Testing a Continuum Structure of Self-Determined Motivation: A Meta-Analysis

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Abstract

Self-determination theory proposes a multidimensional representation of motivation comprised of several factors said to fall along a continuum of relative autonomy. The current meta-analysis examined the relationships between these motivation factors in order to demonstrate how reliably they conformed to a predictable continuum-like pattern. Based on data from 486 samples representing over 205,000 participants who completed one of thirteen validated motivation scales, the results largely supported a continuum-like structure of motivation and indicate that self-determination is central in explaining human motivation. Further examination of heterogeneity indicated that while regulations were predictably ordered across domains and scales, the exact distance between subscales varied across samples in a way that was not explainable by a set of moderators. Results did not support the inclusion of integrated regulation or the three subscales of intrinsic motivation (i.e. intrinsic motivation to know, to experience stimulation, and to achieve) due to excessively high inter-factor correlations and overlapping confidence intervals. Recommendations for scale refinements and the scoring of motivation are provided.

Keywords: self-determination theory; simplex; continuum; meta-analysis; multidimensional scaling

Public Significance Statement

This meta-analysis demonstrates that self-determination is a central element of human motivation and indeed supports the hypothesis that motivation follows a continuum of self-determination but also that better motivation scoring methods need to be developed. These findings have significance for motivation researchers by displaying the importance of self-determination, and thereby supporting the importance of quality of motivation over quantity.

Self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2017) is a general theory of human motivation that is widely used across many sub-disciplines of psychology, including educational psychology (e.g., Reeve, 2002), exercise psychology (e.g., Teixeira, Carraça, Markland, Silva, & Ryan, 2012), and work psychology (e.g., Gagné & Deci, 2005). It has evolved to become one of the most highly used and cited motivation theories with some fundamental SDT texts approaching 30,000 citations (e.g., Deci & Ryan, 1985; Ryan & Deci, 2000a). Given the extent of its use, it is useful to review how its basic premises hold up to empirical scrutiny. One such premise is that human motivation can be conceptualized and operationalized using multiple categorical dimensions related to the source of one's motivation and that these dimensions can be meaningfully ordered along a continuum structure, also more technically referred to as a simplex structure. This assumption has been tested over the years using a variety of methods that have more or less supported this premise. However, the evidence remains scattered and no meta-analytic tests have been undertaken to examine the tenability of the continuum assumption. The present study provides such a test.

Given that the continuum assumption underlying the different types of motivation in SDT has given rise to scoring practices that rely completely on this assumption, it is important to put it to the test. Through meta-analysis, we investigated whether the simplex pattern of correlations between the types of motivation specified by SDT holds up and whether this pattern is homogeneous across samples. We also looked for possible moderators to explain any heterogeneity found across the samples. Knowing whether the simplex pattern is consistent and homogeneous provides evidence for a multidimensional but orderly structure of human motivation and also allows us to ascertain whether popular scoring practices, such as the relative autonomy index (RAI; Grolnick & Ryan, 1987), are valid representations of this conceptualization of motivation. This information will help determine the relative importance of quantity versus quality of motivation in predicting important outcomes, such as performance and well-being.

Motivation According to Self-Determination Theory

Self-determination theory, which rests on organismic and humanistic principles (Ryan & Deci, 2017), proposes a multidimensional theory of motivation which developed out of the idea that intrinsic and extrinsic reasons for behaving will lead to differential performance and well-being outcomes for individuals (Deci & Ryan, 1985). While intrinsic motivation refers to behaviors enacted for their own sake, extrinsic motivation is defined as doing something for an instrumental reason, and can be divided further into several differentiated forms.

This division of extrinsic motivation into different types stems from the notion in developmental psychology (Grusec & Goodnow, 1994; Hoffman, 1984) that as they develop, human beings not only learn norms and behaviors necessary to co-exist, but that these norms are internalized in a person's behavioral repertoire. In regard to motivation, Ryan (1995) formally defined this internalization process as "the active assimilation of behavioral regulations that are originally alien or external to the self" (p. 405). Ryan further specified that quality of internalization can vary, giving rise to different qualities of motivation. Accordingly, different types of extrinsic motivation are assumed to vary on locus of *causality* (deCharms, 1968), defined as the perceived origins of one's motivated actions. Assuming all motivated behavior has an internal locus of *control* (i.e., "I can do this"; Heider, 1958), we can further divide motivated behavior into volitional and non-volitional action. Non-volitional action (i.e., "I have to do this"; external perceived locus of causality or controlled motivation) is experienced as forced upon a person by outside factors, whereas volitional action (i.e., "I want to do this"; internal perceived locus of causality or autonomous motivation) is freely engaged in. For this reason, extrinsic motivation is divided into different forms varying in locus of causality or degree of internalization, as described below.

Insert Figure 1 here

External regulation is characterized by behaviors in which a person acts in order to obtain social or material rewards or avoid punishment from an external source such as a manager or parent. External regulation therefore encompasses reasons for action that are not internalized, with an external perceived locus of causality. Scale items commonly used to capture external regulation include, "Because others will reward me financially only if I put enough effort in my job" (MWMS; Gagné. et al., 2015) and "I exercise because other people say I should" (BREQ; Mullan, Markland, & Ingledew, 1997). Introjected regulation describes a situation in which a person will act to avoid personal feelings of guilt or shame, or to enhance self-esteem. Introjected regulation comprises reasons for action that are only partially internalized (i.e., involve some form of self-evaluation or ego-involvement), with an external perceived locus of causality (Ryan & Deci, 2000a). An athlete who puts efforts into their sport based upon a desire to enhance their self-esteem or to avoid the shame of poor performance is demonstrating behavior driven by introjected regulation, as reflected in introjected regulation items such as “I feel ashamed when I miss an exercise session” (BREQ; Mullan et al., 1997) and “Because it makes me feel proud of myself” (MWMS; Gagné et al., 2015).

Identified regulation describes engaging in behaviors seen as personally meaningful, such as volunteers who spend time working in an animal shelter to improve animal welfare. While the work is often times not enjoyable in itself (e.g., cleaning kennels), the volunteers see their behavior as meaningful and in line with personal values and beliefs, meaning that this form of extrinsic motivation is moderately autonomously driven, with an internal perceived locus of causality. Example items from identified regulation subscales include, “I value the benefits of exercise” (BREQ-2, Markland & Tobin, 2004), and “Because I personally consider it important to put efforts in this job” (MWMS; Gagné et al., 2015). Integrated regulation characterizes a person whose engagement in a behavior is perceived as part of their identity. That is, the behavior is not only seen as meaningful but an expression of who the person is, making it even more autonomously driven. A nurse, for example, may not only see the importance of their job in helping others, but also have integrated the profession of nurse into their sense of self strongly enough to motivate participation in uninteresting and not inherently rewarding tasks. An example item is “Because it’s an opportunity to just be who I am” (BRSQ; Lonsdale, Hodge, & Rose, 2008). Finally, intrinsic motivation is a completely autonomous form of motivation, with an internal locus of causality, and is characterized by behaviors engaged in out of interest and enjoyment for the activity. Examples of this may include musicians or athletes who play just for the enjoyment of the behavior itself, and is captured through items such as, “Because the work I do is interesting” (MWMS; Gagné et al., 2015) and “I find exercise a pleasurable activity” (BREQ; Mullan et al., 1997). Though early conceptualizations of motivation assumed that having none of these reasons to engage in an activity would indicate a lack of motivation, more recent conceptualizations include “amotivation” to represent the absence of motivation. Examples of this include “I do little because I don’t think this work is worth putting efforts into” (MWMS; Gagné et al., 2015) and, “I wonder what is the point” (BRSQ; Lonsdale, Hodge, & Rose, 2008).

Using organismic assumptions, whereby an organism has inherent tendencies to become more complex while maintaining its overall integrity (Ruiz-Mirazo, Etxeberria, Moreno, & Ibanez, 2000), SDT maintains that internalization, though a natural tendency, can be promoted or thwarted through environmental facilitators and barriers (Ryan & Deci, 2017). SDT developed the concept of basic psychological needs to understand how the environment can promote internalization as well as the maintenance of intrinsic motivation. They comprise the needs for competence, autonomy and relatedness, which were empirically shown to universally affect human well-being and optimal functioning (Chirkov, Ryan, Kim, & Kaplan 2003; Deci & Ryan, 2000; Nie et al., 2015; Ryan & Deci, 2000b). Competence is defined as feeling effective in one’s environment, while relatedness refers to experiencing others as being responsive to oneself as well as being responsive to others (Ryan & Deci, 2017). Autonomy is defined as feeling volitional in one’s behavior. It is not independence, which refers to being free from control, influence or support. One can in fact be autonomously dependent on others, as when one willingly relinquishes decision control to a physician in order to get healthier (Koestner & Losier, 1996; Koestner et al., 1999). Research has shown that the satisfaction of these three psychological needs leads to the adoption of more autonomous (i.e., identified, integrated, intrinsic) motivation, whereas the thwarting of the same needs leads to the adoption of more controlled (i.e., external, introjected) motivation (e.g., Ng et al., 2012; Van den Broeck et al., 2016).

Over 30 years of research has demonstrated strong connections between motivational regulations and a wealth of antecedents and outcomes. A meta-analysis in the behavioral health domain linked intrinsic motivation, as well as integrated and identified regulations, to increased well-being outcomes and healthy behaviors (Ng et al., 2012). Introjected regulation was negatively associated with well-being outcomes, while it was positively related to healthy behaviors, and external regulation was negatively related to well-being outcomes and unrelated to healthy behaviors (Ng et al., 2012). A recent systematic review of the SDT literature in the exercise domain also found clear evidence that more autonomous forms of motivation (i.e., identified regulation and intrinsic motivation) were positively related to desirable exercise outcomes, while controlled forms (i.e., external and introjected regulation) showed mixed results, varying between negative and null relations (Teixeira, et al., 2012). A recent review by Deci, Olafsen, and Ryan (2017) similarly points out numerous positive outcomes associated with autonomous forms of work motivation including greater work satisfaction (Richer, Blanchard, & Vallerand, 2002), knowledge sharing (Foss, Minbaeva, Pedersen, & Reinholt, 2009), work commitment (Fernet, Austin, & Vallerand, 2012), self-reported performance (Kuvaas & Dysvik, 2009), and even company profitability (Preenen et al., 2016), as well as lower emotional exhaustion and burnout (Fernet et al., 2010; 2012; Richer et al., 2002). A recent meta-analysis by Cerasoli, Nicklin, and Ford, (2014) indicated that while intrinsic motivation as well as incentives (i.e., implying external regulation) were both associated with performance quantity, only intrinsic motivation was associated with performance quality. Interestingly, studies applying person-centered analyses, such as latent profile analysis, support the notion that individuals endorse multiple types of motivation simultaneously, and so long as autonomous reasons for behaving are stronger than more controlled reasons, associations with outcomes are still positive (e.g. Howard, Gagné, Morin, & Van den Broeck, 2016b)

In broadly summarizing the literature across domains, behaviors enacted out of interest and meaning (identified regulation and intrinsic motivation) will likely result in higher performance and well-being, whereas behaviors enacted in pursuit of external incentives or ego-protection (external and introjected regulations) will likely be completed in a more lackluster fashion, often inspiring the minimum required effort, lacking creativity and proactivity, and likely to negatively influence an individual's well-being (Ryan & Deci, 2017).

Measuring Motivation

The first scale developed to measure distinct regulation types was the Self-Regulation Questionnaire developed by Ryan and Connell (SRQ; 1989). This initial scale measured three types of extrinsic motivation (viz. external, introjected, and identified), as well as intrinsic motivation, by asking students why they engage in particular school-related behaviors. This scale format has since been adapted and used throughout many domains including sport, exercise, work, education, and health. Subsequent research has strongly supported the existence of these distinct types of motivation through the validation of several measures intended for use in specific life domains, such as the Academic Motivation Scale (AMS; Vallerand et al., 1992), the Multidimensional Work Motivation Scale (MWMS; Gagné et al., 2015), the Behavioral Regulation in Exercise Questionnaire, and the Behavioral Regulation in Sport Questionnaire (BREQ and BRSQ respectively; Mullan et al., 1997; Lonsdale, Hodge, & Rose, 2008). Factor structures of these scales have been repeatedly validated across multiple domains, countries, and languages (e.g., Gagné et al., 2015; Pelletier et al., 1995; Vallerand et al., 1992).

Some caveats in these validations however include the fact that many measures of motivation do not include integrated regulation, as it has proven challenging to create a subscale that is distinguishable from identified regulation and intrinsic motivation (e.g., Gagné et al., 2015). In addition, the widely used Academic Motivation Scale (Vallerand et al., 1992) and the Sports Motivation Scale (Pelletier et al., 1995) draw finer distinctions by including three types of intrinsic motivation: intrinsic motivation to know, intrinsic motivation to experience stimulation, and intrinsic motivation to accomplish (Carbonneau, Vallerand, & Lafrenière, 2012). Amotivation is another area of inconsistency with the majority of scales including an amotivation subscale (e.g. MWMS, BREQ-2, SMS, and AMS) and others omitting it (e.g. the BREQ and the Motivation at Work Scale; MAWS; Gagné et al., 2010). Regardless of these differences, all of these scales claim to follow a simplex ordering of subscales, as is required by the continuum assumption of motivation within SDT.

The Continuum Assumption

Despite empirical evidence for the distinctness of different types of motivation, SDT also hypothesizes that a continuum of self-determination underlies the regulations (Ryan & Connell, 1989), reflecting the locus of causality of each regulation type. Ryan and Connell (1989) were the first to propose the continuum hypothesis in SDT by arguing that regulations were ordered in a simplex pattern. A simplex model is a predictable ordering of factors differing in quantity or degree (Guttman, 1954). A simplex precludes the presence of differences in kind. Relative to the theorized continuum of motivation, a simplex pattern would be characterized by adjacent regulations having strong correlations and non-adjacent regulations having weaker correlations between them. While a true simplex requires equal theoretical spacing between factors, a quasi-simplex describes instances in which a predictable ordering is present but distances between variables are inconsistent. Even though SDT may more rightly be considered a quasi-simplex as noted by Ryan and Connell (1989), for simplicity we use the term simplex throughout. Ryan and Connell (1989) devised a method to test for conformity of the correlation matrix between motivation types to a simplex pattern. Their adjacency index derived a measure of the variance accounted for by a predicted pattern of correlations against an actual one. However, Chemolli and Gagné (2014) tested this method against correlation matrices from different samples that obviously showed different levels of conformity to a simplex pattern, and found that in each case the adjacency index supported the continuum hypothesis. In other words, they showed that the adjacency index was not a sensitive test of the simplex pattern.

Li and Harmer (1996; Li, 1999) took the idea of an adjacency index further and tested the “linear dependency” of regulations using path analysis, which relies on the assumption that associations from one regulation to another are mediated by regulations in between. Results largely supported a simplex interpretation, although indirect effects were also found between external regulation and intrinsic motivation in males, and amotivation and intrinsic motivation in females. Chatzisarantis, Hagger, Biddle, Smith, and Wang (2003) found concurring results in a meta-analytic investigation of this same linear dependency in sport and exercise samples, and further suggested that amotivation and even intrinsic motivation should not be considered part of the continuum. However, it has also been demonstrated that covariance structure analyses such as these are highly insensitive and will likely fail to identify even extreme violations of a simplex structure (Rogosa & Willett, 1985).

Chemolli and Gagné (2014) subsequently set out to test the continuum assumption using a statistical test that was developed expressly for this purpose: Rasch analysis (Rasch, 1960). They used this analytic method on samples using two well-validated and highly used motivation scales in the work and education domains, and found no support for a continuum of self-determination, instead supporting a multidimensional representation of motivation. However, through the application of bifactor exploratory structural equation modeling (ESEM), Howard, Gagné, Morin, and Forest (2016a) succeeded at simultaneously identifying each of the subscales representing the different types of motivation *and* a general factor that could represent a continuum underlying all the items across the subscales. Such a model constitutes evidence for a continuum of self-determination. Moreover, it showed that both the specific and the general factors explained variance in a range of covariates.

A far less rigorous but more common test of the continuum assumption consists simply of observing the expected trend of positive to negative correlations between regulations in a correlation matrix. For example, Guay, Morin, Litalien, Valois, and Vallerand (2015) conducted ESEM on two samples totaling over 5000 college and high school student responses to the AMS (Vallerand et al., 1992). They found that while one sample (Sample 2) did indeed display the expected pattern of correlations, the other sample (Sample 1) did not conform perfectly.

In light of the disparate conclusions drawn from various studies using various analytical methods and growing doubt concerning the viability of the continuum assumption, we set out to meta-analyze all available correlation matrices derived from research using well-validated SDT-based motivation scales. This meta-analysis is important because it helps inform the debate about whether (1) there is a continuum of self-determination underlying the different types of motivation proposed in SDT and (2) whether various scoring practices, including the relative autonomy index (RAI; Grolnick & Ryan, 1987), are appropriate. This second point has become more contentious in recent years as authors have questioned the appropriateness of the RAI scoring procedure which is based upon an assumed, but rarely tested, continuum (Chemolli & Gagné, 2014).

The RAI is a scoring rubric which consists of assigning weights to subscale scores of each regulation according to association with outcomes, or their placement on the hypothesized continuum, before combining them to form a composite score describing a person's overall motivation. While a number of variations exist, the standard calculation is depicted by the following formula:

RAI = 2(intrinsic) + 1(identified) - 1(introjection) - 2(external)

The RAI has been called into question numerous times in the last two decades and for various reasons. Some have argued that using a single score masks important effects unique to certain types of motivation (Judge, Bono, Erez, & Locke, 2005; Losier, & Koestner, 1999). Others have argued that the RAI is a difference score (Chemolli & Gagné, 2014), which have been criticized on numerous grounds, including that they are unreliable and that they can mask the real source of effects (Edwards, 2001; Johns, 1981; Zuckerman, Gagné, Nafshi, Knee, & Kieffer, 2002).

More recently, it has also been suggested that the weights assigned to the different forms of motivation do not accurately represent the nature of all regulations. Specifically, the negative loading assigned to introjected regulation is questionable as this regulation theoretically contains both positive (e.g. pride) and more negative (e.g. shame) elements (Gagné et al., 2015; Ng et al., 2012). Recent bifactor modeling supports the positive influence of introjected regulation as the factor loadings of introjection items on the general factor representing the continuum were positive and therefore not necessarily representing a negative motivational force, as the RAI weightings indicate (Howard et al., 2016a). The highly negative weighting assigned to external regulation may also be inappropriate as the RAI positions external regulation as a negative force equal in strength to intrinsic motivation, but in the opposite direction. Findings from Howard et al., (2016a) suggest that external regulation should instead be considered a relatively neutral source of self-determination, rather than a strongly negative one, as they obtained non-significant factor loadings for external regulation items on the general factor. For this reason, they recommended against using the RAI, which seems to weigh the motivation types inappropriately.

Overview of the Meta-Analysis

Despite claims that the correlation pattern between types of motivation should follow a simplex pattern, and a tacit acceptance of this assumption by researchers, it has never been systematically verified whether this pattern is present and consistent across measures, domains, and contexts. The general statements concerning the continuum structure of regulations within SDT canon does not specify whether it should be expected to replicate exactly across domains, nor give insight into how SDT scales should be designed in order to correctly represent this rather important facet of motivation measurement. This meta-analytic examination of inter-regulation correlations across domains and scales will verify the generalizability of this simplex pattern. Specifically, this meta-analysis aims to achieve the following two objectives.

The first objective is to test the degree to which a simplex is present and stable across domains, measures, and contexts. It is possible that the context in which an activity is undertaken (e.g., work, study, sport, exercise) could change the strength of relations between the different types of motivation. For example, in the work domain, external regulation (motivation through rewards) may be more closely linked to intrinsic motivation, given that workers need to earn a living, compared to the sport domain, where rewards may have a more antagonistic relation to intrinsic motivation (i.e., turning play into work). We also considered that the scales used to measure motivation within and across life domains may not all be created equal, giving rise to differences in correlation matrices. Indeed, items used to measure the same motivational constructs differ across life domains to reflect the context, possibly giving rise to differences in correlations between subscales. Additional moderating variables to be considered in this meta-analysis include country of data collection, status as student, school level (where appropriate), publication status, age, and gender.

The second objective is to identify and rectify areas in which theory and practice disagree, specifically with regards to: (a) the theoretical distance between regulations and appropriate weights to represent these distances, and as such speak to the appropriateness of aggregate scoring methods; (b) the necessity of integrated regulation, which has proven to be difficult to distinguish from identified regulation and intrinsic motivation (e.g., Gagné et al., 2015); (c) the appropriateness of amotivation as part of a continuum of self-determination (Chatzisarantis et al., 2003); (d) the necessity and appropriateness of having three types of intrinsic motivation; and (e) the degree to which introjection should be considered as a controlled form of motivation.

Given that SDT is a commonly used theory across many domains, it is not surprising to find a range of more or less well-validated motivation scales being used across different life domains, such as education, work, sport, and exercise. The current meta-analysis is concerned only with motivation scales that have been systematically developed to represent the breadth of motives within a life domain and sufficiently tested for their reliability and validity, instead of haphazardly created for a single study. This led to the inclusion of 13 scales for consideration in the meta-analysis. The first selected scale was the original Self-Regulation Questionnaire (SRQ; Ryan & Connell, 1989; also known as the Perceived Locus of Causality scale; Goudas, Biddle, & Fox, 1994), which was the scale first developed to examine children's motivation towards school work. The 18 items representing external, introjected, identified and intrinsic regulations, being easily adaptable, have been used to measure motivation in other domains. For example the SRQ is commonly adapted to the health domain to examine behaviors such as weight loss (Gorin, Powers, Koestner, Wing, & Raynor, 2014), eating disorders (van der Kaap-Deeder et al., 2014), and alcohol consumption (Hagger et al., 2012). Other examples of domains this scale has been adapted to include friendship motivation (Okada, 2007; Soenens, Vansteenkiste, & Niemiec, 2009), and support for charitable causes (Gutberg, 2013).

In the domain of work there exist four validated and commonly used scales. The first was developed by Blais and colleagues (1993) in French and contains 31 items measuring external, introjected, and identified regulation, as well as intrinsic motivation. The majority of studies using this scale either did not provide correlations between subscales (n = 44) or were published in French and therefore not captured in the search criteria. As such, we were able to obtain an insufficient number of samples (n = 2) to include it in any meaningful way in the current meta-analysis. The Work Extrinsic and Intrinsic Motivation Scale (WEIMS; Tremblay, Blanchard, Taylor, Pelletier, & Villeneuve, 2009) was adapted from Blais et al. (1993) to include questions assessing amotivation and integrated regulation, while the Motivation at Work Scale (Gagné et al., 2010) was adapted from Blais et al. to improve the subscales' psychometric properties for the four core regulations (i.e. external, introjection, identified, and intrinsic motivation). Most recently, the Multidimensional Work Motivation Scale (Gagné et al., 2015) was created with all new items to deal with psychometric issues with the previous three scales. It includes subscales to measure two facets of external regulation by distinguishing between material and social rewards and punishments. Though it includes amotivation, it does not include integrated regulation.

The domain of sport has seen the development of two scales which have been updated over time – the Sports Motivation Scale (SMS; Pelletier et al., 1995) and the Behavioral Regulation in Sport Questionnaire (BRSQ; Lonsdale, Hodge, & Rose, 2008). Subsequently a SMS-6 (Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007) and SMS-II (Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013) have been developed and validated based on the original SMS. The SMS-6 is notable as it expands the original SMS to include items to measure integrated regulation. The most recent iteration of this scale development process is the SMS-II which, compared to the SMS which originally contained three subscales describing intrinsic motivation, revised this structure to contain only a single factor representing intrinsic motivation.

Likewise, in the domain of exercise, two scales have predominated - the Exercise Motivation Scale (EMS; Li, 1999), and the Behavioral Regulation in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997). Subsequent variations of the BREQ include the BREQ-2 (Markland & Tobin, 2004) and BREQ-3 (also known as the BREQ-2 revised; Wilson, Rodgers, Loitz, & Scime, 2006), which added amotivation and integrated regulation subscales respectively.

Within the education domain, the Academic Motivation Scale (AMS; Vallerand et al., 1992; adapted from the French EMS; Vallerand, Blais, Brière, & Pelletier, 1989) is the only validated and commonly used measure. In addition to the three core regulation (external, introjected, and identified), the AMS also includes an amotivation subscale, as well as three types of intrinsic motivation – intrinsic motivation to know, intrinsic motivation to achieve, and intrinsic motivation to experience stimulation.

Method

Inclusion Criteria

In order to be included in the present research, studies had to meet the following criteria: (1) they examined motivation in primary quantitative research using one of the 13 scales mentioned above (or an adaptation of; SRQ, WEIMS, MAWS, MWMS, SMS, SMS-6, SMS-II, BRSQ, EMS, BREQ, BREQ-2, BREQ-3, and AMS); (2) they provided data for correlations between at least two subscales (those that appeared to measure multiple subscales but did not use or report required statistics were contacted for further information); (3) scales which had been significantly altered from the validated version for any reason were excluded (e.g., for use in different domains; Gutberg, 2013; Okada, 2007; Soenens, Vansteenkiste, & Niemiec, 2009); and (4) the report of results was published in English, though the scale may have been used in another language. The inclusion criteria resulted in a final database of 486 independent samples from 374 published and 88 unpublished articles, and a total of 4111 correlation coefficients from over 205,000 participants (ranging from 11- 4554 participants, $mean_n = 427.64$). A full list of articles included in this meta-analysis is included in the online supplementary section.

Literature Search

Literature search procedures are depicted in Figure 2. We employed multiple search strategies in order to identify all relevant data pertaining to correlations between SDT motivation subscales. Data must have been available between 1989 and October 2016 to be included in this study. All published and non-published data were sought after, including dissertations. The primary method was a forward search beginning with scale validation articles and attainment of studies citing these works through the use of Web of Science and Google Scholar databases. This search yielded 9,233 articles and dissertations. Secondly, the EBSCO and PsychINFO databases were searched for scale names (e.g. *Sports Motivation Scales, SMS*, *Multidimensional Work Motivation Scale, MWMS*, etc.). At this point duplicates were removed. The first and third authors then examined each of the remaining articles to eliminate those which had cited the scale validation articles but not used the scale in quantitative research. These two steps resulted in the removal of 8473 articles. Of the remaining 763 articles, many did not provide correlation tables or other information pertinent to this study (k = 478). Accordingly we attempted to contact authors requesting the missing information from specific articles, resulting in emails to 311 authors. A reminder was sent to those who had not replied one month after first contact. A final attempt to contact these authors was made three months after initial contact. A number of authors were not contactable after exhaustive searches for valid email addresses (n = 10). This email protocol also served as a means to contact authors and research groups active in respective SDT fields, inquiring about any unpublished or soon to be published data sets. We received replies from 106 authors (34.08%), of which 33 either indicated that the data had been lost or deleted, or declined to participate due to time constraints involved with retrieving archived data. A further 16 authors expressed interest in participating but failed to provide data after several months and multiple reminders. The remaining 57 authors provided an additional 96 samples (63 from published articles, 33 from unpublished sources).

Insert Figure 2 here

Coding

A coding spreadsheet was developed and agreed upon by all the authors. The following information was to be included in the coding procedure; study identification (author names, year of publication, journal published in, published/unpublished, cross sectional/longitudinal, sample size), motivation variable information (scale used, alpha coefficient), correlations between regulation subscales, and demographic information (domain of research, country, language, student/employee/other, level of school [university/secondary/primary], mean age, percent of males in sample). Samples were coded primarily by the first author, with the third author providing checks by randomly coding approximately 10% of articles independently. Intercoder agreement rates indicated almost perfect agreement (Cohen's κ = .954; McHugh, 2012). Disagreements were discussed between the first and third authors and all were resolved through re-examination of articles.

Meta-Analytic Procedures

Aggregate effect sizes were calculated using the Comprehensive Meta-Analysis software (CMA, Version 3.3.070; Borenstein, Hedges, Higgins, & Rothstein, 2011). Random-effects models were used throughout which assume that between-study variance is attributable to either study artifacts or to moderating factors. This method is strongly recommended over the more restrictive fixed-effects model which assumes that variance is solely due to sampling error, which is untenable in all but a few instances (Borenstein, Hedges, & Rothstein, 2007; Hunter & Schmidt, 2000; Schmidt & Hunter, 2014).

Each raw correlation was corrected for reliability and weighted by sample size. When alpha coefficients were not obtainable, mean reliability scores of the scale were imputed. Confidence intervals, Cochran's Q and I^2 statistics, as well as T and T^2 statistics are reported to describe homogeneity (see Table 1). The T statistic is an estimation of the standard deviation of effect sizes for the population, whereas T^2 is the associated variance. The I^2 statistic describes the percentage of the variability in the effect estimate that results from true heterogeneity, or moderating effects, rather than artifacts such as sampling error or chance (Higgins & Thompson, 2002; Higgins, Thompson, Deeks, & Altman, 2003). We predominantly relied on the I^2 statistic rather than Cochran's Q because the Q statistic and associated chi-square tests depend upon sample size and will return highly significant results in very large samples even when very little variation actually exists (Rosenthal & DiMatteo, 2001). Given the rather extensive size of this meta-analysis, with up to 461 samples and 205,000 individual data points being included in some analyses, Q and chi-squared statistics are likely to overestimate the degree of true heterogeneity present (i.e. accountable by moderators). In contrast, the I^2 statistic is a transformation of Cochran's Q statistic that accounts for sample size, and is therefore less influenced by large sample size or number of independent samples analyzed (Higgins & Thompson, 2002; Higgins et al., 2003).

In order to test for possible moderators that may explain heterogeneity (e.g., scale, domain, demographic variables), meta-regression was applied to the continuous moderators of age and percentage of males in the sample, while standard subgroup moderation analyses were applied to categorical variables. The degree of variance explained by moderators was assessed primarily based on I^2 with greater than 75% representing considerable heterogeneity, 50% representing moderate heterogeneity, 25% suggesting low levels of heterogeneity (Higgins et al., 2003; Higgins & Green, 2011).

Publication bias is likely not a concern in the current meta-analysis as recent work has suggested that the file drawer problem does not produce an inflation bias in meta-analytically derived correlations as is commonly believed (Dalton, Aguinis, Dalton, Bosco, & Pierce, 2012). This is partly due to the fact that studies are not favored for publication based upon significant inter-factor correlations, as they may be for studies focusing on difference tests. Nonetheless moderation analysis was performed in order to compare published and unpublished subsamples. Additionally, funnel plots were calculated and are available in the online supplements.

Finally, metric multi-dimensional scaling (MDS) was applied to the resulting correlation table in order to further explore the dimensionality of the continuum. Specifically, this test is designed to identify the number of dimensions (or axes on a graph) by which the data are best represented. Such a test is also ideal for depicting graphically how similar or distant various regulations are in a two (or three) dimensional space. In essence, this is an alternative method to factor analysis designed to depict important relationships and non-obvious structures in an economical manner (Jaworska & Chupetlovska-Anastasova, 2009). However, it must be noted that MDS is a predominantly exploratory approach and does not allow for strong conclusions to be drawn (Giguère, 2006). These analyses were conducted in SPSS (version 22). Initial configuration was set to simplex ordering, with a maximum of 100 iterations permitted to reach a suitable solution (stress convergence at .0001, minimum stress .0001). An initial analysis was run in which 5 dimensions were specified in order to examine the associated scree plot representing the degree of stress. Lower values of stress indicate a well-fitting model such that .00 represents perfect fit, .025 is considered excellent, .05 is good fit, .10 is a fair fitting model, and >.20 is considered poor fit (Kruskal, 1964). Allowing for additional dimensions will almost always result in lower stress values, but simultaneously adds complexity to the interpretation. As such, the optimal number of dimensions should be determined by examination of the degree of reduced stress against parsimony. The dispersion accounted for (DAF) statistic is a measure of the variance accounted for in the current model.

Insert Table 1 here

Results

Effect sizes, confidence intervals, variance and homogeneity statistics are presented in Table 1. A composite correlation matrix was calculated from 4111 correlations, as shown in Table 2. The current meta-analytic comparison between published and unpublished works are highly similar (see Table 3 & Figure 3) with 95% confidence intervals between correlations of the two groups displaying considerable overlap on most variables. More specifically, 13 out of 15 pairs overlapped substantially (confidence intervals overlap of about 50% or more indicates non-difference in values at the $p \gtrapprox .05$ level; Cumming & Finch, 2005). Only two confidence intervals did not overlap (i.e., intrinsic-identified and external-amotivation correlations, $p < .01$; Cumming & Finch, 2005), but both pairs nevertheless showed analogous positive associations of similar strength. Likewise, funnel plots were generated for each effect size (see Figure S2 in the supplementary materials). When trim and fill procedures were followed, it was noticed that while additional "expected" studies were often added, such additions had marginal influence on the expected effect size, and furthermore did not follow a uniform pattern, with expected studies sometimes being added to the negative side (indicating an initial overestimation of effect size) and other times additional expected studies being added on the positive side (indicating an underestimation of effect size). Accordingly, systematic publication bias was not considered to be present.

Insert Table 2 here

Inspection of confidence intervals (see Table 1) indicates that the correlations remained within a relatively small range of values and that for any given regulation, confidence intervals with the remaining regulations did not overlap (e.g. the correlation between amotivation and external regulation did not overlap with the correlation between amotivation and introjected regulation). Non-overlapping 95% confidence intervals are indicative of differences between values at the $p < .01$ level (Cumming & Finch, 2005). The exception to this trend was integrated regulation which correlated with regulations in much the same direction and strength as identified regulation.

Overall, the correlation matrix generally conforms to a simplex pattern, as correlations between conceptually adjacent regulations are higher than correlations between non-adjacent regulations, becoming negative at the extremes. However, it is worth noting that correlations between the "autonomous" types of regulations (identified, integrated, and intrinsic) are much higher than those between the other adjacent regulations. For example the correlations between identified, integrated, and intrinsic range from .818 - .913, whereas correlations between adjacent "controlled" pairs range from .510 - .603. Moreover, introjected regulation is as positively related to autonomous forms of regulations as it is with external regulation. However, further analysis of the sources of heterogeneity, through the I^2 statistic, found true heterogeneity ranging from 98.13%-99.75% across the correlation matrix, indicating that correlations varied across samples. These indicators of homogeneity support a simplex structure but suggests the values will vary.

Insert Table 3 here

Insert Figure 3 here

Categorical and continuous moderator variables were examined next in an attempt to explain the heterogeneity of correlations and arrive at acceptably non-variant correlation matrices which can confidently be generalized to other similar populations. The first set of moderator variables tested for were domain effects. Five domains were identified as containing sufficient samples to provide reliable results (work, exercise, sport, physical education, and education). These correlations matrices are presented in Table 4. When displayed graphically (Figure 4), it is evident that correlations between regulations are very similar in strength and in directionality, regardless of domain. While the I^2 statistic indicates that variance remains to be explained (see Table 4; between 94.65% and 99.85% of variance not explained) these results nevertheless suggest that the structure of motivation is relatively consistent across life domain.

Insert Table 4 here

Insert Figure 4 here

The next moderating factor examined was the specific scale used, while still controlling for domain. Analyses were run for the 13 measures of motivation included in this meta-analysis, with correlation matrices for the most commonly used scales presented in Table 5 (matrices for all scales are presented in the online supplementary section). Number of samples for each correlation ranged from 1 to 83 and were particularly low for the WEIMS (k = 4-6) and the SMS-II measures (k = 1-2). While statistical power is not an issue as the meta-analysis does not focus on statistical significance, it should be kept in mind that results based on small samples are less rigorous estimates of the population than analyses containing more studies (Valentine, Pigott, & Rothstein, 2010). The Self-Regulation Questionnaire (SRQ; Ryan & Connell, 1989; Goudas et al., 1994) has been commonly applied over multiple domains, particularly the sport, physical education, and education domains, and as such results are presented for use of this scale separately within each of these domains in the online supplementary materials (See Table S1).

Results presented in Table 5 indicate that while general patterns remain similar, there is some variance in the size of correlations (including noticeable exceptions including the unexpectedly high correlation between identified and external regulation in the AMS data; k = 9) indicating that the relationships between regulations are somewhat dependent upon the scales used in addition to the domain of application. However, it appears that while somewhat variable, the simplex pattern is still evident indicating a relatively stable continuum structure of motivation (See Figure 5).

Insert Table 5 here

Insert Figure 5 here

In order to examine the influence of nationality, this moderator was applied at the first stage of moderation (i.e. when not controlling for domain or scale). A sufficient number of samples were available for 7 countries (k ranging from 3 to 69, as presented in the online supplements). As can be seen in Figure 6, while some relationships varied between nation groups (e.g., the relationship between amotivation and identified regulation for the USA sample), and the unexplained variance remained high (>92.61%), the vast majority of cases displayed very similar correlations regardless of nation of data collection.

Insert Figure 6 here

Next, moderation analyses were conducted in order to account for employment characteristics, that is, whether participants were students, employees, or non-specified (Table 6 & Figure 7). As seen in Figure 7, the simplex pattern is relative consistent across these groups, although integrated and identified regulations showed some discrepancy due to very high correlations between these factors. The student subsample was examined further by dividing students into groups representing elementary school, secondary school, college, and university level students. While the pattern of regulations varied slightly over the different subgroups, 95% confidence intervals between groups overlapped in all bar a couple of comparisons (See Table S4 available in the online supplementary materials). Additionally, the I^2 statistic remained high indicating that this subgroup analysis did not explain all of the heterogeneity found in the correlation matrix. The final set of moderators considered were the continuous variables of age and gender (% male). Results of meta-regression in which correlations were independently regressed onto continuous age and gender variables (i.e. proportion of males in sample) generally indicated that age and gender could not explain the variance in the correlations (statistics are available upon request). The majority of these results were not significant and did not greatly reduce the percentage of variance accounted for by moderators (I^2), indicating that age and gender are not likely important factors in explaining heterogeneity in the correlation matrix.

Insert Table 5 here

Insert Figure 7 here

Multidimensional scaling was applied to the meta-analytically derived correlation matrix in order to further test the continuum hypothesis (which would imply a single dimension) and measure the distance between regulations statistically. The first step involved generation of a scree plot of the stress (a measure of model fit) of an increasing amount of dimensions (see Figure 8a). A distinct plateau in the graph was observed at three dimensions, indicating that any more dimensions would be superfluous.

Insert Figure 8 here

However as is often the case, this observational analysis is not conclusive as it is unclear whether two, or even one dimension would be sufficient to represent the data. As such, analyses were run separately specifying 1-3 dimensions to attain individual fit statistics. The 3-dimensional solution was clearly not optimal as it did not exhibited substantially reduced stress (i.e. model misfit) than a 2-dimensional solution, and is also less parsimonious. The 1-dimensional model displayed excellent fit statistics (Normalized Stress = .00246; Stress-I = .04963; DAF = .99754) and explained 99.75% of variance in the model. The data fit the 2-dimensional model even better (Normalized Stress = .00125;

Stress-I = .03535; DAF = .99875), but only explained .071% more of the variance in the structure. Accordingly, it appears that the 1-dimensional model should be retained for reason of parsimony, although the 2-dimensional model may still have important implications. Furthermore, parallel analyses showed that the stress (i.e. model fit) observed in the current data is significantly lower than that observed in simulated random data sets (see figure 8b), indicating that the regulations are ordered in a substantially more predictable manner than would be expected from random data, adding validity to the notion that motivation factors are highly ordered. Figures 9 and 10 display graphical representations of the distance between motivation regulations for 1- and 2-dimensional solutions.

Insert Figure 9 here

Insert Figure 10 here

This process was also repeated for a separate meta-analytically derived correlation matrices including only studies which used the three subscales of intrinsic motivation (see Figures 11 and 12). This analysis not only highlights the theoretical closeness of these three intrinsic motivation subscales, but also their problematic overlap with identified and integrated regulation.

Insert Figure 11 here

Insert Figure 12 here

Discussion

Based on a meta-analysis from 486 samples with over 205,000 data points derived from the use of 13 different motivation scales, the continuum hypothesis proposed in self-determination theory to describe the multidimensional structure of motivation was tested. Results largely supported the presence of a continuum ordering of motivation.

Beginning with the exploratory multidimensional scaling results, it appears that a single or first dimension is by far the most important factor in explaining the structure underlying motivation. As presented in Figure 3, when displayed in this unidimensional manner the continuum of self-determination is clearly evident, with exception to the extremely close proximity between identified and integrated regulations. Factors are relatively equidistant along this dimension, again with the exception of integrated regulation, and the somewhat closer proximity of intrinsic motivation to identified regulation. Furthermore, the data fit this model excellently (Higgins & Green, 2011) and explain more than 99% of the variance in this structure. This analysis indicates that participants perceive these factors in a manner consistent with the continuum hypothesis as the ordering is precisely as would be expected under this assumption, with integrated regulation providing the exception.

In other words, people experience these motivational regulations as differing in degree of self-determination or locus of causality. Given that degree of self-determination is also related to differential performance and well-being outcomes (e.g., Deci et al., 2017; Deci & Ryan, 2017; Ng et al., 2012), the degree of self-determination in a person's motivational profile (i.e., quality) therefore appears to be a very important dimension of human motivation, possibly more so than the overall level (i.e., quantity) of a person's motivation. This is consistent with results obtained using bi-factor modeling (Howard et al., 2016a) demonstrating that a general factor representing the degree to which a person is motivated in a self-determined manner accounts for more variance in covariates than specific regulations (though the regulations still accounted for some). This is also consistent with motivation profile results showing that as long as the autonomous forms of regulations are higher than the controlled forms in a person's profile, both performance and well-being outcomes tend to be positive (Howard et al., 2016b).

When investigating the influence of additional dimensions, it was found that model fit did improve and the proportion of variance explained increased in a two dimensional solution, though these improvements were very modest (ΔStress = .00121, ΔDAF = .00121%). Furthermore, it is unclear what this second dimension would represent. Regardless, this second dimension may have practical and theoretical implications for identified and integrated regulation as it suggests that while they occupy the same space on a single dimensional continuum of self-determination, they are somewhat different on this second dimension. This second dimension may explain why integrated regulations is at times distinguishable from identified regulation in classical test theory approaches to measurement modelling such as CFA scale validation procedures. A recent study by Sheldon, Osin, Gordeeva, Suchkov, & Sychev (in press) conducted MDS on a newly developed scale and found near identical results to the current meta-MDS results, again indicating that a second dimension may indeed be present. They argue that the second dimension may represent the degree of effort or self-control (Muraven & Baumeister, 2000) individuals need to exert for each type of motivation, which is particularly interesting when examining the large distance between external regulation and amotivation on this second factor. While theoretically adjacent in terms of self-determination, external regulation and amotivation are likely to result in very different behaviors with external regulation (which is highest in this second factor) more likely to lead to behavior enactment, and amotivation (which is lowest in this second dimension) relatively unlikely to lead to any behavior.

As mentioned earlier, Howard et al. (2016a) found, when applying bifactor exploratory structural equation modeling, that a general factor representing the continuum was capable of accounting for the majority of variance in covariates. However, the individual regulations were found to explain additional unique and significant variance in covariates, which may feasibly be a direct result of the second dimension modeled in the current study. This second dimension, while relatively minor, may differentiate regulations enough to make it appear as though each individual regulation has unique characteristics beyond its degree of self-determination. It is currently unclear whether this second dimension is theoretically important in SDT, has practical implications, or merely represents noise in the measures.

These findings are also consistent with results from the linear dependency approach to continuum testing. Through the calculation of adjacency indices (Ryan & Connell, 1989) or linear dependencies models (Li & Harmer, 1996), these studies have consistently found and argued for a continuum structure between regulations. In other words, regulations were found to relate strongly with theoretically neighboring regulations and were not directly associated with more distant regulations, as would be predicted by the presence of a continuum. While these types of tests are known to lack sensitivity (Chemolli & Gagné, 2014; Rogosa & Willett, 1985), alternate approaches, such as Rasch Analysis, may be too conservative and restrictive as it forces the data to fit a single dimension. Indeed, Rasch analysis shows poor fit when more than one dimension underlies the data (Chemolli & Gagné, 2014). In contrast, more flexible models, such as those derived from MDS (Sheldon et al., in press) and bi-factor modeling (Howard et al., 2016a) demonstrate better fit because they allow for more than one dimension.

Moving now to the meta-analysis of the simplex pattern itself, results showed that though heterogeneity was found, external, introjected, and identified regulation as well as intrinsic motivation and amotivation were consistently separated and displayed non-overlapping confidence intervals. Integrated regulation was the exception with high correlations with either intrinsic motivation or identified regulation, or both, in almost all domains and scales in which it was measured, and indeed confidence intervals of integrated regulation almost always overlapped with neighboring regulations, suggesting a lack of differentiation. Furthermore, after testing this structure in subpopulations based on domain, scale used, nationality, age, and gender, results indicated that while the overall pattern was stable, heterogeneity remained, indicating that the exact distance between regulations is likely to vary slightly, seemingly dependent on factors beyond the scope of this meta-analysis. The present results are consistent with the meta-analysis conducted by Chatzisarantis and colleagues (2003) examining the linear dependency between regulations in the physical education domain utilizing the SRQ, which likewise could not identify homogeneous correlation matrices. Chatzisarantis et al., (2003) suggested this may be because associations between motivation types are innately heterogeneous, although they do not rule out the possibility of additional moderators emerging with large samples. This heterogeneity, whether inherent in the structure of motivation or caused by contextual factors, is likely responsible for the occasional transgressions of the simplex structure noted in multiple studies (e.g., Guay et al., 2015). As such, while chance dictates that occasionally the simplex pattern will be violated, these are relatively rare occurrences and are not, in and of themselves, strong evidence against the continuum.

Theoretical Implications

The consideration of whether a multidimensional conceptualization of motivation falls along a continuum is not unique to SDT. Similar questions have been raised for other important psychological constructs, including commitment, personality, burnout, and engagement. The three component model of organizational commitment, for example, includes subscales measuring affective, normative, and continuance commitment (Meyer & Allen, 1991). An ordering of these commitment mindsets has been proposed based on how desirable they are in terms of how they relate to positive workplace outcomes, and links have even been made between these commitment mindsets and the SDT-based motivational regulations (Gagné, Chemolli, Forest, & Koestner, 2008; Meyer, Gagné, & Parfyonova, 2010). Arguments have been made that burnout and engagement, and their associated subscales, are opposite ends of a single continuum (e.g. Demerouti, Mostert, & Bakker, 2010; González-Romá, Schaufeli, Bakker & Lloret, 2006). Finally, the circumplex model of personality (Wiggins, 1979) proposes personality traits around a circle made up of two dimensions, namely agency and communion. All of these fields could benefit from more thorough investigation of these proposed structures.

The current study provides evidence for a continuum of self-determination underlying motivation regulations that accounts for a large proportion of variance in the structure of human motivation. This indicates that degree of self-determination, or feelings of volition, in motivated behavior is an extremely important aspect of motivation, as it has not only been shown in the current meta-analysis to reflect how people experience different reasons for engaging in important life activities, but has also been shown to affect performance and well-being outcomes in other research (e.g., Deci et al., 2017; Deci & Ryan, 2017; Ng et al., 2012). The bulk of this empirical knowledge indicates that the quality of one's motivation maybe more important than quantity of motivation, meaning that the quality of one's reasons for doing something (i.e., autonomous) is more important than one's overall quantity of motivation (i.e., one's total motivation comprising both controlled and autonomous reasons). SDT is one of the only theories of motivation dealing with the issue of quality of motivation with such level of detail. Indeed, though other theories offer multidimensional conceptualizations of motivation, such as goal orientations theory (Elliot, 2005), regulatory focus theory (Higgins, 1979), and learned motives theories (e.g., McClelland, 1985), these theories offer multiple categories of motivation that are not ordered in any particular way, and therefore do not directly speak about the quality, or preferability of one type of motivation over another. Other widely used theories of motivation, such as goal setting theory (Locke & Latham, 1990), which focuses on goal specificity, difficulty, and commitment as predictors of motivation, expectancy theory

(Vroom, 1964), which focuses on expectancy, instrumentality, and valence as predictors of motivation, and social learning theory (Bandura, 1986), which focuses on vicarious learning and self-efficacy as predictors of motivation, offer unidimensional conceptualizations that only focus on the general quantity of motivation, disregarding any perceived quality that motivation may entail.

The current study may also have implications for the common practice within SDT of categorizing introjected regulation as a controlled form of motivation. Indeed, the current study suggests that introjected regulation is relatively equidistant from both external and identified regulations, and positively correlated with both identified regulation and intrinsic motivation (r = .603 & .313 respectively). When examining the empirical literature, examples predominantly link introjection with positive outcomes such as affective commitment, job effort, proactivity, vitality, and healthy behaviors (Gagné et al., 2015; Ng et al., 2012; Pelletier et al., 2013), or do not find significant relationships (Gagné et al., 2015). However in some cases introjection is also associated with negative outcomes such as depression and anxiety (Ng et al., 2012). This pattern is exactly what would be predicted by a factor lying in the center of a continuum and which represents both positive and negative elements (e.g., pride approach and shame avoidance questions; Gagné et al., 2015). This implies that any “controlled motivation” factor which is extracted from combining external and introjected regulation, and therefore contain only information common to both regulations, will, in addition to suffering from lower reliability (Gagné et al., 2015), neglect the more positive elements of introjection. As a result, construct relevant information is lost in this process which will likely reduce predictive power.

Moreover, results of this meta-analysis indicate that integrated regulation may not have a place on the continuum. Highly self-determined regulations are already somewhat crowded by relatively high correlations between intrinsic motivation and identified regulation which in itself may be an issue worth addressing in subsequent scale development projects. The addition of an integrated regulation factor, as is common in domains such as sport and exercise, merely crowds this conceptual space further and is practically indistinguishable from identified regulation, as clearly demonstrated in Figures 8 and 9. Either there needs to be a revision of the theory to exclude this form of regulation or new ways of conceptualizing and operationalizing integrated regulation need to be developed.

Similarly, conceptualizing intrinsic motivation as multidimensional has not received strong support in this meta-analysis. Correlations between the subscales of intrinsic motivation to accomplish, to know, and to experience stimulation ranged from .86-.96 which represents extremely high similarity and in itself calls into question whether these are in fact separable constructs. As with the high degree of similarity between identified and integrated regulations, these subscales will likely face issues of multicollinearity and result in difficulty in interpreting results. Furthermore, when multidimensional scaling is applied to these factors it is evident that they occupy a very similar space along the self-determination continuum (see Figure 5), adding more factors to a space already occupied and informed by identified regulation. This issue has been addressed to some degree with subsequent revisions of the SMS (e.g. SMS-6 & SMS-II) excluding these intrinsic subscales in favor of a general intrinsic motivation factor. Based on the results of this meta-analysis, it is recommended that intrinsic subscales are not used.

This meta-analysis also informs the debate concerning whether amotivation should be considered along the continuum of self-determination as it is by definition a lack of motivation (Chatzisarantis et al., 2003). The current results suggest that amotivation is well placed along the continuum as evidenced by its rather equidistant spacing along the single dimension solution produced through multidimensional scaling (see Figure 3). Indeed it appears to provide a negative counterpoint to intrinsic motivation (i.e. equally as negative as intrinsic motivation is positive). Examination of the two-dimensional model (Figure 4) does however indicate that, along the second dimension, amotivation is quite distant from its conceptual neighbor, external regulation. This is an interesting finding and may be responsible for some findings which support the removal of amotivation from the SDT continuum (Chatzisarantis et al., 2003). However, it is unclear whether this theoretical distance from external regulation is grounds for excluding amotivation or alternatively a unique characteristic and therefore an argument for its inclusion. Additional support for amotivation can be found in studies applying person centered analyses (Howard et al., 2016b) which found that between 13-27% of employees experience a motivation profile predominantly characterized by amotivation. This suggests that many people do indeed experience amotivation to the exclusion of other SDT regulations, and therefore is a useful construct in describing these people. As such, it is currently recommended that amotivation be included in SDT research as it appears to fit the simplex ordering of regulations well, and may be an important individual factor when the second dimension, resembling effort, found here and by Sheldon et al. (in press) is considered. However, this conclusion is not definitive and further research is strongly recommended.

Practical Implications

The current study also allows for more informed recommendations to be made concerning the appropriateness of different operationalizations of motivation. While the strength of SDT lies in its elaborate and pluralistic conceptualization of motivation, this creates complexity in its application. For this reason, researchers have attempted to simplify measures of motivation by aggregating scores from the different regulation subscales. One such simplification is the Relative Autonomy Index (RAI; Grolnick & Ryan, 1987) which, despite its popularity, has been criticized as an overly simplistic representation of an otherwise complex set of motivational regulations (Chemolli & Gagné, 2014). However, the current study, finding rather strong evidence for a continuum of self-determination, supports the idea that a single motivation score representing degree of self-determination could be used. Considering a single dimension accounts for more than 99% of the structure of regulations in MDS, and past findings that a general factor of self-determined motivation accounted for 38% of the variance in affective commitment (Howard et al., 2016a), it may make practical sense to use a single motivation score. This approach would also increase parsimony of SDT based research models and allow for more straightforward integration with other constructs and theories. However, due to the statistical concerns about differences scores (Edwards, 2001; Johns, 1981) it may be advisable to develop a more sophisticated method for creating such a single factor representation than the one offered by the current RAI. It is also clear from this meta-analysis that different weights need to be used for such an approach to scoring the different regulations.

Specifically, while the initial RAI weights appear to have been derived based upon the simplex pattern of correlations between the motivation subscales (Grolnick & Ryan, 1987), others may expect that these weights are derived from the relationships between regulations and outcomes. One could assume that correlations between regulations should correspond closely to correlations between regulations and outcomes, but the meta-analysis by Ng et al. (2012) indicates that it may not be the case. Indeed correlations between regulations and well-being versus health behavioral outcomes differed. For example, while introjection was positively related to health behaviors, it was negatively related to well-being outcomes (Ng et al., 2012). As such, neither the results of this meta-analysis, or previous work (e.g., Howard et al., 2016a; Ng et al., 2012) provide evidence for the weights used in the RAI. If motivation is described as a predictable ordering of motivation types (as shown in the current study), as well as individual regulations which maintain unique characteristics and therefore predictive ability (see Howard et al., 2016a), then scoring methods should reflect both of these facets. However, to date no empirical research has been conducted to verify these weights, either through an examination of the simplex (i.e., distance between regulations) or through an examination of associations between regulations and outcomes. Therefore, future research could focus on the viability and performance of a scale designed to represent *both* sources of information in an effort to establish a more comprehensive measure of human motivation, while maintaining the parsimony of a single factor measure. An important first step in this process would further meta-analyses examining the relationships between regulations and outcomes in a range of domains (e.g. work, education, sport, & exercise).

A second common method of operationalizing SDT motivation is through the dichotomization of regulations into autonomous and controlled factors, with autonomous motivation representing a combination of intrinsic motivation and identified regulation, whereas controlled regulation is commonly a composite of introjected and external regulations. This method tries to strike a balance between the perceived overly simplistic single dimensional representation approach and the unwieldy practice of specifying all regulations individually. While this higher order factor structure has been tested many times and has shown reasonable factorial validity (Gagné et al., 2010; Ryan & Connell, 1989), concerns have been raised regarding the point at which controlled and autonomous motivation are divided. Following the interpretation of the current findings, this approach is not recommended on empirical grounds as introjection is not necessarily a controlled form of regulation, but seems to be a mix of self-determination and control.

The final common approach to operationalizing SDT motivation is specification and use of all regulation subscales individually (e.g. intrinsic, identified, introjected, and external), as is presented in every scale validation article. Though the results of this meta-analysis tells us that the regulations can be ordered along a continuum of self-determination, the feasible addition of a second dimension in MDS indicates there is still value in considering the different regulations. These results concur with the results of bi-factor modeling, which have indicated the relevance of considering both specific factors and a general motivation factor (Gunnell & Gaudreau, 2015; Howard et al., 2016a). There may therefore be value in keeping a full operationalization of regulations. However, this approach raises concerns about multicollinearity and parsimony (Asparouhov, Muthèn, & Morin, 2015). Multicollinearity will be present to some degree whenever factors correlate, but becomes particularly troubling as correlations approach unity, as is the case for the autonomous types of regulations. The issue of parsimony is another concern which has led many researchers to adopt the more simplistic approaches. Modeling all of the regulations individually is not always feasible, particularly with smaller sample sizes or models for which motivation is only one of many variables of interest.

An alternative method of scoring motivation is the person-centered approach (e.g., latent profile analysis; Howard et al., 2016b). This method may prove important as it largely circumvents the entire debate concerning how best to operationalize motivation and instead recognizes that individuals report some degree of each type of motivation. Such an approach provides a more naturalistic perspective of how motivations coexist and are experienced by individuals.

Limitations

This meta-analysis, despite being based on a large number of samples, has limitations to take into consideration. First, heterogeneity could not be explained by the moderators considered. While this is unfortunate as it prohibits specification of what exactly the correlations should look like for any given population, it is also a testament to the degree of variability in these matrices. Future studies specific to domains would be better suited to answering this question as the scope of the current study and the nature of many of the included samples precluded taking into consideration domain specific moderators (e.g., classroom or work characteristics), which are likely to play a significant role in moderating the relationships between regulations.

Second, a number of existing samples were not included in the meta-analysis as authors were not contactable or able to provide the necessary information after rather comprehensive attempts to elicit such information, making the results of the meta-analysis not completely representative of all the SDT-based research done to date on human motivation. While the achieved sample size was larger than in most meta-analyses, and was sufficient to test most of the questions we sought to address, including more studies may have enabled further moderation analyses with the possibility of identifying non-variant correlation matrices for subpopulations. Through Bayesian updating, these studies as well as newly collected data could be incorporated into the current set as a mean of expanding this project and keeping the information up to date (Schmidt & Raju, 2007).

Third, while this study sought primarily to examine the pattern of correlations between motivational regulations, future research could resolve the issue of how best to operationalize motivation through the incorporation of antecedent and outcome variables. This would allow for the direct comparison of various operationalizations (e.g. RAI vs. dichotomization vs. individual regulations) and more clearly describe differences in the amount of variance each approach is capable of explaining. Such a meta-analysis would be more manageable if done within domains, or even for individual scales.

Conclusion

A meta-analysis of data from different life domains using motivation scales based on self-determination theory's multidimensional conceptualization of motivation revealed support for a unidimensional, simplex-like ordering of motivational regulations. Moreover, multi-dimensional scaling demonstrated the possibility of a smaller but potentially important second dimension, which should be explored further in future research. These findings are significant to motivation research as they indicate that self-determination is a very important dimension of human motivation. However, caution is warranted when ignoring other motivational aspects captured by specific motivational regulations. In this regard, more research needs to be undertaken on the scoring of motivation to maximize the prediction of outcomes.

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Figure 1: *Representation of Motivation in Self-Determination Theory*

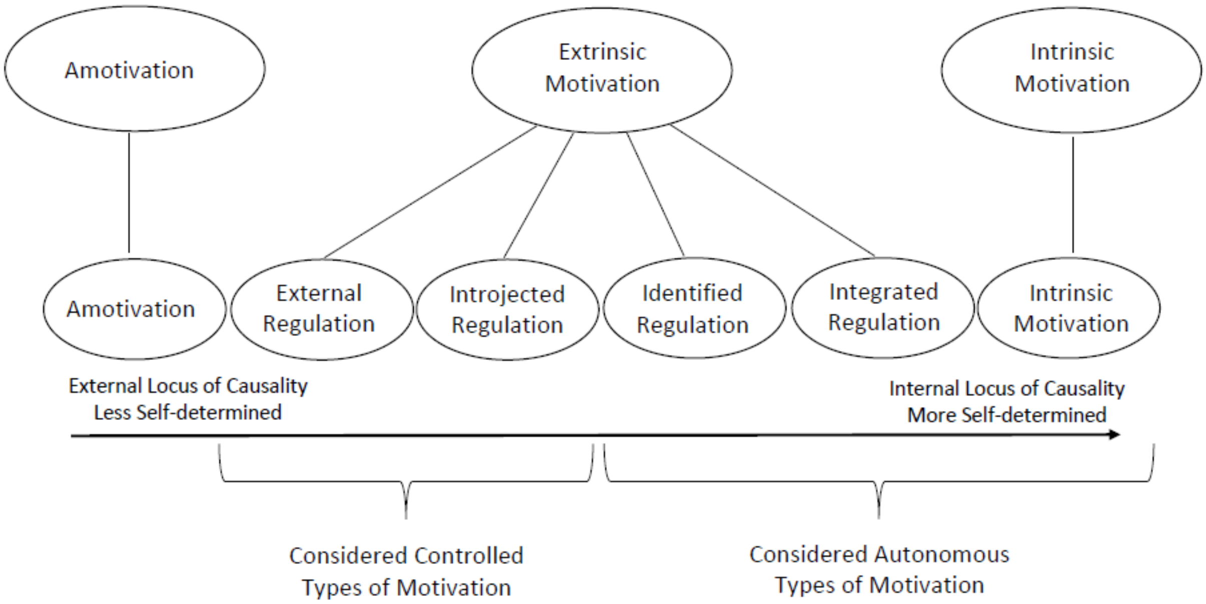


Figure 2. *Flow Diagram of Literature Search Procedures*

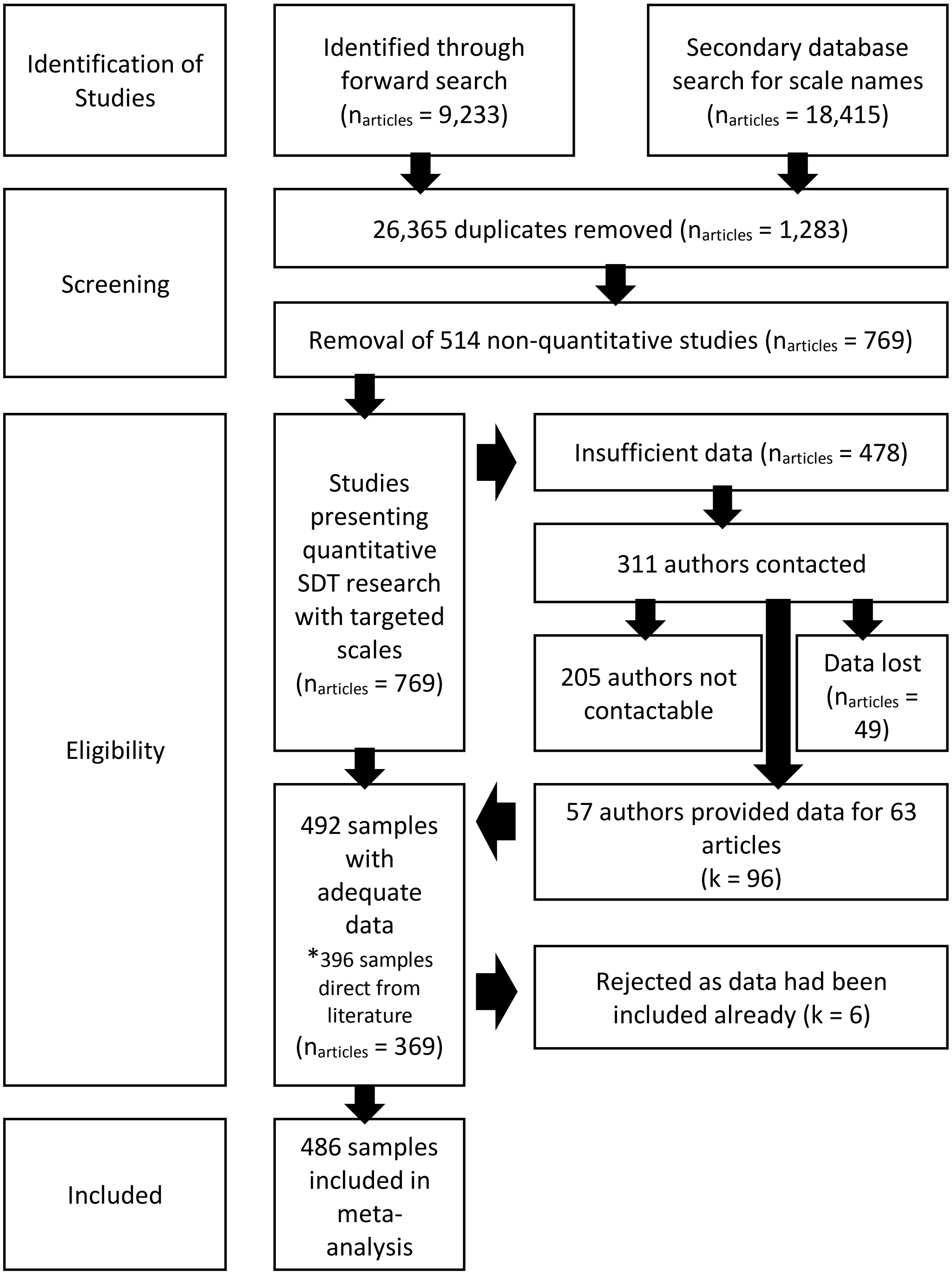
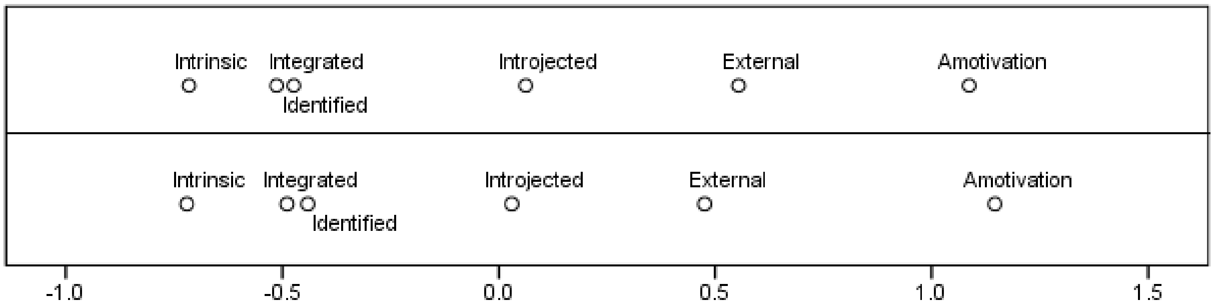
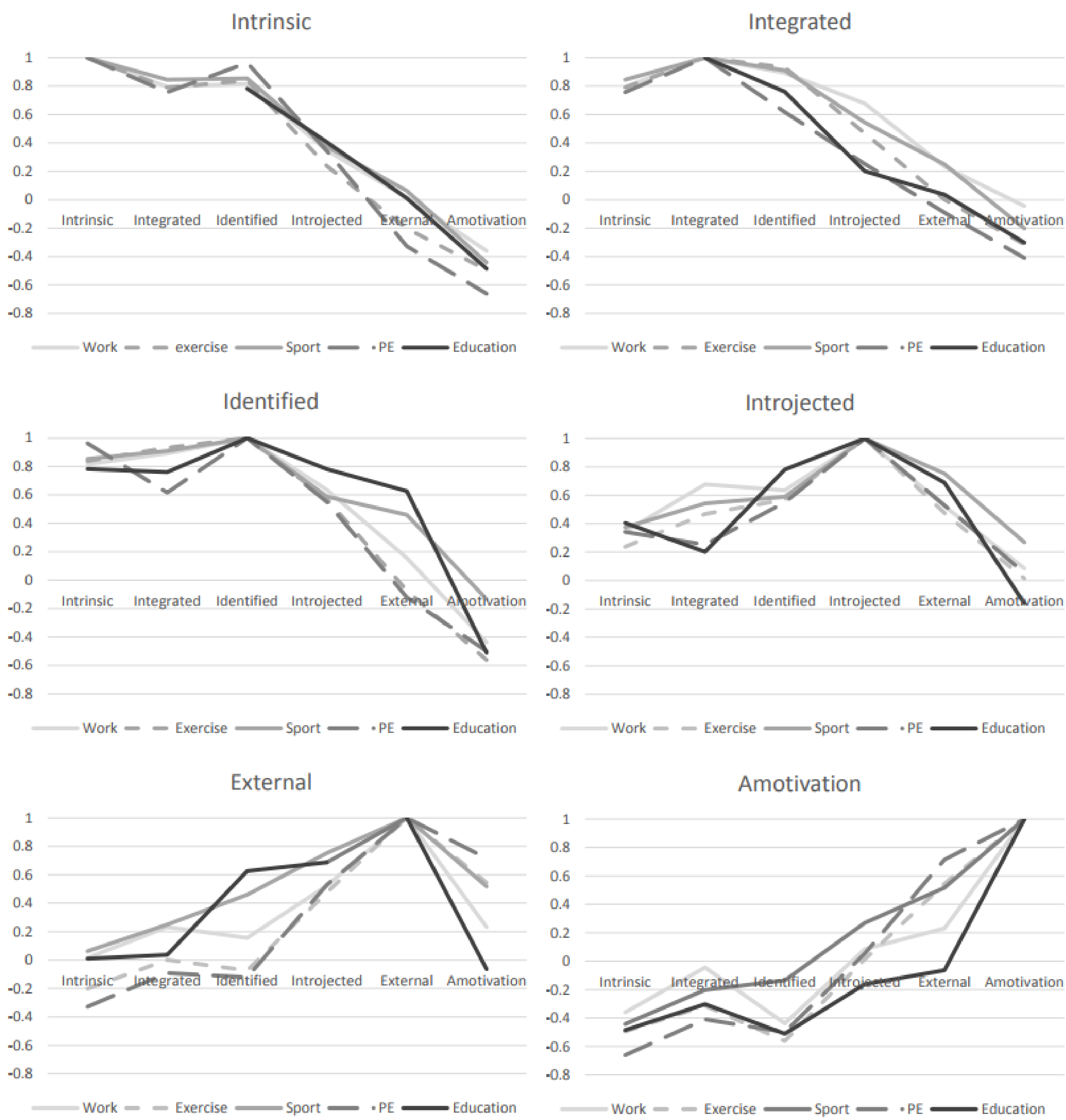


Figure 3. *Graphical Representation of Continuum for Published (top row) and Unpublished Data (bottom row).*



Note: Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Figure 4. *Graphical Display of Correlations between Regulations for each Major Domain*



Note: Y-axis represents correlation coefficients between regulations. Each graph represents relationships for a different regulation with the first depicting intrinsic motivation, the second integrated regulation, etc.

Figure 5: *Graphical Display of Correlations between Regulations for each Major Scale*

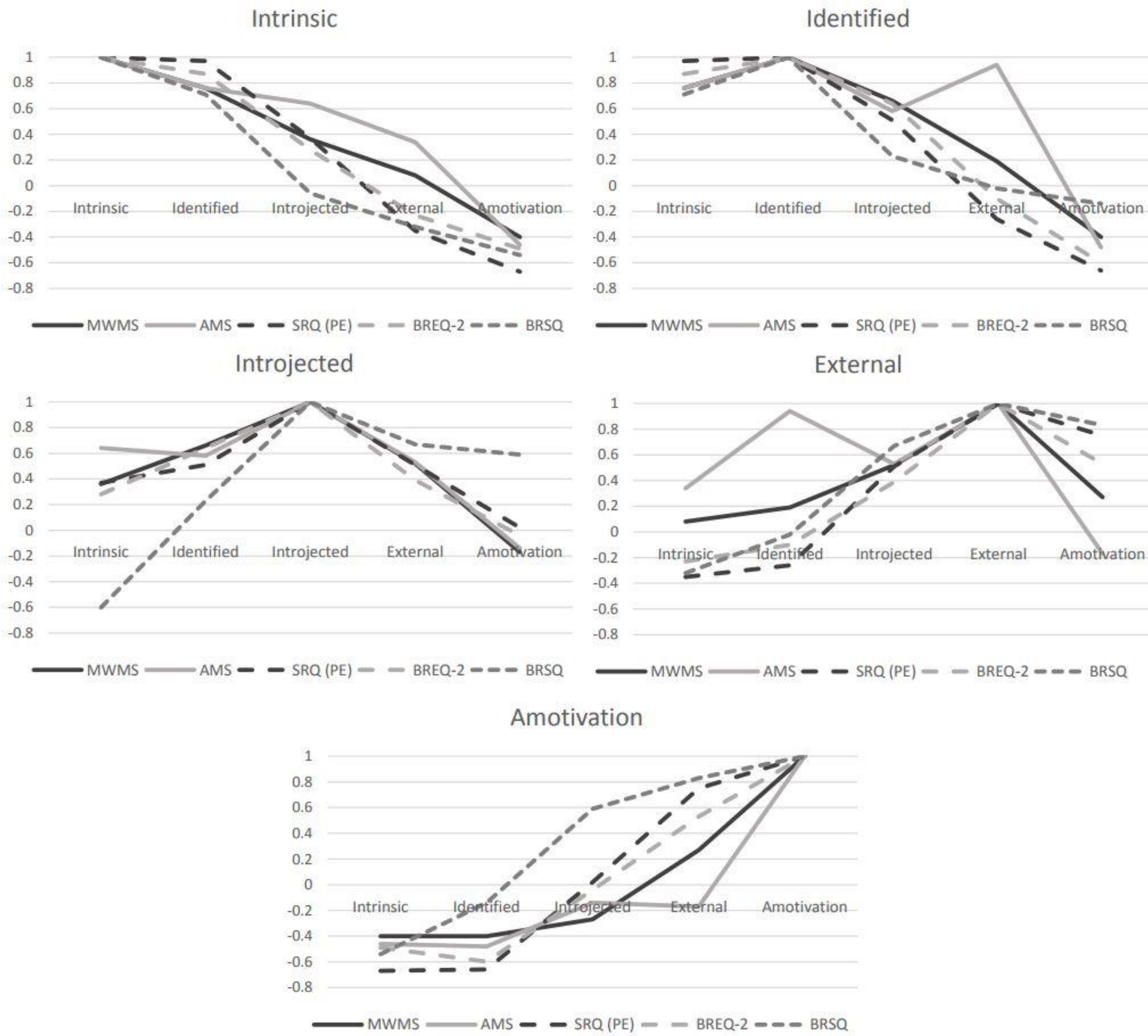


Figure 6: *Graphical Display of Correlations between Regulations for each Major Nation*

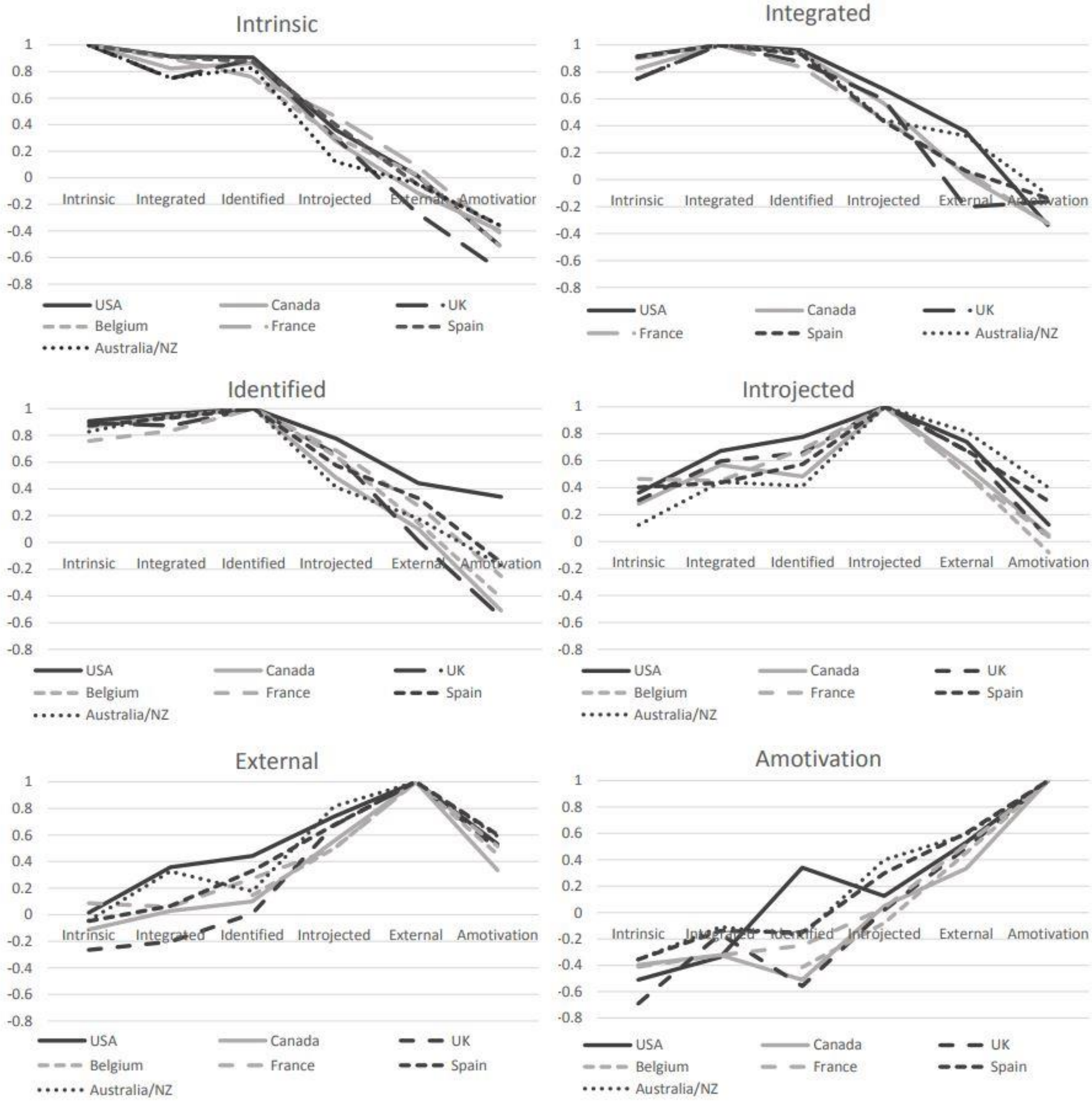
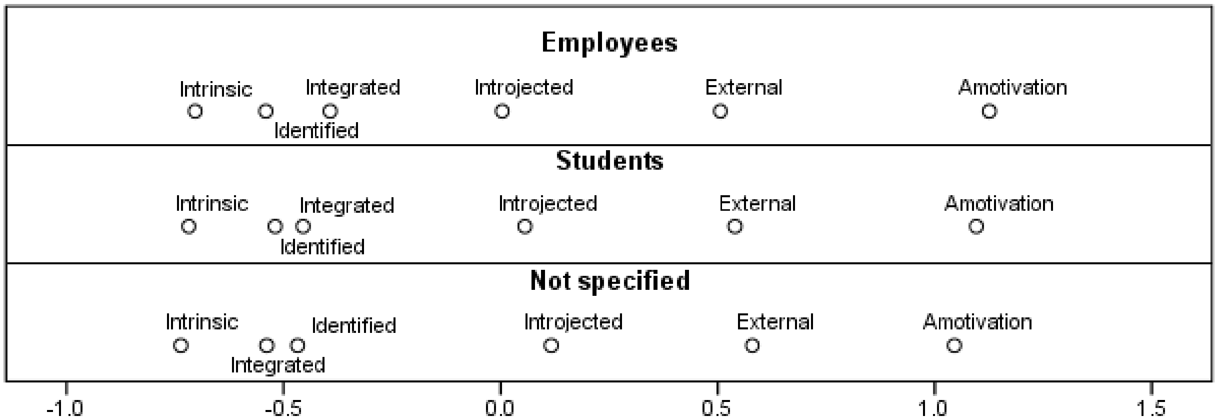
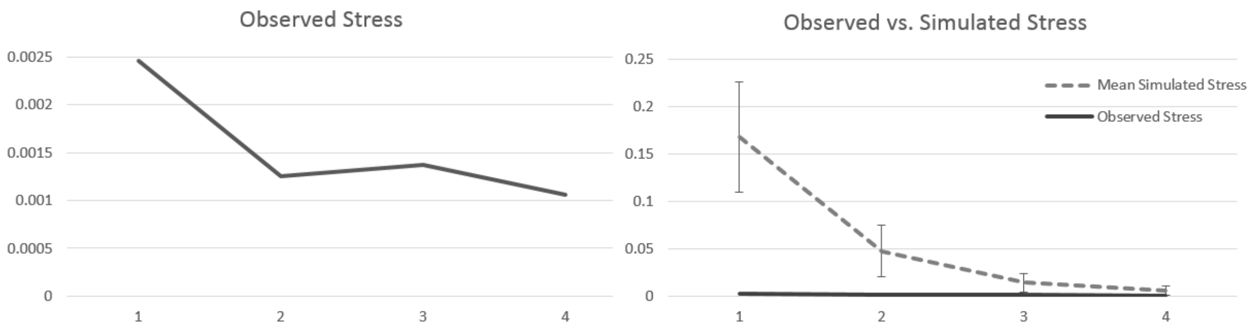


Figure 7. *Graphical Representation of Continuum Structures for Student, Employee, and Not Specified Samples.*



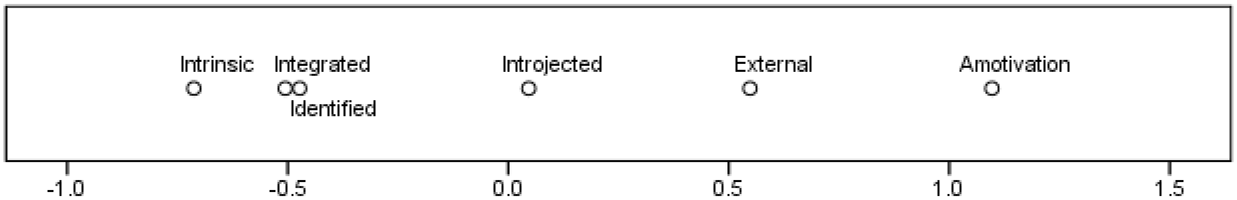
Note: Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Figure 8. *Elbow Plots of Stress in Multidimensional Scaling Analysis.*



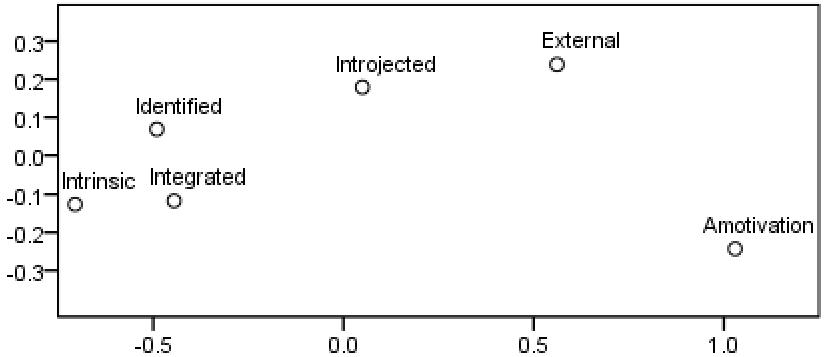
Note: a) Observed stress results of 1-4 dimension solutions in multi-dimensional scaling. b) Simulated data represents stress values associated with 1-4 dimensions in random data sets.

Figure 9: *Graphical Representation of the Single Dimensional Results of MDS*



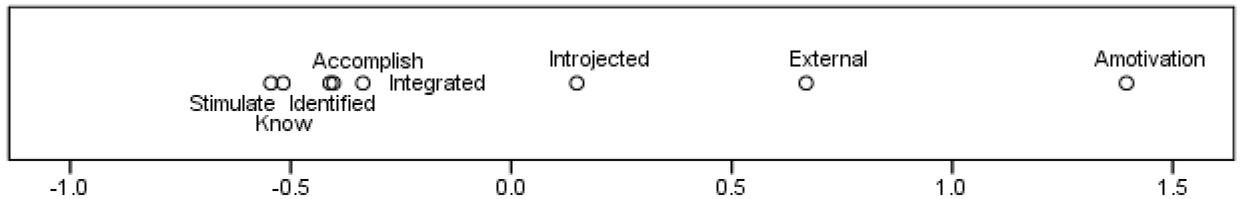
Note: Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Figure 10. *Graphical Representation of Two Dimensional Results of MDS.*



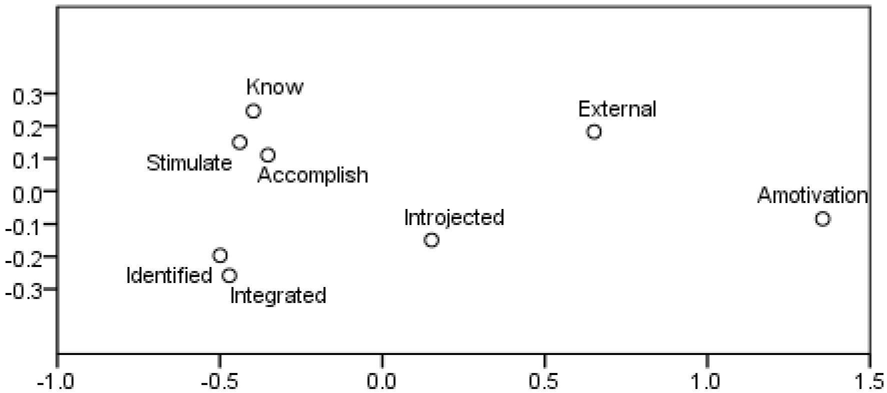
Note: Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Figure 11. *Graphical Representation of Single Dimensional Results of MDS for Data containing Intrinsic Motivation Subscales*



Note: In order from left to right: Stimulate, Know, Identified, Accomplish, Integrated, Introjected, External, Amotivation. Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Figure 12. *Graphical Representation of Two Dimensional Results of MDS for Data Containing Intrinsic Motivation Subscales*



Note: Interval markers have no inherent meaning beyond demonstrating relative distance between factors.

Table 1. *Meta-analytic Summary Statistics*

				95% CI					
	k	*n*	*r*	Lower	Upper	*Q*	I^2	T	T^2
Intrinsic									
Integrated	84	26420	.818	0.756	0.865	14623.80*	.994	0.755	0.570
Identified	384	168252	.854	0.826	0.878	152514.40*	.998	0.960	0.922
Introjected	372	166341	.313	0.278	0.347	22761.80*	.984	0.370	0.137
External	386	181923	-.093	-0.131	-0.055	25484.57*	.985	0.379	0.144
Amotivation	247	108352	-.477	-0.511	-0.442	13161.90*	.981	0.349	0.122
Integrated									
Identified	98	28030	.913	0.876	0.940	24519.48*	.996	0.948	0.898
Introjected	99	30200	.516	0.425	0.597	10430.70*	.991	0.594	0.353
External	97	29924	.128	0.033	0.220	6528.04*	.985	0.471	0.222
Amotivation	76	23414	-.248	-0.298	-0.197	1244.29*	.940	0.226	0.051
Identified									
Introjected	447	194718	.603	0.573	0.632	47845.70*	.991	0.498	0.248
External	460	202138	.173	0.106	0.239	112638.20*	.996	0.751	0.565
Amotivation	302	132208	-.389	-0.431	-0.345	25674.08*	.988	0.444	0.197
Introjected									
External	457	205136	.600	0.565	0.634	69013.60*	.993	0.583	0.340
Amotivation	299	134473	.113	0.066	0.159	22558.84*	.987	0.411	0.169
External									
Amotivation	313	139987	.510	0.448	0.570	72033.34*	.996	0.726	0.527

Note: * p <.001, k = number of independent samples, n = number of participants, r = Meta-analytic correlation coefficient after corrections, 95% CI = upper and lower confidence intervals around corrected correlation coefficient (r), Q = Cochran's Q, used to examine the hypothesis that all studies examine the same effect, I^2 = percentage of variance in the corrected population sample not explained by chance, T = standard deviation of effect sizes for the population, T^2 = variance of T.

Table 2. *Meta-analytic Correlation Matrix of SDT Regulations*

	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic	-					
Integrated	.818 (84)	-				
Identified	.853 (384)	.913 (98)	-			
Introjected	.313 (372)	.516 (99)	.603 (447)	-		
External	-.093 (386)	.128 (97)	.173 (460)	.564 (449)	-	
Amotivation	-.477 (247)	-.248 (76)	-.370 (300)	.113 (299)	.510 (313)	-

Note: Number of samples in parentheses.

Table 3. *Correlation Matrices of Published and Unpublished Regulation Data*

Published						
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		.775-.894	.845-.899	.272-.347	-.155--.072	-.522--.444
Integrated	.844 (58)		.879-.950	.404-.599	.024-.175	-.287--.167
Identified	.875 (301)	.922 (69)		.565-.631	.095-.247	-.452--.357
Introjected	.310 (288)	.508 (68)	.599 (352)		.569-.650	.055-.163
External	-.114 (299)	.100 (68)	.172 (362)	.611 (358)		.471-.602
Amotivation	-.484 (200)	-.228 (55)	-.406 (250)	.109 (247)	.540 (256)	

Unpublished						
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		.605-.836	.677-.812	.323-.413	-.115-.076	-.515--.376
Integrated	.742 (26)		.789-.940	.324-.694	-.091-.444	-.405--.226
Identified	.752 (76)	.887 (28)		.552-.701	.113-.330	-.387--.202
Introjected	.325 (77)	.534 (30)	.632 (85)		.491-.620	.046-.238
External	-.020 (80)	.191 (28)	.224 (88)	.559 (87)		.199-.464
Amotivation	-.448 (43)	-.318 (20)	-.297 (45)	.143 (43)	.338 (47)	

Note: Correlation coefficients (and k) below diagonal. 95% confidence intervals above diagonal. Unpublished coefficients include dissertations.

Table 4. *Correlation Matrices of Major SDT Domains*

	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Work						
Intrinsic		97.57 (0)	99.58 (0)	97.39 (0)	95.49 (0)	97.91 (0)
Integrated	.80 (9)		99.41 (0)	98.27 (0)	86.04 (0)	82.90 (0)
Identified	.82 (76)	.89 (9)		99.16 (0)	95.62 (0)	96.96 (0)
Introjected	.35 (75)	.68 (11)	.64 (77)		98.02 (0)	97.92 (0)
External	.02 (79)	.23 (9)	.16 (81)	.52 (81)		98.19 (0)
Amotivation	-.36 (32)	-.04 (5)	-.44 (32)	.09 (33)	.26 (20)	
Sport						
Intrinsic		99.61 (0)	99.72 (0)	99.10 (0)	99.28 (0)	97.65 (0)
Integrated	.85 (38)		99.65 (0)	99.53 (0)	99.28 (0)	94.59 (0)
Identified	.85 (89)	.91 (41)		98.59 (0)	99.24 (0)	97.43 (0)
Introjected	.37 (80)	.54 (39)	.59 (117)		98.17 (0)	97.61 (0)
External	.06 (87)	.25 (39)	.46 (124)	.71 (114)		99.21 (0)
Amotivation	-.44 (82)	-.20 (39)	-.14 (111)	.27 (105)	.52 (111)	
Education						
Intrinsic		-	99.05 (0)	99.22 (0)	97.14 (0)	82.371 (0)
Integrated	-		91.39 (.01)	0.00 (.48)	4.18 (.31)	0.00 (.949)
Identified	.78 (21)	.76 (2)		99.72 (0)	99.91 (0)	98.530 (0)
Introjected	.41 (19)	.20 (2)	.78 (31)		98.05 (0)	98.480 (0)
External	.01 (19)	.04 (2)	.62 (32)	.63 (29)		97.407 (0)
Amotivation	-.49 (5)	-.30 (2)	-.51 (14)	-.16 (14)	-.08 (13)	
Exercise						
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		99.30 (0)	99.52 (0)	96.26 (0)	94.65 (0)	97.57 (0)
Integrated	.79 (34)		99.66 (0)	97.38 (0)	94.52 (0)	93.60(0)
Identified	.84 (151)	.93 (39)		98.55 (0)	96.80 (0)	97.14 (0)
Introjected	.24 (153)	.47 (40)	.57 (157)		97.04 (0)	98.85 (0)
External	-.20 (153)	.00 (40)	-.07 (158)	.43 (156)		99.52 (0)
Amotivation	-.50 (98)	-.31 (26)	-.52 (100)	.01 (101)	.55 (102)	
Physical Education						
Intrinsic		0.00 (1)	99.85 (0)	98.32 (0)	98.57 (0)	98.91 (0)
Integrated	.76 (1)		10.14 (.29)	63.75 (.10)	0.00 (.47)	75.96 (.04)
Identified	.96 (33)	.62 (2)		99.33 (0)	99.44 (0)	99.20 (0)
Introjected	.34 (32)	.25 (2)	.55 (43)		99.52 (0)	98.10 (0)
External	-.33 (34)	-.09 (2)	-.12 (43)	.53 (42)		99.77 (0)
Amotivation	-.66 (24)	-.41 (2)	-.50 (34)	.05 (33)	.72 (33)	

Note: Correlations (k) are below the diagonal. I^2 and (p value of Chi-squared test associated with Q) statistics are presented above the diagonal. Intrinsic subscales are not presented here but are available in the appendix.

Table 5. *Correlation Matrices and I^2 for Major Scales from each Domain*

	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
MWMS (Work)						
Intrinsic		-	97.60 (0)	91.54 (0)	74.18 (0)	93.53 (0)
Integrated	-	-	-	-	-	-
Identified	.76 (40)	-		98.28 (0)	82.07 (0)	92.92 (0)
Introjected	.36 (40)	-	.66 (40)		93.98 (0)	78.08 (0)
External	.08 (45)	-	.19 (45)	.52 (45)		98.15 (0)
Amotivation	-.40 (14)	-	-.40 (14)	-.17 (14)	.27 (18)	
AMS (Education)						
Intrinsic		-	99.50 (0)	99.02 (0)	96.77 (0)	89.27 (0)
Integrated	-	-	-	-	-	-
Identified	.76 (6)	-		.98.54 (0)	99.96 (0)	83.76 (0)
Introjected	.64 (5)	-	.58 (9)		95.64 (0)	96.99 (0)
External	.34 (4)	-	.94 (9)	.53 (9)		97.21 (0)
Amotivation	-.46 (3)	-	-.48 (9)	-.14 (9)	-.17 (8)	
SRQ (Physical Education)						
Intrinsic		-	99.83 (0)	98.48 (0)	98.34 (0)	99.01 (0)
Integrated	-	-	-	-	-	-
Identified	.97 (27)	-		99.32 (0)	98.99 (0)	98.76 (0)
Introjected	.37 (27)	-	.51 (27)		99.64 (0)	98.74 (0)
External	-.35 (27)	-	-.26 (27)	.51 (27)		99.85 (0)
Amotivation	-.67 (20)	-	-.66 (20)	.02 (20)	.75 (20)	
BREQ-2 (Exercise)						
Intrinsic		-	99.68 (0)	96.14 (0)	94.91 (0)	96.58 (0)
Integrated	-		-	-	-	-
Identified	.87 (83)	-		98.97 (0)	95.31 (0)	99.16 (0)
Introjected	.28 (82)	-	.64 (83)		97.55 (0)	98.25 (0)
External	-.23 (82)	-	-.10 (82)	.39 (83)		99.51 (0)
Amotivation	-.49 (75)	-	-.60 (77)	-.04 (75)	.53 (78)	
BRSQ (Sport)						
Intrinsic		99.52 (0)	97.85 (0)	97.34 (0)	95.62 (0)	97.03 (0)
Integrated	.84 (23)		99.27 (0)	96.74 (0)	91.26 (0)	90.71 (0)
Identified	.71 (25)	.86 (24)		96.36 (0)	98.82 (0)	92.87 (0)
Introjected	-.06 (23)	.26 (22)	.23 (24)		97.29 (0)	96.00 (0)
External	-.32 (23)	-.03 (22)	-.02 (24)	.67 (24)		98.66 (0)
Amotivation	-.54 (23)	-.19 (22)	-.14 (23)	.59 (23)	.83 (22)	

Note: Correlations (k) are below the diagonal. I^2 and (p value of Chi-squared test associated with Q) statistics are presented above the diagonal. The AMS results do not include three subscales of intrinsic regulation (these are reported in the online Supplementary section). Remaining scales can be found in the associated online supplementary materials.

Table 6. C*orrelation Matrices for Student, Employee, or Other Groups*

	Other (not specified)					
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		98.30 (0)	99.38 (0)	98.46 (0)	97.38 (0)	96.33 (0)
Integrated	.75 (36)		99.10 (0)	96.39 (0)	94.92 (0)	87.88 (0)
Identified	.79 (115)	.90 (42)		97.18 (0)	98.93 (0)	97.82 (0)
Introjected	.25 (112)	.39 (43)	.53 (134)		99.49 (0)	98.70 (0)
External	-.14 (117)	.01 (43)	.15 (138)	.60 (141)		99.28 (0)
Amotivation	-.43 (82)	-.28 (32)	-.28 (97)	.18 (97)	.55 (104)	
	Employees					
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		99.56 (0)	99.60 (0)	97.43 (0)	95.51 (0)	98.05 (0)
Integrated	.90 (8)		99.41 (0)	98.39 (0)	61.70 (.011)	81.97 (0)
Identified	.81 (71)	.90 (9)		99.14 (0)	95.68 (0)	98.12 (0)
Introjected	.32 (67)	.68 (10)	.63 (72)		97.98 (0)	98.02 (0)
External	.00 (72)	.29 (8)	.15 (75)	.53 (74)		98.70 (0)
Amotivation	-.35 (28)	-.02 (6)	-.42 (30)	.12 (29)	.36 (32)	
	Students					
	Intrinsic	Integrated	Identified	Introjected	External	Amotivation
Intrinsic		99.45 (0)	99.80 (0)	98.53 (0)	98.81 (0)	98.36 (0)
Integrated	.81 (25)		99.71 (0)	98.25 (0)	97.57 (0)	92.06 (0)
Identified	.90 (159)	.91 (31)		99.31 (0)	99.78 (0)	98.64 (0)
Introjected	.34 (153)	.48 (31)	.63 (189)		99.34 (0)	98.86 (0)
External	-.13 (159)	.13 (31)	.17 (195)	.63 (188)		99.74 (0)
Amotivation	-.54 (108)	-.26 (26)	-.45 (136)	.08 (132)	.55 (135)	

Note: Correlations (k) are below the diagonal. I^2 and (p value of Chi-squared test associated with Q) statistics are presented above the diagonal.