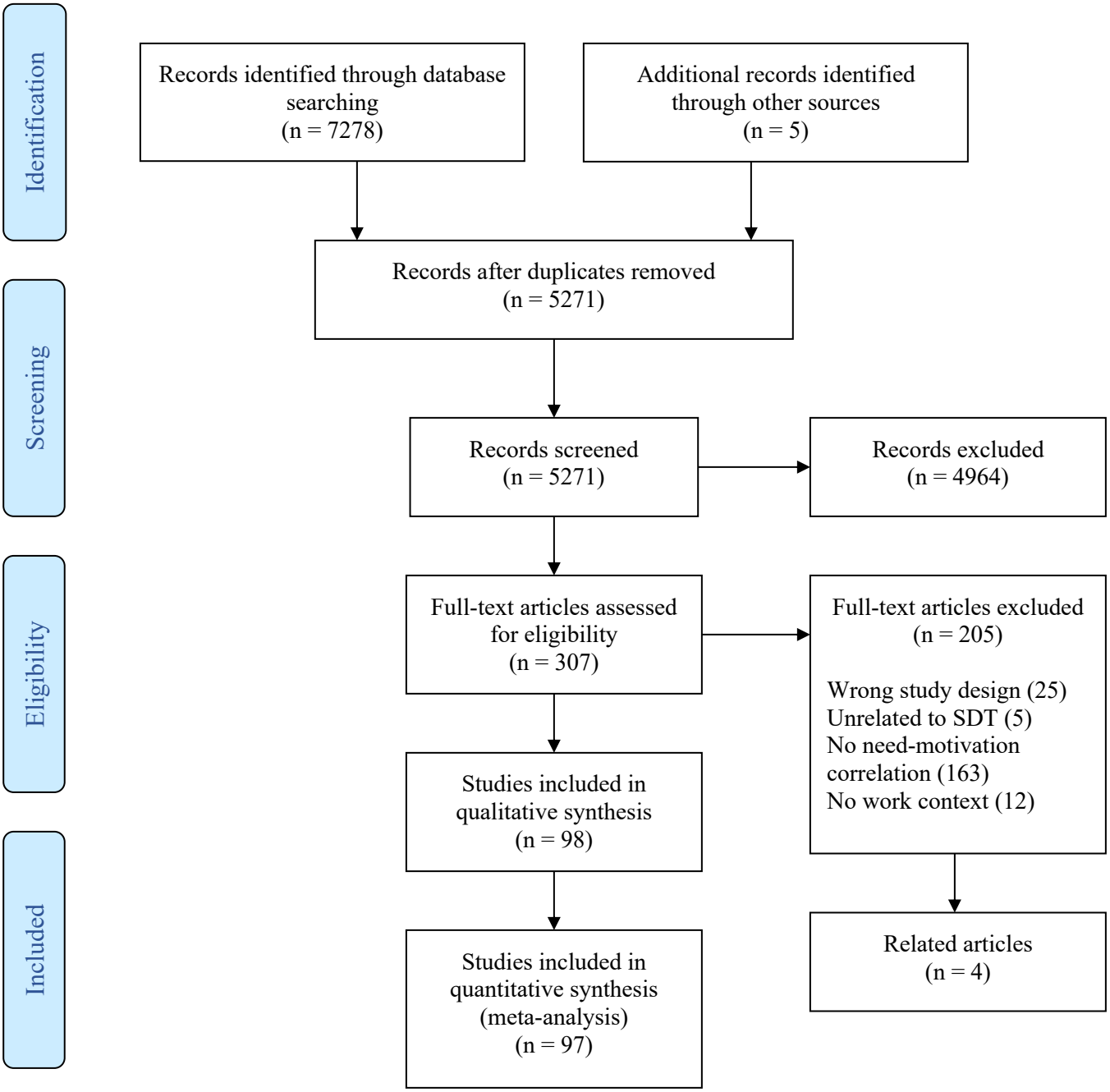

**Table 1**

*Characteristics of Studies on Autonomy Satisfaction Included in the Meta-Analysis*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Abos et al. | Spain | 2018 | Journal Article | Educational Services | Autonomous Motivation | 0.44 | 584 |
| Alcaraz et al. | Spain | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.29 | 302 |
| Amado et al. | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.11 | 332 |
| Andersson Arntén et al. (1) | Sweden | 2016 | Journal Article | Public Administration | Intrinsic Motivation | 0.28 | 595 |
| Andersson Arntén et al. (2) | Sweden | 2016 | Journal Article | Public Administration | Identified Regulation | 0.20 | 595 |
| Battistelli et al. (1) | Italy | 2017 | Journal Article | Manufacturing | Intrinsic Motivation | 0.42 | 159 |
| Battistelli et al. (2) | Italy | 2017 | Journal Article | Manufacturing | Integrated Regulation | 0.45 | 159 |
| Belschak et al. | Netherlands | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.47 | 141 |
| Bentzen et al. | Norway, Sweden | 2016 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.22 | 343 |
| Bidee et al. | Belgium | 2017 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.77 | 42 |
| Briand (1) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Autonomous Motivation | 0.32 | 105 |
| Briand (2) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.40 | 105 |

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|---|---|---|---|---|---|---|---|
| Briand (3) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Identified Regulation | 0.16 | 105 |
| Carson & Chase (1) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.26 | 246 |
| Carson & Chase (2) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.30 | 246 |
| Carson & Chase (3) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.30 | 246 |
| Carson & Chase (4) | United States | 2009 | Journal Article | Educational Services | Identified Regulation | 0.18 | 245 |
| Chen | United States, Hong Kong, Singapore, Taiwan, Australia, Korea, Canada, Europe | 2012 | Dissertation | Educational Services | Autonomous Motivation | 0.33 | 245 |
| Cnossen et al. | Netherlands | 2019 | Journal Article | Multiple | Intrinsic Motivation | -0.09 | 111 |
| Deng et al. | United States | 2004 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.63 | 153 |
| Douglas | United States | 1994 | Dissertation | Manufacturing | Intrinsic Motivation | 0.62 | 150 |
| Dysvik & Kuvaas (1) | Norway | 2011 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.39 | 199 |
| Dysvik & Kuvaas (2) | Norway | 2011 | Journal Article | Finance & Insurance | Intrinsic Motivation | 0.53 | 103 |
| Dysvik et al. (1) | Norway | 2013 | Journal Article | Transportation & Warehousing | Intrinsic Motivation | 0.41 | 625 |
| Dysvik et al. (2) | Norway | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.44 | 629 |

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|---|---|---|---|---|---|---|---|
| Eder | United States | 2007 | Dissertation | Multiple | Intrinsic Motivation | 0.16 | 269 |
| Fényszárosi et al. (1) | Hungary | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.56 | 1662 |
| Fényszárosi et al. (2) | Hungary | 2018 | Journal Article | Multiple | Identified Regulation | 0.45 | 1662 |
| Fernet et al. (1) | Canada | 2012 | Journal Article | Educational Services | Autonomous Motivation | 0.32 | 586 |
| Fernet et al. (1) | Canada | 2012 | Journal Article | Educational Services | Autonomous Motivation | 0.37 | 586 |
| Fertig (1) | United States | 2009 | Dissertation | Multiple | Autonomous Motivation | -0.28 | 382 |
| Fertig (2) | United States | 2009 | Dissertation | Multiple | Intrinsic Motivation | 0.08 | 382 |
| Fertig (3) | United States | 2009 | Dissertation | Multiple | Identified Regulation | 0.07 | 382 |
| Foss et al. | Denmark | 2015 | Journal Article | Multiple | Autonomous Motivation | 0.23 | 1523 |
| Gagne, Forest et al. (1) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.47 | 345 |
| Gagne, Forest et al. (2) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.37 | 62 |
| Gagne, Forest et al. (3) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.39 | 345 |
| Gagne, Forest et al. (4) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.07 | 62 |
| Gagne, Forest et al. (5) | Belgium | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.57 | 530 |
| Gagne, Forest et al. (6) | Belgium | 2015 | Journal Article | Multiple | Identified Regulation | 0.34 | 530 |
| Gagne, Forest et al. (7) | Norway | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.54 | 856 |

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|---|---|---|---|---|---|---|---|
| Gagne, Forest et al. (8) | Norway | 2015 | Journal Article | Multiple | Identified Regulation | 0.30 | 856 |
| Gagne, Forest et al. (9) | China | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.40 | 305 |
| Gagne, Forest et al. (10) | China | 2015 | Journal Article | Multiple | Identified Regulation | 0.36 | 305 |
| Gagne, Tian et al. (1) | Australia | 2019 | Journal Article | Professional, Scientific & Technical Services | Autonomous Motivation | 0.43 | 394 |
| Gagne, Tian et al. (2) | Australia | 2019 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.43 | 394 |
| Gagne, Tian et al. (3) | Australia | 2019 | Journal Article | Professional, Scientific & Technical Services | Identified Regulation | 0.40 | 394 |
| Gagne, Tian et al. (4) | China | 2019 | Journal Article | Information & Cultural Industries | Autonomous Motivation | 0.52 | 195 |
| Gagne, Tian et al. (5) | China | 2019 | Journal Article | Information & Cultural Industries | Intrinsic Motivation | 0.44 | 195 |
| Gagne, Tian et al. (6) | China | 2019 | Journal Article | Information & Cultural Industries | Identified Regulation | 0.48 | 195 |
| Galletta et al. | Italy | 2016 | Journal Article | Healthcare & Social Assistance | Autonomous Motivation | 0.45 | 304 |
| Glaser et al. | Germany | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.21 | 830 |
| Goodboy et al. | United States | 2017 | Journal Article | Multiple | Intrinsic Motivation | 0.55 | 243 |
| Grabski | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.81 | 195 |
| Graves & Luciano (1) | United States | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.49 | 283 |
| Graves & Luciano (2) | United States | 2013 | Journal Article | Multiple | Identified Regulation | 0.40 | 283 |

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|---|---|---|---|---|---|---|---|
| Guzman & Garcia | Spain | 2011 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.34 | 506 |
| Guzman et al. (1) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.28 | 506 |
| Guzman et al. (2) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.31 | 506 |
| Guzman et al. (3) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.31 | 506 |
| Guzman et al. (4) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Integrated Regulation | 0.19 | 506 |
| Guzman et al. (5) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.17 | 506 |
| Haivas et al. (1) | Romania | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.39 | 349 |
| Haivas et al. (2) | Romania | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.35 | 349 |
| Haivas et al. (3) | Romania | 2014 | Journal Article | Multiple | Integrated Regulation | 0.36 | 349 |
| Haivas et al. (4) | Romania | 2014 | Journal Article | Multiple | Identified Regulation | 0.32 | 349 |
| Janke & Dickhauser | Germany, Austria, Switzerland | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.72 | 107 |
| Janke et al. | Germany | 2015 | Journal Article | Educational Services | Intrinsic Motivation | 0.33 | 334 |
| Jansen in de Wal et al. (1) | Netherlands | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.56 | 2360 |
| Jansen in de Wal et al. (2) | Netherlands | 2014 | Journal Article | Educational Services | Identified Regulation | 0.51 | 2360 |
| Jensen & Bro | Denmark | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.53 | 1486 |
| Joo et al. | Korea | 2010 | Journal Article | Unknown | Intrinsic Motivation | 0.52 | 283 |

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|---|---|---|---|---|---|---|---|
| Ju et al. | China | 2019 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.32 | 3717 |
| Jung-Gehling & Strauss | Germany | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.35 | 346 |
| Kang et al. | Korea | 2005 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.38 | 320 |
| Ke et al. (1) | China | 2012 | Journal Article | Manufacturing | Intrinsic Motivation | 0.40 | 127 |
| Ke et al. (2) | China | 2012 | Journal Article | Manufacturing | Intrinsic Motivation | 0.21 | 127 |
| Ke et al. (3) | China | 2012 | Journal Article | Manufacturing | Intrinsic Motivation | 0.12 | 127 |
| Ke et al. (4) | China | 2012 | Journal Article | Manufacturing | Intrinsic Motivation | 0.35 | 127 |
| Kibler et al. (1) | United Kingdom | 2019 | Journal Article | Multiple | Intrinsic Motivation | 0.37 | 186 |
| Kibler et al. (2) | United Kingdom | 2019 | Journal Article | Multiple | Intrinsic Motivation | 0.45 | 544 |
| Koen et al. | Netherlands | 2016 | Journal Article | Multiple | Autonomous Motivation | 0.26 | 172 |
| Kuvaas | Norway | 2009 | Journal Article | Multiple | Intrinsic Motivation | 0.38 | 779 |
| Kyndt et al. | Belgium | 2012 | Journal Article | Multiple | Autonomous Motivation | 0.48 | 358 |
| Li et al. | China | 2018 | Journal Article | Utilities | Intrinsic Motivation | 0.22 | 196 |
| Lin | China | 2013 | Dissertation | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.35 | 146 |
| Llopis & Foss | Denmark | 2015 | Journal Article | Manufacturing | Intrinsic Motivation | 0.23 | 170 |
| Malinowska et al. (1) | Poland | 2018 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.54 | 318 |
| Malinowska et al. (2) | Poland | 2018 | Journal Article | Professional, Scientific & Technical Services | Identified Regulation | 0.40 | 318 |

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|---|---|---|---|---|---|---|---|
| Millette & Gagne (1) | Canada | 2008 | Journal Article | Healthcare & Social Assistance | Autonomous Motivation | 0.12 | 124 |
| Millette & Gagne (2) | Canada | 2008 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.23 | 124 |
| Millette & Gagne (3) | Canada | 2008 | Journal Article | Healthcare & Social Assistance | Identified Regulation | 0.05 | 124 |
| Moran et al. (1) | China | 2012 | Journal Article | Multiple | Intrinsic Motivation | 0.29 | 225 |
| Moran et al. (2) | China | 2012 | Journal Article | Multiple | Integrated Regulation | 0.28 | 225 |
| Moran et al. (3) | China | 2012 | Journal Article | Multiple | Identified Regulation | 0.28 | 225 |
| Nesheim & Gressgard | Norway | 2014 | Journal Article | Mining, Quarrying, and Oil and Gas Extraction | Intrinsic Motivation | 0.20 | 5856 |
| Olafsen & Frolund | Norway | 2018 | Journal Article | Multiple | Autonomous Motivation | 0.51 | 160 |
| Olafsen & Halvari (1) | Norway | 2017 | Journal Article | Accomodation & Food Services | Autonomous Motivation | 0.63 | 405 |
| Olafsen & Halvari (2) | Norway | 2017 | Journal Article | Accomodation & Food Services | Intrinsic Motivation | 0.61 | 405 |
| Olafsen & Halvari (3) | Norway | 2017 | Journal Article | Accomodation & Food Services | Identified Regulation | 0.53 | 405 |
| Olafsen et al. | Norway | 2015 | Journal Article | Finance & Insurance | Intrinsic Motivation | 0.56 | 166 |
| Olson (1) | United States | 2004 | Dissertation | Educational Services | Autonomous Motivation | 0.24 | 101 |
| Olson (2) | United States | 2004 | Dissertation | Educational Services | Intrinsic Motivation | 0.24 | 101 |
| Olson (3) | United States | 2004 | Dissertation | Educational Services | Identified Regulation | 0.12 | 101 |
| Parker et al. (1) | Canada | 2017 | Journal Article | Multiple | Intrinsic Motivation | 0.43 | 516 |

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|---|---|---|---|---|---|---|---|
| Parker et al. (2) | Canada | 2017 | Journal Article | Multiple | Identified Regulation | 0.25 | 516 |
| Pohl et al. | Italy | 2012 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.31 | 222 |
| Rajeswari & Anantharaman | India | 2005 | Journal Article | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.37 | 156 |
| Rasskazova et al. (1) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.57 | 4708 |
| Rasskazova et al. (2) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.33 | 4708 |
| Rasskazova et al. (3) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.19 | 10827 |
| Rietzschel et al. | Netherlands | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.15 | 295 |
| Roche & Haar | New Zealand | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.30 | 386 |
| Ruppmann | United States | 2018 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.15 | 101 |
| Saghaeiannejad et al. | Iran | 2013 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.55 | 127 |
| Scudella (1) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.34 | 17 |
| Scudella (2) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.32 | 24 |
| Scudella (3) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.47 | 33 |
| Scudella (4) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.38 | 19 |
| Sherman | United States | 2014 | Dissertation | Multiple | Intrinsic Motivation | 0.21 | 98 |
| Smrcina Henderson | United States | 2017 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.50 | 479 |
| Solstad et al. | Norway | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.37 | 222 |
| Sorebo et al. | Norway | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.42 | 124 |

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|---|---|---|---|---|---|---|---|
| Spivack | United States | 2012 | Dissertation | Educational Services | Intrinsic Motivation | 0.40 | 275 |
| Spivack & Milosevic (1) | United States | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.42 | 210 |
| Spivack & Milosevic (2) | United States | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.42 | 210 |
| Spivack & Milosevic (3) | United States | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.40 | 210 |
| Taylor et al. | United Kingdom | 2008 | Journal Article | Educational Services | Autonomous Motivation | 0.41 | 204 |
| Tetrick | United States | 1989 | Journal Article | Public Administration | Intrinsic Motivation | 0.22 | 422 |
| Thibault Landry et al. (1) | Greece | 2017 | Journal Article | Multiple | Autonomous Motivation | 0.55 | 130 |
| Thibault Landry et al. (2) | Canada | 2017 | Journal Article | Professional, Scientific & Technical Services | Autonomous Motivation | 0.28 | 144 |
| Thibault Landry & Whillans | Argentina, Australia, Canada, China, Germany, India, Japan, Mexico, Singapore, South Africa, United Kingdom, United States | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.71 | 5852 |
| Thogersen-Ntoumani & Notoumanis (1) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.16 | 149 |

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|---|---|---|---|---|---|---|---|
| Thogersen-Ntoumani & Notoumanis (2) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.05 | 149 |
| Toode et al. (1) | Estonia | 2015 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.24 | 201 |
| Toode et al. (2) | Estonia | 2015 | Journal Article | Healthcare & Social Assistance | Identified Regulation | 0.15 | 201 |
| Tummers et al. | Netherlands | 2002 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | -0.02 | 1204 |
| van den Berg | Netherlands | 2011 | Journal Article | Multiple | Intrinsic Motivation | 0.42 | 73 |
| Van den Berghe et al. (1) | Belgium | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.42 | 193 |
| Van den Berghe et al. (2) | Belgium | 2014 | Journal Article | Educational Services | Identified Regulation | 0.33 | 193 |
| Van den Berghe et al. (3) | Belgium | 2014 | Journal Article | Educational Services | Autonomous Motivation | 0.42 | 193 |
| Vandercammen et al. (1) | Belgium | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.63 | 72 |
| Vandercammen et al. (2) | Belgium | 2014 | Journal Article | Multiple | Autonomous Motivation | 0.06 | 37 |
| Vosberg (1) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.79 | 82 |
| Vosberg (2) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.82 | 60 |
| Vosberg (3) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.76 | 120 |
| Wallace & Brinkerhoff | Canada | 1991 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.13 | 95 |
| Wang (1) | Canada | 2018 | Dissertation | Multiple | Intrinsic Motivation | 0.73 | 158 |
| Wang (2) | Canada | 2018 | Dissertation | Multiple | Identified Regulation | 0.37 | 158 |
| Wang (3) | Canada | 2018 | Dissertation | Multiple | Autonomous Motivation | 0.65 | 158 |

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|---|---|---|---|---|---|---|---|
| Wang (4) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.23 | 110 |
| Wang (5) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.34 | 110 |
| Wang (6) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.32 | 110 |
| Winegar (1) | United States | 2003 | Dissertation | Public Administration | Intrinsic Motivation | 0.12 | 404 |
| Winegar (2) | United States | 2003 | Dissertation | Public Administration | Intrinsic Motivation | 0.19 | 404 |
| Zheng et al. | China | 2011 | Journal Article | Other Services | Intrinsic Motivation | 0.28 | 283 |

**Table 2**

*Characteristics of Studies on Competence Satisfaction Included in the Meta-Analysis*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Abos et al. | Spain | 2018 | Journal Article | Educational Services | Autonomous Motivation | 0.55 | 584 |
| Alcaraz et al. | Spain | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.02 | 302 |
| Amado et al. | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.34 | 332 |
| Bennett et al. (1) | England | 2016 | Journal Article | Educational Services | Intrinsic Motivation | 0.23 | 202 |
| Bennett et al. (2) | England | 2016 | Journal Article | Educational Services | Intrinsic Motivation | 0.25 | 227 |
| Bentzen et al. | Norway, Sweden | 2016 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.28 | 343 |
| Bidee et al. | Belgium | 2017 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.85 | 42 |
| Briand (1) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Autonomous Motivation | 0.36 | 105 |
| Briand (2) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.36 | 105 |
| Briand (3) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Identified Regulation | 0.27 | 105 |
| Carson & Chase (1) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.20 | 246 |

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|---|---|---|---|---|---|---|---|
| Carson & Chase (2) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.32 | 246 |
| Carson & Chase (3) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.24 | 246 |
| Carson & Chase (4) | United States | 2009 | Journal Article | Educational Services | Identified Regulation | 0.14 | 245 |
| Chen | United States, Hong Kong, Singapore, Taiwan, Australia, Korea, Canada, Europe | 2012 | Dissertation | Educational Services | Autonomous Motivation | 0.44 | 245 |
| Chiang et al. | United States | 2016 | Journal Article | Public Administration | Autonomous Motivation | 0.14 | 161 |
| Cnossen et al. | Netherlands | 2019 | Journal Article | Multiple | Intrinsic Motivation | -0.03 | 111 |
| Conway et al. (1) | England | 2015 | Journal Article | Other Services | Intrinsic Motivation | 0.11 | 193 |
| Conway et al. (2) | England | 2015 | Journal Article | Other Services | Identified Regulation | 0.25 | 193 |
| Douglas | United States | 1994 | Dissertation | Manufacturing | Intrinsic Motivation | 0.53 | 150 |
| Dysvik et al. (1) | Norway | 2013 | Journal Article | Transportation & Warehousing | Intrinsic Motivation | 0.18 | 625 |
| Dysvik et al. (2) | Norway | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.19 | 629 |
| Fényszárosi et al. (1) | Hungary | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.68 | 1662 |
| Fényszárosi et al. (2) | Hungary | 2018 | Journal Article | Multiple | Identified Regulation | 0.54 | 1662 |
| Fertig (1) | United States | 2011 | Journal Article | Multiple | Intrinsic Motivation | 0.18 | 382 |
| Fertig (2) | United States | 2011 | Journal Article | Multiple | Identified Regulation | 0.21 | 382 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fertig (3) | United States | 2009 | Dissertation | Multiple | Autonomous Motivation | -0.27 | 382 |
| Gagne, Forest et al. (1) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.26 | 345 |
| Gagne, Forest et al. (2) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.29 | 62 |
| Gagne, Forest et al. (3) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.23 | 345 |
| Gagne, Forest et al. (4) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.13 | 62 |
| Gagne, Forest et al. (5) | Belgium | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.27 | 530 |
| Gagne, Forest et al. (6) | Belgium | 2015 | Journal Article | Multiple | Identified Regulation | 0.23 | 530 |
| Gagne, Forest et al. (7) | Norway | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.33 | 856 |
| Gagne, Forest et al. (8) | Norway | 2015 | Journal Article | Multiple | Identified Regulation | 0.27 | 856 |
| Gagne, Forest et al. (9) | China | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.45 | 305 |
| Gagne, Forest et al. (10) | China | 2015 | Journal Article | Multiple | Identified Regulation | 0.42 | 305 |
| Goodboy et al. | United States | 2017 | Journal Article | Multiple | Intrinsic Motivation | 0.26 | 243 |
| Grabski | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.69 | 195 |
| Graef et al. | United States | 1983 | Journal Article | Multiple | Intrinsic Motivation | 0.22 | 107 |
| Graves & Luciano (1) | United States | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.62 | 283 |
| Graves & Luciano (2) | United States | 2013 | Journal Article | Multiple | Identified Regulation | 0.54 | 283 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Guzman & Garcia | Spain | 2011 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.31 | 506 |
| Guzman et al. (1) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.37 | 506 |
| Guzman et al. (2) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.33 | 506 |
| Guzman et al. (3) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.45 | 506 |
| Guzman et al. (4) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Integrated Regulation | 0.26 | 506 |
| Guzman et al. (5) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.33 | 506 |
| Haivas et al. (1) | Romania | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.36 | 349 |
| Haivas et al. (2) | Romania | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.32 | 349 |
| Haivas et al. (3) | Romania | 2014 | Journal Article | Multiple | Integrated Regulation | 0.35 | 349 |
| Haivas et al. (4) | Romania | 2014 | Journal Article | Multiple | Identified Regulation | 0.27 | 349 |
| Janke & Dickhauser | Germany, Austria, Switzerland | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.68 | 107 |
| Janke et al. | Germany | 2015 | Journal Article | Educational Services | Intrinsic Motivation | 0.44 | 334 |
| Jansen in de Wal et al. (1) | Netherlands | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.23 | 2360 |
| Jansen in de Wal et al. (2) | Netherlands | 2014 | Journal Article | Educational Services | Identified Regulation | 0.26 | 2360 |
| Jensen & Bro | Denmark | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.69 | 1486 |
| Lai | Norway | 2011 | Journal Article | Multiple | Intrinsic Motivation | 0.55 | 881 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lai & Kapstad | Norway | 2009 | Journal Article | Public Administration | Intrinsic Motivation | 0.60 | 769 |
| Lim et al. (1) | China | 2018 | Journal Article | Construction | Intrinsic Motivation | 0.72 | 220 |
| Lim et al. (2) | China | 2018 | Journal Article | Construction | Identified Regulation | 0.38 | 220 |
| Lim et al. (3) | Malaysia | 2018 | Journal Article | Construction | Intrinsic Motivation | 0.06 | 172 |
| Lim et al. (4) | Malaysia | 2018 | Journal Article | Construction | Identified Regulation | 0.01 | 172 |
| Olafsen & Frolund | Norway | 2018 | Journal Article | Multiple | Autonomous Motivation | 0.41 | 160 |
| Olafsen & Halvari (1) | Norway | 2017 | Journal Article | Accomodation & Food Services | Autonomous Motivation | 0.48 | 405 |
| Olafsen & Halvari (2) | Norway | 2017 | Journal Article | Accomodation & Food Services | Intrinsic Motivation | 0.37 | 405 |
| Olafsen & Halvari (3) | Norway | 2017 | Journal Article | Accomodation & Food Services | Identified Regulation | 0.51 | 405 |
| Olafsen et al. | Norway | 2015 | Journal Article | Finance & Insurance | Intrinsic Motivation | 0.63 | 166 |
| Olson (1) | United States | 2004 | Dissertation | Educational Services | Autonomous Motivation | 0.56 | 101 |
| Olson (2) | United States | 2004 | Dissertation | Educational Services | Intrinsic Motivation | 0.58 | 101 |
| Olson (3) | United States | 2004 | Dissertation | Educational Services | Identified Regulation | 0.40 | 101 |
| Rasskazova et al. (1) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.40 | 4708 |
| Rasskazova et al. (2) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.26 | 4708 |
| Rasskazova et al. (3) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.14 | 10827 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Richer et al. (1) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.37 | 490 |
| Richer et al. (2) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.23 | 490 |
| Richer et al. (3) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.20 | 490 |
| Richer et al. (4) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.36 | 490 |
| Richer et al. (5) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.27 | 490 |
| Richer et al. (6) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.23 | 490 |
| Richer et al. (7) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.30 | 490 |
| Richer et al. (8) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.16 | 490 |
| Richer et al. (9) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.13 | 490 |
| Richer et al. (10) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.36 | 490 |
| Richer et al. (11) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.20 | 490 |
| Richer et al. (12) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.17 | 490 |
| Roche & Haar | New Zealand | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.32 | 386 |
| Ruppmann | United States | 2018 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.49 | 101 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Schroder & Schmitt-Rodermund | Germany | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.26 | 152 |
| Scudella (1) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.59 | 17 |
| Scudella (2) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.17 | 24 |
| Scudella (3) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.13 | 33 |
| Scudella (4) | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.49 | 19 |
| Sherman | United States | 2014 | Dissertation | Multiple | Intrinsic Motivation | 0.52 | 98 |
| Smrcina Henderson | United States | 2017 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.29 | 479 |
| Solstad et al. | Norway | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.40 | 222 |
| Sorebo et al. | Norway | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.59 | 124 |
| Taylor et al. | United Kingdom | 2008 | Journal Article | Educational Services | Autonomous Motivation | 0.53 | 204 |
| Tetrick | United States | 1989 | Journal Article | Public Administration | Intrinsic Motivation | 0.24 | 422 |
| Thibault Landry et al. (1) | Greece | 2017 | Journal Article | Multiple | Autonomous Motivation | 0.27 | 130 |
| Thibault Landry et al. (2) | Canada | 2017 | Journal Article | Professional, Scientific & Technical Services | Autonomous Motivation | 0.32 | 144 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Thibault Landry & Whillans (1) | Argentina, Australia, Canada, China, Germany, India, Japan, Mexico, Singapore, South Africa, United Kingdom, United States | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.69 | 5852 |
| Thogersen-Ntoumani & Notoumanis (1) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.21 | 149 |
| Thogersen-Ntoumani & Notoumanis (2) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.13 | 149 |
| Tonial (1) | United States | 2009 | Dissertation | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.68 | 62 |
| Tonial (2) | United States | 2009 | Dissertation | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.55 | 62 |
| Van den Berghe et al. (1) | Belgium | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.24 | 193 |
| Van den Berghe et al. (2) | Belgium | 2014 | Journal Article | Educational Services | Identified Regulation | 0.24 | 193 |
| Van den Berghe et al. (3) | Belgium | 2014 | Journal Article | Educational Services | Autonomous Motivation | 0.27 | 193 |
| Vandercammen et al. (1) | Belgium | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.58 | 72 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Vandercammen et al. (2) | Belgium | 2014 | Journal Article | Multiple | Autonomous Motivation | 0.10 | 37 |
| Vosberg (1) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.80 | 82 |
| Vosberg (2) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.83 | 60 |
| Vosberg (3) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.79 | 120 |
| Wang (1) | Canada | 2018 | Dissertation | Multiple | Intrinsic Motivation | 0.31 | 158 |
| Wang (2) | Canada | 2018 | Dissertation | Multiple | Identified Regulation | 0.30 | 158 |
| Wang (3) | Canada | 2018 | Dissertation | Multiple | Autonomous Motivation | 0.34 | 158 |
| Wang (4) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.31 | 110 |
| Wang (5) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.32 | 110 |
| Wang (6) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.59 | 110 |
| Winegar (1) | United States | 2003 | Dissertation | Public Administration | Intrinsic Motivation | 0.15 | 404 |
| Winegar (2) | United States | 2003 | Dissertation | Public Administration | Intrinsic Motivation | 0.35 | 404 |

**Table 3**

*Characteristics of Studies on Relatedness Satisfaction Included in the Meta-Analysis*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Abos et al. | Spain | 2018 | Journal Article | Educational Services | Autonomous Motivation | 0.38 | 584 |
| Alcaraz et al. | Spain | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.35 | 302 |
| Amado et al. | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.27 | 332 |
| Bentzen et al. | Norway, Sweden | 2016 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.30 | 343 |
| Bidee et al. | Belgium | 2017 | Journal Article | Healthcare & Social Assistance | Intrinsic Motivation | 0.88 | 42 |
| Briand (1) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Autonomous Motivation | 0.37 | 105 |
| Briand (2) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Intrinsic Motivation | 0.41 | 105 |
| Briand (3) | Canada | 2009 | Master's Thesis | Professional, Scientific & Technical Services | Identified Regulation | 0.24 | 105 |
| Carson & Chase (1) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.43 | 246 |
| Carson & Chase (2) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.34 | 246 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Carson & Chase (3) | United States | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.35 | 246 |
| Carson & Chase (4) | United States | 2009 | Journal Article | Educational Services | Identified Regulation | 0.34 | 245 |
| Chen | United States, Hong Kong, Singapore, Taiwan, Australia, Korea, Canada, Europe | 2012 | Dissertation | Educational Services | Autonomous Motivation | 0.35 | 245 |
| Cnossen et al. | Netherlands | 2019 | Journal Article | Multiple | Intrinsic Motivation | -0.02 | 111 |
| Dysvik et al. (1) | Norway | 2013 | Journal Article | Transportation & Warehousing | Intrinsic Motivation | 0.26 | 625 |
| Dysvik et al. (2) | Norway | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.38 | 629 |
| Fényszárosi et al. (1) | Hungary | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.37 | 1662 |
| Fényszárosi et al. (2) | Hungary | 2018 | Journal Article | Multiple | Identified Regulation | 0.31 | 1662 |
| Fitzgerald et al. (1) | United States | 2015 | Journal Article | Healthcare & Social Assistance | Autonomous Motivation | 0.24 | 124 |
| Fitzgerald et al. (2) | United States | 2013 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.26 | 124 |
| Fitzgerald et al. (3) | United States | 2013 | Dissertation | Healthcare & Social Assistance | Identified Regulation | 0.13 | 124 |
| Gagne, Forest et al. (1) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.31 | 345 |
| Gagne, Forest et al. (2) | Canada | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.35 | 62 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gagne, Forest et al. (3) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.20 | 345 |
| Gagne, Forest et al. (4) | Canada | 2015 | Journal Article | Multiple | Identified Regulation | 0.05 | 62 |
| Gagne, Forest et al. (5) | Belgium | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.38 | 530 |
| Gagne, Forest et al. (6) | Belgium | 2015 | Journal Article | Multiple | Identified Regulation | 0.28 | 530 |
| Gagne, Forest et al. (7) | Norway | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.34 | 856 |
| Gagne, Forest et al. (8) | Norway | 2015 | Journal Article | Multiple | Identified Regulation | 0.22 | 856 |
| Gagne, Forest et al. (9) | China | 2015 | Journal Article | Multiple | Intrinsic Motivation | 0.36 | 305 |
| Gagne, Forest et al. (10) | China | 2015 | Journal Article | Multiple | Identified Regulation | 0.37 | 305 |
| Gegenfurtner et al. | Germany | 2009 | Journal Article | Professional, Scientific & Technical Services | Autonomous Motivation | 0.32 | 444 |
| Goodboy et al. | United States | 2017 | Journal Article | Multiple | Intrinsic Motivation | 0.47 | 243 |
| Grabski | United States | 2015 | Dissertation | Educational Services | Intrinsic Motivation | 0.78 | 195 |
| Graves & Luciano (1) | United States | 2013 | Journal Article | Multiple | Intrinsic Motivation | 0.35 | 283 |
| Graves & Luciano (2) | United States | 2013 | Journal Article | Multiple | Identified Regulation | 0.24 | 283 |
| Guzman & Garcia | Spain | 2011 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.32 | 506 |
| Guzman et al. (1) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.33 | 506 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Guzman et al. (2) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.35 | 506 |
| Guzman et al. (3) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.39 | 506 |
| Guzman et al. (4) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Integrated Regulation | 0.27 | 506 |
| Guzman et al. (5) | Spain | 2013 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.37 | 506 |
| Haivas et al. (1) | Romania | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.32 | 349 |
| Haivas et al. (2) | Romania | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.29 | 349 |
| Haivas et al. (3) | Romania | 2014 | Journal Article | Multiple | Integrated Regulation | 0.31 | 349 |
| Haivas et al. (4) | Romania | 2014 | Journal Article | Multiple | Identified Regulation | 0.23 | 349 |
| Janke & Dickhauser (1) | Germany, Austria, Switzerland | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.68 | 107 |
| Janke et al. | Germany | 2015 | Journal Article | Educational Services | Intrinsic Motivation | 0.32 | 334 |
| Jansen in de Wal et al. (1) | Netherlands | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.32 | 2360 |
| Jansen in de Wal et al. (2) | Netherlands | 2014 | Journal Article | Educational Services | Identified Regulation | 0.32 | 2360 |
| Jensen & Bro | Denmark | 2018 | Journal Article | Educational Services | Intrinsic Motivation | 0.37 | 1486 |
| Olafsen & Frolund | Norway | 2018 | Journal Article | Multiple | Autonomous Motivation | 0.31 | 160 |
| Olafsen & Halvari (1) | Norway | 2017 | Journal Article | Accomodation & Food Services | Autonomous Motivation | 0.46 | 405 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Olafsen & Halvari (2) | Norway | 2017 | Journal Article | Accomodation & Food Services | Intrinsic Motivation | 0.43 | 405 |
| Olafsen & Halvari (3) | Norway | 2017 | Journal Article | Accomodation & Food Services | Identified Regulation | 0.39 | 405 |
| Olson (1) | United States | 2004 | Dissertation | Educational Services | Autonomous Motivation | 0.22 | 101 |
| Olson (2) | United States | 2004 | Dissertation | Educational Services | Intrinsic Motivation | 0.22 | 101 |
| Olson (3) | United States | 2004 | Dissertation | Educational Services | Identified Regulation | 0.12 | 101 |
| Rasskazova et al. (1) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.40 | 4708 |
| Rasskazova et al. (2) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.31 | 4708 |
| Rasskazova et al. (3) | Russia | 2016 | Journal Article | Utilities | Intrinsic Motivation | 0.19 | 10827 |
| Richer et al. (1) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.35 | 490 |
| Richer et al. (2) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.17 | 490 |
| Richer et al. (3) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.38 | 490 |
| Richer et al. (4) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.25 | 490 |
| Richer et al. (5) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.33 | 490 |
| Richer et al. (6) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.14 | 490 |
| Richer et al. (7) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.37 | 490 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Richer et al. (8) | Canada | 2002 | Journal Article | Multiple | Autonomous Motivation | 0.20 | 490 |
| Roche & Haar | New Zealand | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.24 | 386 |
| Sherman | United States | 2014 | Dissertation | Multiple | Intrinsic Motivation | 0.03 | 98 |
| Smrcina Henderson | United States | 2017 | Dissertation | Healthcare & Social Assistance | Intrinsic Motivation | 0.38 | 479 |
| Solstad et al. | Norway | 2015 | Journal Article | Arts, Entertainment & Recreation | Autonomous Motivation | 0.50 | 222 |
| Sorebo et al. | Norway | 2009 | Journal Article | Educational Services | Intrinsic Motivation | 0.17 | 124 |
| Taylor et al. | United Kingdom | 2008 | Journal Article | Educational Services | Autonomous Motivation | 0.28 | 204 |
| Thibault Landry & Whillans (1) | Argentina, Australia, Canada, China, Germany, India, Japan, Mexico, Singapore, South Africa, United Kingdom, United States | 2018 | Journal Article | Multiple | Intrinsic Motivation | 0.68 | 5852 |
| Thogersen-Ntoumani & Notoumanis (1) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Intrinsic Motivation | 0.29 | 149 |
| Thogersen-Ntoumani & Notoumanis (2) | United Kingdom | 2007 | Journal Article | Arts, Entertainment & Recreation | Identified Regulation | 0.16 | 149 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Trepanier et al. (1) | Canada | 2012 | Journal Article | Educational Services | Autonomous Motivation | 0.22 | 568 |
| Trepanier et al. (2) | Canada | 2012 | Journal Article | Educational Services | Autonomous Motivation | 0.40 | 568 |
| Van den Berghe et al. (1) | Belgium | 2014 | Journal Article | Educational Services | Intrinsic Motivation | 0.26 | 193 |
| Van den Berghe et al. (2) | Belgium | 2014 | Journal Article | Educational Services | Identified Regulation | 0.27 | 193 |
| Van den Berghe et al. (3) | Belgium | 2014 | Journal Article | Educational Services | Autonomous Motivation | 0.30 | 193 |
| Vandercammen et al. (1) | Belgium | 2014 | Journal Article | Multiple | Intrinsic Motivation | 0.16 | 72 |
| Vandercammen et al. (2) | Belgium | 2014 | Journal Article | Multiple | Autonomous Motivation | 0.07 | 37 |
| Vosberg (1) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.70 | 82 |
| Vosberg (2) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.66 | 60 |
| Vosberg (3) | United States | 2017 | Dissertation | Educational Services | Intrinsic Motivation | 0.80 | 120 |
| Wang (1) | Canada | 2018 | Dissertation | Multiple | Intrinsic Motivation | 0.48 | 158 |
| Wang (2) | Canada | 2018 | Dissertation | Multiple | Identified Regulation | 0.28 | 158 |
| Wang (3) | Canada | 2018 | Dissertation | Multiple | Autonomous Motivation | 0.45 | 158 |
| Wang (4) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.21 | 110 |
| Wang (5) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.21 | 110 |
| Wang (6) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.40 | 110 |

**Table 4**

*Characteristics of Studies on Autonomy Frustration Included in the Systematic Review*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Kanat-Maymon et al. | Israel | 2018 | Journal Article | Multiple | Autonomous Motivation | -0.17 | 314 |
| Pulido et al. (1) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Intrinsic Motivation | -0.03 | 147 |
| Pulido et al. (2) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Integrated Regulation | 0.06 | 147 |
| Pulido et al. (3) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Identified Regulation | 0.07 | 147 |
| Schroder & Schmitt-Rodermund | Germany | 2013 | Journal Article | Multiple | Autonomous Motivation | 0.13 | 152 |
| Wang (1) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.30 | 110 |
| Wang (2) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.19 | 110 |
| Wang (3) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.32 | 110 |

**Table 5**

*Characteristics of Studies on Competence Frustration Included in the Systematic Review*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Pulido et al. (1) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Intrinsic Motivation | -0.14 | 147 |
| Pulido et al. (2) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Integrated Regulation | 0.01 | 147 |
| Pulido et al. (3) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Identified Regulation | 0.06 | 147 |
| Wang (1) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.03 | 110 |
| Wang (2) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.05 | 110 |
| Wang (3) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.23 | 110 |

**Table 6**

*Characteristics of Studies on Relatedness Frustration Included in the Systematic Review*

| Authors | Country | Year | Type of Publication | Industry | Type of Motivation | *r* | *n* |
|---|---|---|---|---|---|---|---|
| Pulido et al. (1) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Intrinsic Motivation | -0.06 | 147 |
| Pulido et al. (2) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Integrated Regulation | 0.01 | 147 |
| Pulido et al. (3) | Spain | 2017 | Journal Article | Arts, Entertainment and Recreation | Identified Regulation | 0.01 | 147 |
| Wang (1) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.32 | 110 |
| Wang (2) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | 0.05 | 110 |
| Wang (3) | China | 2018 | Dissertation | Retail Trade | Autonomous Motivation | -0.20 | 110 |

**Table 7**

*Meta-Analytic Effect Size Estimates of the Relationship Between Need Satisfaction and Autonomous Motivation*

| | | | | 95% CI | | |
|---|---|---|---|---|---|---|
| Variables | *k* | *r* | *SE* | Lower | Upper | *Q* |
| Autonomy | 132 | 0.38 | 0.0240 | 0.34 | 0.41 | 2826.45 |
| Competence | 102 | 0.41 | 0.0356 | 0.35 | 0.46 | 3112.68 |
| Relatedness | 74 | 0.37 | 0.0348 | 0.31 | 0.43 | 853.61 |

*Note: k* = number of effect sizes; *r* = effect size estimate (Pearson correlation); *SE* = standard error; 95% CI = 95% confidence interval around the estimated coefficient; *Q* = Cochran's heterogeneity statistic.

**Table 8**

*Subgroup Analyses of the Relationship Between Need Satisfaction and Autonomous Motivation by Industry and Type of Motivation*

| Model | *F* | *df* | β | *SE* | *t* | 95% CI | | *p* |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper | |
| Autonomy | | | | | | | | |
| Intercept | 7.44 | 130 | 0.368 | 0.0261 | 14.107 | 0.316 | 0.419 | .0001 |
| Education | | | 0.153 | 0.0561 | 2.728 | 0.042 | 0.264 | .01 |
| Intercept | 11.73 | 153 | 0.345 | 0.0351 | 9.844 | 0.276 | 0.415 | .0001 |
| Intrinsic | | | 0.084 | 0.0343 | 2.458 | 0.015 | 0.152 | .05 |
| Extrinsic | | | -0.039 | 0.0365 | -1.057 | -0.111 | 0.034 | .292 |
| Intercept | 11.73 | 153 | 0.307 | 0.0320 | 9.579 | 0.243 | 0.370 | .0001 |
| Intrinsic | | | 0.123 | 0.0261 | 4.709 | 0.071 | 0.175 | .0001 |
| Autonomous | | | 0.039 | 0.0365 | 1.057 | -0.034 | 0.111 | .292 |
| Competence | | | | | | | | |
| Intercept | 4.55 | 100 | 0.386 | 0.0404 | 9.549 | 0.305 | 0.466 | .0001 |
| Education | | | 0.166 | 0.0776 | 2.132 | 0.012 | 0.319 | .05 |
| Intercept | 4.52 | 119 | 0.362 | 0.0466 | 7.760 | 0.269 | 0.454 | .0001 |
| Intrinsic | | | 0.111 | 0.0481 | 2.314 | 0.016 | 0.207 | .05 |
| Extrinsic | | | 0.013 | 0.0522 | 0.258 | -0.090 | 0.117 | .797 |
| Intercept | 4.52 | 119 | 0.375 | 0.0456 | 8.231 | 0.285 | 0.466 | .0001 |
| Intrinsic | | | 0.098 | 0.0389 | 2.518 | 0.021 | 0.175 | .05 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Autonomous | | | -0.013 | 0.0522 | -0.258 | -0.117 | 0.090 | .797 |
| Relatedness | | | | | | | | |
| Intercept | 1.56 | 72 | 0.357 | 0.0424 | 8.422 | 0.272 | 0.441 | .0001 |
| Education | | | 0.091 | 0.0729 | 1.249 | -0.054 | 0.236 | .216 |
| Intercept | 5.27 | 91 | 0.366 | 0.0402 | 9.111 | 0.286 | 0.447 | .0001 |
| Intrinsic | | | 0.043 | 0.0359 | 1.195 | -0.028 | 0.114 | .235 |
| Extrinsic | | | -0.042 | 0.0371 | -1.119 | -0.115 | 0.032 | .266 |
| Intercept | 5.27 | 91 | 0.325 | 0.0399 | 8.138 | 0.245 | 0.404 | .0001 |
| Intrinsic | | | 0.084 | 0.0260 | 3.242 | 0.033 | 0.136 | .01 |
| Autonomous | | | 0.042 | 0.0371 | 1.119 | -0.032 | 0.115 | .266 |

*Note: df* = degrees of freedom; *SE* = standard error; 95% CI = 95% confidence interval around the estimated coefficient; Education = educational services; Intrinsic = intrinsic motivation; Extrinsic = extrinsic motivation; Autonomous = autonomous motivation. All models were estimated using Fisher z-transformed correlations.

**Table 9**

*Relative Weight Analysis of Autonomy, Competence, and Relatedness in Predicting Autonomous Forms of Work Motivation*

| | | Predictors | | | | | |
|---|---|---|---|---|---|---|---|
| | | Autonomy | | Competence | | Relatedness | |
| Outcome | $R^2$ | *RW* | *%* | *RW* | *%* | *RW* | *%* |
| Autonomous Motivation | .02 | .00 | 29.84 | .00 | 20.97 | .01 | 49.19 |
| Intrinsic Motivation | .02 | .01 | 36.39 | .00 | 14.22 | .01 | 49.39 |
| Identified Regulation | .03 | .01 | 20.85 | .01 | 30 | .02 | 49.14 |

*Note: RW* = relative weight; *%* = rescaled relative weight (i.e., relative weight divided by full model $R^2$). The analysis for autonomous motivation included 16 studies, the analysis for intrinsic motivation included 29 studies, and the analysis for identified regulation included 13 studies.

## Appendix A

Search Strategies

Business Source Premier

TI ( identified regulation OR integrated regulation OR intrinsic* motivat* OR self-determined motivation OR autonomous* motivat* ) AND TI ( autonom* OR competen* OR relatedness OR belonging* OR mastery )

AB ( identified regulation OR integrated regulation OR intrinsic* motivat* OR self-determined motivation OR autonomous* motivat* ) AND AB ( autonom* OR competen* OR relatedness OR belonging* OR mastery )

CINAHL

TI ( identified regulation OR integrated regulation OR intrinsic* motivat* OR self-determined motivation OR autonomous* motivat* ) AND TI ( autonom* OR competen* OR relatedness OR belonging* OR mastery )

AB ( identified regulation OR integrated regulation OR intrinsic* motivat* OR self-determined motivation OR autonomous* motivat* ) AND AB ( autonom* OR competen* OR relatedness OR belonging* OR mastery )

MEDLINE

((identified regulation[Title/Abstract] OR integrated regulation[Title/Abstract] OR intrinsic* motivat*[Title/Abstract] OR self-determined motivation[Title/Abstract] OR autonomous* motivat*[Title/Abstract])) AND (autonom*[Title/Abstract] OR competen*[Title/Abstract] OR relatedness[Title/Abstract] OR belonging*[Title/Abstract] OR mastery[Title/Abstract])

PsycINFO

**Title**: identified regulation *OR* **Title**: integrated regulation *OR* **Title**: intrinsic* motivat* *OR* **Title**: self-determined motivation *OR* **Title**: autonomous* motivat**AND* **Title**: autonom* *OR* **Title**: competen* *OR* **Title**: relatedness *OR* **Title**: belonging**OR* **Title**: mastery

**Abstract**: identified regulation *OR* **Abstract**: integrated regulation*OR* **Abstract**: intrinsic* motivat* *OR* **Abstract**: self-determined motivation *OR***Abstract**: autonomous* motivat* *AND* **Abstract**: autonom* *OR* **Abstract**: competen**OR* **Abstract**: relatedness *OR* **Abstract**: belonging* *OR* **Abstract**: mastery

SCOPUS

TITLE-ABS-KEY ( identified AND regulation OR integrated AND regulation OR intrinsic* AND motivat* OR self-determined AND motivation OR autonomous* AND motivat* ) AND ( autonom* OR competen* OR relatedness OR belonging* OR mastery )

## Appendix B

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*Note:* References with an asterisk (*) are related publications.

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