

Evaluating the Effect of Basic Psychological Needs Support and Thwarting on Motivation for

Emotionally Demanding Behaviour Change

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Abstract

According to numerous sources, common factors found in all psychological intervention methods are significant predictors of treatment outcome, potentially holding even greater predictive power than treatment techniques used in any one individual therapy method (e.g., Horvath & Symonds, 1991; Martin, Garske, & Davis, 2000; Safran & Muran, 2006; Wampold et al., 1997; Zuroff & Blatt, 2006). In response to the gap in our understanding of *how* psychotherapy leads to positive outcomes and therapy completion, several authors have investigated the possible contribution of Self-Determination Theory (SDT) variables to therapeutic change (e.g., Mansour et al., 2012; McBride et al., 2010; Zuroff et al., 2007; Zuroff et al., 2012). SDT is an overarching theory of human motivation, development, and wellness (Ryan & Deci, 2017). The model proposes that people's basic psychological needs for autonomy, competence, and relatedness must be satisfied for personal growth and mental health, and that that these three needs form the basis for the movement from controlled to autonomous or intrinsic forms of motivation (Ryan & Deci, 2008; Ryan, Lynch, Vansteenkiste & Deci, 2010). Given the theoretical underpinnings of SDT (i.e. that needs satisfaction is central to the development of more internalized forms of motivation), it is probable that the common psychotherapeutic factors of basic needs support and resulting needs satisfaction would contribute to stronger intrinsic motivation for treatment.

These hypotheses were investigated in a series of two studies, both employing basic needs support and/or thwarting as the active ingredient used to affect participant motivation for and compliance with the intervention. In Study 1, we developed an analogue intervention study to examine the effect of basic needs support and satisfaction in psychotherapy on motivation for treatment, engagement and persistence in treatment, and therapy homework completion. Undergraduate participants were recruited to participate in a mindfulness stress-reduction intervention with a deception component. Participants' basic psychological needs were either supported or thwarted in-lab by researchers. Results indicated that needs support and thwarting during our in-lab manipulation predicted needs satisfaction at endpoint. Further, greater competence satisfaction predicted higher ratings of motivation, and greater relatedness satisfaction predicted more homework completion. Several hypotheses were not upheld (e.g., higher endpoint autonomy or relatedness satisfaction did not predict greater endpoint motivation). However, daily means of needs satisfaction aggregated over the week indicated that

greater overall autonomy and competence satisfaction predicted greater autonomous motivation across study days.

We attempted to address Study 1's limitations (e.g., underpowered support and thwarting interventions) with a follow-up study. In Study 2, participants assigned a person within their social circle (e.g., friend, sibling) to encourage them in an attempt to reduce their social media use over the course of two weeks. We predicted that participants' loved ones would use a variety of behaviours and support methods to encourage participants' social media reduction, and that some participants would perceive their supporter's actions as more or less supportive or thwarting. Results indicated that participants who anticipated or experienced more needs supportive behaviours from interpersonal relationships during the study experienced greater reduction of social media use. No relationship was evident between participants' ratings of their supporters' thwarting behaviours and behavioural change outcomes. Participants who perceived their supporters to be more needs supportive experienced greater autonomous and controlled motivation to reduce social media use. However, participant ratings of autonomous and controlled motivation bore no significant relationship to ratings of social media reduction.

A significant relationship between perceived needs support, satisfaction, and behaviour change emerged in both studies, despite the unexpected null relationship between motivation and behaviour change. Results from Studies 1 and 2 suggested that basic needs satisfaction ratings do not necessarily align with experiencing perceived support of said needs, even if support predicts task completion. It appears possible that needs support, and relatedness support in particular, may be an important contributing factor for engagement in emotionally demanding tasks regardless of perceived needs satisfaction or felt motivation. Moreover, our Study 1 results reinforced the additive hypothesis of needs satisfaction as it contributes to intrinsic motivation (i.e., each need uniquely contributes to motivation, regardless of the level of satisfaction of other needs; Dysvik, Kuvaas, & Gagné, 2013). As more research signals the important contribution of both competence and relatedness satisfaction to the internalization of more autonomous forms of motivation and emotionally-demanding task completion, it will be important for researchers and clinicians to attend to the support of these basic needs. Further, there would be value in future prospective research evaluating the effect of needs support and satisfaction on motivation without external pay or credit incentives. Future research in this domain would benefit from examining interpersonal support and thwarting in a psychotherapy context.

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Table of Contents

Examining Committee Membership	ii
Author’s Declaration	iii
Abstract	iv
Acknowledgements	vi
List of Figures	viii
List of Tables	ix
Literature Review	1
Study 1: Basic Psychological Needs Support Experimental Study	15
Method	16
Results	21
Discussion	29
Study 2: Interpersonal Relationships and Behaviour Change	37
Method	40
Results	43
Discussion	49
General Discussion	52
References	60
Appendix A	68
Appendix B	74
Appendix C	76
Appendix D	83
Appendix E	86
Appendix F	110

List of Figures

<i>Figure 1.</i> Study 1 conditions.	18
<i>Figure 2.</i> Collapsed Study 1 conditions.	25

List of Tables

<i>Table 1.</i> One-Way ANOVAs of Condition and Basic Needs Satisfaction at Baseline	107
<i>Table 2.</i> One-Way ANOVAs of Condition and Basic Needs Satisfaction at Endpoint	107
<i>Table 3.</i> Hierarchical Multiple Regression Analyses Predicting Baseline Autonomous Motivation by Baseline Basic Needs Satisfaction	108
<i>Table 4.</i> Hierarchical Multiple Regression Analyses Predicting Baseline Controlled Motivation by Baseline Basic Needs Satisfaction	109
<i>Table 5.</i> Hierarchical Multiple Regression Analyses Predicting Endpoint Autonomous Motivation by Endpoint Basic Needs Satisfaction	110
<i>Table 6.</i> Hierarchical Multiple Regression Analyses Predicting Endpoint Controlled Motivation by Endpoint Basic Needs Satisfaction	111
<i>Table 7.</i> Multiple Regression Analyses Predicting Baseline Autonomous Motivation by Baseline Basic Needs Satisfaction	112
<i>Table 8.</i> Multiple Regression Analyses Predicting Baseline Controlled Motivation by Baseline Basic Needs Satisfaction	112
<i>Table 9.</i> Multiple Regression Analyses Predicting Endpoint Autonomous Motivation by Endpoint Basic Needs Satisfaction	112
<i>Table 10.</i> Multiple Regression Analyses Predicting Endpoint Controlled Motivation by Endpoint Basic Needs Satisfaction	113
<i>Table 11.</i> One-Way ANOVAs of Condition and Mindfulness Homework Completion	113
<i>Table 12.</i> Hierarchical Linear Growth Model of Autonomous Motivation Over Time	113
<i>Table 13.</i> Hierarchical Linear Growth Model of Controlled Motivation Over Time	113
<i>Table 14.</i> Hierarchical Linear Growth Model of Autonomous Motivation Over Time, As Predicted by Basic Needs Satisfaction	114
<i>Table 15.</i> Hierarchical Linear Growth Model of Controlled Motivation Over Time, As Predicted by Basic Needs Satisfaction	114
<i>Table 16.</i> Hierarchical Linear Growth Model of Autonomous Motivation Over Time, As Predicted by Autonomy Satisfaction and Autonomy Support vs. Thwarting Conditions	114
<i>Table 17.</i> Hierarchical Linear Growth Model of Autonomous Motivation Over Time, As Predicted by Competence Satisfaction and Competence Support vs. Thwarting Conditions	114
<i>Table 18.</i> Hierarchical Linear Growth Model of Autonomous Motivation Over Time, As Predicted by Relatedness Satisfaction and Relatedness Support vs. Thwarting Conditions	115
<i>Table 19.</i> Hierarchical Linear Growth Model of Controlled Motivation Over Time,	115

As Predicted by Autonomy Satisfaction and Autonomy Support vs. Thwarting Conditions	
<i>Table 20.</i> Hierarchical Linear Growth Model of Controlled Motivation Over Time, As Predicted by Competence Satisfaction and Competence Support vs. Thwarting Conditions	115
<i>Table 21.</i> Hierarchical Linear Growth Model of Controlled Motivation Over Time, As Predicted by Relatedness Satisfaction and Relatedness Support vs. Thwarting Conditions	115
<i>Table 22.</i> Hierarchical Multiple Regression Analyses Predicting Social Media Percent Reduction by Baseline IBQ Support and Thwarting	116
<i>Table 23.</i> Hierarchical Multiple Regression Analyses Predicting Social Media Percent Reduction by Midway IBQ Support and Thwarting	116
<i>Table 24.</i> Hierarchical Multiple Regression Analyses Predicting Social Media Percent Reduction by Final IBQ Support and Thwarting	117
<i>Table 25.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Baseline IBQ Support and Thwarting	117
<i>Table 26.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Midway IBQ Support and Thwarting	117
<i>Table 27.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Final IBQ Support and Thwarting	118
<i>Table 28.</i> Hierarchical Multiple Regression Analyses Predicting Participant Ratings of Behaviour Change Success by Baseline Autonomous and Controlled Motivation	118
<i>Table 29.</i> Hierarchical Multiple Regression Analyses Predicting Participant Ratings of Behaviour Change Success by Midway Autonomous and Controlled Motivation	118
<i>Table 30.</i> Hierarchical Multiple Regression Analyses Predicting Participant Ratings of Behaviour Change Success by Baseline Autonomous and Controlled Motivation	119
<i>Table 31.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Baseline Autonomous and Controlled Motivation	119
<i>Table 32.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Midway Autonomous and Controlled Motivation	119

<i>Table 33.</i> Multiple Regression Analyses Predicting Ratings of Success in Behaviour Change by Final Autonomous and Controlled Motivation	120
<i>Table 34.</i> Multiple Regression Analyses Predicting Autonomous Motivation by IBQ Support and Thwarting at Midway	120
<i>Table 35.</i> Multiple Regression Analyses Predicting Controlled Motivation by IBQ Support and Thwarting at Midway	120
<i>Table 36.</i> Multiple Regression Analyses Predicting Autonomous Motivation by IBQ Support and Thwarting at Endpoint	120
<i>Table 37.</i> Multiple Regression Analyses Predicting Controlled Motivation by IBQ Support and Thwarting at Endpoint	120

Literature Review

Common Factors in Psychotherapy and Working Alliance

Numerous sources have supported the possibility that common factors found in all psychological intervention methods could be more influential predictors of treatment outcome than treatment techniques championed by any one individual therapy method (e.g., Horvath & Symonds, 1991; Martin, Garske, & Davis, 2000; Safran & Muran, 2006; Wampold et al., 1997; Zuroff & Blatt, 2006). For example, Bandura (1977) proposed that differing level and strength of self-efficacy in clients were responsible for a significant proportion of the changes achieved through different treatment methods. A client's context and expectancies have also been proposed as common factors that account for improvement across therapy modalities (Drisko, 2004). In particular, the working alliance between a client and therapist is the most studied and cited of the potential common factors that could form the basis of a process-oriented model of psychotherapy (Martin et al., 2000; McBride et al., 2010).

According to Bordin (1979), working alliance is comprised primarily of three features: an agreement on the goals of therapy, an assignment of a task or series of tasks, and the development of a bond between therapist and client. In a meta-analysis of 24 psychotherapy treatment studies examining working alliance as a predictor of therapy outcome, Horvath and Symonds (1991) found that working alliance was a moderate predictor of positive therapy outcomes. Importantly, the authors found that this relationship between working alliance and outcome did not differ according to the therapy modality used or the length of treatment. Further, there is robust evidence to suggest that working alliance accounts for significantly more variance in psychotherapy outcome compared to treatment modality (Lambert, 1992; Cuijpers, Reijnders, & Huibers, 2019). In addition, client ratings of working alliance appeared to be the most predictive of positive therapy outcomes, compared to therapists' and observers' ratings of working alliance. Moreover, Zuroff and Blatt (2006) found that across different forms of treatment, when clients perceived a more positive working alliance early in treatment, they experienced significantly more rapid decline in symptoms going forward. This relationship between working alliance and positive outcomes also held throughout an 18-month follow-up period. A more exhaustive meta-analysis of 79 studies conducted by Martin and colleagues (2000) similarly found that there appears to be a moderate and consistent relationship between

working alliance and positive outcome, and that this relation holds even after accounting for a plethora of variables (e.g., type of therapy, client socio-economic status, age, education, etc.).

Despite these findings, the focus in treatment-oriented research has been on developing manualized treatment methods with the aim of targeting specific behavioural outcomes (Ryan & Deci, 2008). Most of the resulting evidence-based treatments are designed and tested with participants who meet very specific criteria and fall into discrete diagnostic categories (Ryan & Deci, 2008). However, authors controversially claim that outcomes from different therapies have no significant difference in efficacy (Luborsky et al., 2002; Messer & Wampold, 2002). According to Ryan and Deci (2008), there is a paucity of research dedicated to developing evidence-based treatments that focus on the process of change in psychotherapy. The authors assert that treatments that address the process of change are particularly important in the treatment of new or unique problems because in such cases standardized treatments might not apply directly to the individual's treatment needs. As presenting problems and treatment goals in many therapy settings are complex and oftentimes evolve (Yalom, 2002), therapeutic principles that can be easily adapted on a case-by-case basis are essential (Ryan & Deci, 2008). Comprehensive theories that address these process needs would certainly assist therapists in working with clients whose goals for treatment sometimes change and whose problems present in a fashion that the therapist has not yet encountered (Ryan & Deci, 2008).

While working alliance is a pan-theoretical and reliable predictor of positive therapeutic outcomes (Horvath & Symonds, 1991; Martin et al., 2000), it is not a comprehensive treatment method. The correlation between working alliance and outcome is moderate. Meta-analyses have estimated the weighted effect size of working alliance to outcome at $r = .22$ to $r = .26$ (Horvath & Symonds, 1991; Martin et al., 2000). The modest effect size revealed in the available research indicates that there is a great deal of unexplained variance left to be accounted for (Zuroff, Koestner, Moskowitz, McBride, Marshall, & Bagby, 2007). Additionally, although working alliance is predictive of dropout from therapy (independent of the therapy modality used or specific diagnoses), other factors such as client motivation have been implicated in the likelihood of dropout (Castonguay, Constantino, & Holtforth, 2006; Johansson & Eklund, 2006).

Estimates of the rate of dropout after the first session of psychotherapy range from 20% to 57% across various settings and among various treatment populations (Barrett, Chua, Crits-Christoph, Gibbons, & Thompson, 2008). In addition, whether the criterion is therapist judgment

or the number of sessions attended, approximately 48% of clients are considered to discontinue therapy early (Wierzbicki & Pekarik, 1993). As a result, many clients entering treatment do not receive enough psychotherapy to obtain the desired symptomatic relief for which they sought treatment (Barrett et al., 2008). Bados, Balaguer, and Saldaña (2007) found that 46.7% of clients who terminated Cognitive-Behavioural treatment early cited low motivation and or/ a lack of satisfaction with the treatment method or therapist. Another study conducted by Piper et al. (1999) found that while pretherapy variables (e.g., demographics, diagnoses) did not distinguish therapy completers from those who would terminate early, process variables such as client ratings of working alliance significantly differentiated the two groups. A meta-analysis of 11 studies investigating the relationship between therapy dropout and working alliance found that working alliance has a moderately strong relationship with dropout (Cohen's $d = .55$, $r = .27$), with clients who report a weaker working alliance being more likely to terminate therapy early (Sharf, Primavera, & Diener, 2010). It would therefore be a prudent next step for researchers to identify other common factors that both predict positive outcomes in psychotherapy and that forecast early termination of therapy.

Self-Determination Theory as a Potential Framework for Common Factors

In response to the gap in our understanding of *how* various forms of psychotherapy lead to positive outcomes and therapy completion, several authors have investigated the possible contribution of Self-Determination Theory (SDT) variables such as autonomous and controlled motivation to therapeutic change (e.g., Ryan & Deci, 2017; Mansour et al., 2012; McBride et al., 2010; Zuroff et al, 2007; Zuroff et al., 2012). SDT is an overarching theory of human motivation, development, and wellness (Ryan & Deci, 2008). Among the many facets of the human condition SDT attempts to explain are personality development, self-regulation, universal basic psychological needs, life goals, energy and vitality, nonconscious processes, the relationship between culture and motivation, affect, behaviour, and well-being (Deci & Ryan, 2008).

The SDT model proposes that people's basic psychological needs for autonomy, competence, and relatedness must be satisfied as a precondition for personal growth and mental health (Ryan & Deci, 2008). Autonomy refers to the self-endorsement of one's own behaviour and the resulting sense of volition that accompanies this personal backing, competence to an individual's sense of confidence in their ability to effect desired outcomes, and relatedness to a

person's need to feel a sense of connection with others (Ryan & Deci, 2008; Ryan et al., 2010). SDT postulates that these three needs form the basis for self-motivation and the integration of one's personality (Ryan et al., 2010; Ryan & Deci, 2017). Specifically, contextual factors in an individual's environment, such as an extrinsic reward or an opportunity for choice, can thwart or support the fulfillment of basic needs (e.g., a supervisor providing an employee several options for their next project would likely support the satisfaction of that employee's need for autonomy). In turn, this fulfillment or thwarting of needs can be used to predict outcomes (e.g., behaviour, affect, well-being, level or type of motivation experienced; Deci & Ryan, 2008; Ryan & Deci, 2017). The principles of SDT readily lend themselves to application to a number of different psychotherapy treatment interventions, as treatment motivation and a supportive therapeutic environment are considered to be essential in many psychotherapy modalities (Ryan & Deci, 2008; Ryan & Deci, 2017). SDT is particularly relevant to the discussion of common psychotherapeutic factors. The theory's proponents have used SDT principles to outline an evidence-based set of guidelines and principles that aim to increase client motivation to reflect on experiences and events in their lives in order to make positive changes in their goals, behaviours, and relationships (Ryan & Deci, 2008; Ryan & Deci, 2017).

In particular, the SDT constructs of autonomous and controlled motivation, autonomy support, and basic psychological needs have been proposed as factors that could influence psychotherapy outcome (Deci & Ryan, 2008; Ryan & Deci, 2008; Ryan & Deci, 2017). Over the last few years, the roles of SDT variables such as autonomy support and autonomous motivation in psychotherapy outcome have been increasingly explored. However, as highlighted by Zuroff et al. (2012), there are some theoretically relevant SDT variables (e.g., support for relatedness, competence support) that have not yet been examined empirically. The contributions of these variables to the psychotherapeutic process are, as of yet, unexplored (Zuroff et al., 2012).

Basic Psychological Needs

The satisfaction of an individual's basic psychological needs (autonomy, competence, and relatedness) is posited by SDT to be integral for mental wellness and personal development (Ryan & Deci, 2008; Ryan & Deci, 2017; Van den Broeck, Ferris, Chang, & Rosen, 2016). Ryan and Deci (2008; 2017) assert that those who are unable to satisfy one or more basic needs may remain unaware of their importance or may diminish the personal meaningfulness of the need.

The authors suggest that these thwarted needs are often replaced with substitutes (e.g., extrinsic life goals), which then become the focus of the person's energy rather than striving to fulfill the basic psychological need. This needs thwarting leads to predictably poor outcomes. For example, when autonomy is consistently thwarted in the developmental period, this interferes with the child's development of intrinsic motivation, internalization, attachment, and emotional integration, leading to psychopathology (Ryan, Deci, Grolnick, & La Guardia, 2006). Proponents of SDT propose that a person's sense of autonomy, competence, and relatedness to others as experienced in psychotherapy will influence that individual's ability to develop an internal sense of motivation for effective change (Ryan & Deci, 2008). It is likely that facilitating clients' awareness of their basic psychological needs and exploring opportunities for greater satisfaction of these needs in psychotherapy will result in better outcomes and fewer early terminations. Interventions designed to increase a client's sense of autonomy, competence, and relatedness in psychotherapy might therefore result in more effective treatment and higher rates of client retention.

In the context of psychotherapy, Ryan and colleagues (2010) describe the manner in which each client need can be supported. Autonomy support (covered in more detail below) occurs when a therapist softens the pressure to enact specific behaviours and places a higher value on encouraging clients to base their actions on personally meaningful motives and ideals. Competence support can be achieved through providing a client with the necessary skills and mechanisms to effect change, and occurs once a client has developed a sufficient sense of autonomy (as autonomy is necessary in the SDT framework for the most effective uptake of learning and strategy application). Relational support occurs when the client perceives genuine unconditional positive regard and involvement on the part of their therapist.

A plethora of evidence suggests that self-reported autonomy, competence, and relatedness are each important contributors to positive mood, well-being, and thriving in both the short- and long term across a variety of contexts (e.g., Sheldon & Filak, 2008; Emery, Heath, & Mills, 2016; Van den Broeck et al., 2016). For instance, several studies have demonstrated that daily variations in the three basic needs combine to predict daily fluctuations in well-being (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996). Reis and colleagues (2000) examined daily state fluctuations in basic needs satisfaction over a two-week period, controlling for trait-level individual differences. The authors found that emotional well-being

from day to day was significantly predicted by level of basic needs satisfaction reported on a given day. In addition, the authors discovered that relatedness needs were best supported daily by meaningful talk and feeling understood by conversational partners. Moreover, research by Sheldon and colleagues (1996) revealed that in addition to state levels of autonomy and competence predicting daily well-being, participants who scored higher in terms of trait competence and autonomy tended to rate their experience as “better” on average than those who scored lower on these trait measures.

Furthermore, recent studies have demonstrated a consistent link between basic needs satisfaction and objective outcomes. For example, Reeve and Tseng (2011) found that participants who were working in a controlling setting compared to an autonomy supportive or neutral setting produced significantly more of the stress hormone cortisol, even when the tasks being completed were enjoyable. In addition, Ahmad, Vansteenkiste, and Soenens (2013) demonstrated that children who rate their basic needs as more fulfilled tend to be rated as better adjusted in school by their teachers. Basic needs fulfillment has also been implicated in the amount of engagement individuals feel in specific situations. For instance, Van der Elst, Van den Broeck, De Witte, and De Cuyper (2012) found that frustration of autonomy, competence, and relatedness needs in the workplace predicted job insecurity and emotional exhaustion in employees.

Moreover, satisfaction of the three needs has been demonstrated to predict secure attachment relationships (La Guardia, Ryan, Couchman, and Deci, 2000) and ratings of whether an event was satisfying (Sheldon, Elliot, Kim, & Kasser, 2001). La Guardia et al. (2000) also found that there was significant variability for the level of attachment to important others (e.g., mother, romantic partner, best friend) within a single individual. Thus, not all relationships satisfy one’s need for relatedness at the same level for one individual. Sheldon and colleagues investigated whether the three identified basic needs (autonomy, competence, and relatedness) were consistently the most associated with satisfying life events, compared to 7 other potential basic needs. Participants consistently rated autonomy, competence, and relatedness needs as the most fulfilled after the occurrence of satisfying life events.

As overall well-being, secure relationship attachments, engagement, and situational satisfaction share a strong relationship with basic need satisfaction, it is implied that psychological interventions which support a client’s sense of autonomy, competence, and

relatedness in psychotherapy would produce beneficial client outcomes and higher rates of client retention. In essence, these needs-fulfilled clients might experience greater well-being, a better relationship with their therapist, and a better experience of- and more engagement with the process of therapy, and these positive outcomes would likely lead to greater engagement in therapy and reduced early termination from treatment.

SDT: Types of Motivation

SDT principles focus not only on the amount of motivation individuals possess in various life domains, but also the types of motivation individuals hold (Deci & Ryan, 2008; Brown & Ryan, 2015). Previous theories of human motivation were primarily based upon the amount of motivation individuals demonstrated in specific behaviours or activities. Those who reported a high amount of motivation were thought to be more likely to succeed in achieving their goals. However, Deci and Ryan (2008) theorized that the quality of motivation for particular life domains would prove more predictive of outcome (e.g., psychological health, quality of life, performance in a domain, creative problem solving, abstract learning). This theory was borne out in an abundance of research in an extensive number of areas (Deci & Ryan, 2008). Researchers have used an SDT framework of motivation to predict outcomes in a wide variety of behaviour change programs, including those targeting weight loss (Williams, Grow, Freedman, Ryan, & Deci, 1996), alcohol cessation (Ryan, Plant, & O'Malley, 1995), job performance (Gagné & Deci, 2005), and academic performance (Guay, Ratelle, Roy, & Litalien, 2010). For instance, Ryan and colleagues (1995) reported that autonomous motivation significantly predicted improvement in symptoms in a group of individuals receiving alcohol cessation treatment. Williams et al. (1996) discovered a similar relationship between autonomous motivation and successful weight loss. Guay and colleagues (2010) found that autonomous motivation mediated the relationship between high school students' academic self-concept and the level of academic achievement attained. More recently, autonomous motivation has been employed as a predictor of successful symptom reduction in psychotherapy (Ryan & Deci, 2008).

According to SDT, motivation takes several different forms, ranging on a spectrum from the most externally generated form of motivation to the most internalized form. In the SDT framework, a distinction is made between autonomous motivation and controlled motivation.

Individuals are said to be autonomously motivated when they perceive their goals to be independently chosen, personally meaningful, and when they experience volition in acting towards those goals (Deci & Ryan, 2008; Schultz & Ryan, 2015; Zuroff et al., 2012). When individuals experience controlled motivation, however, their drive to act is powered by external rewards or punishments, or internal pressures (e.g., approval seeking, avoidance of shame; Deci & Ryan, 2012).

As these concepts apply to psychotherapy, Ryan and Deci (2008) note that the most controlled form of motivation is known as external regulation, and it occurs when a client feels pressured or coerced to act in a certain way. Next, introjection results when clients enter into treatment as a result of feelings of guilt, the seeking of approval from others, or “shoulds” (Deci & Ryan, 2008; Ryan & Deci, 2017). More autonomous than introjection, identified regulation is an extrinsic form of autonomous motivation in which clients identify and act towards personally meaningful therapy goals. In this type of motivation, clients are motivated towards the eventual outcome instead of the process of therapy. A person who experiences integrated regulation moves a step up the autonomous motivation ladder and identifies that the therapeutic tasks are in-line with personal ideals and perceptions. Finally, the most autonomous form of motivation is intrinsic motivation, in which a client demonstrates a genuine curiosity and interest in what is occurring in therapy. SDT posits that those who experience more controlled forms of motivation will experience less than ideal engagement in therapy and less long-term success. Ryan and Deci (2008) suggest that autonomous motivation is essential in the therapeutic process to facilitate lasting and meaningful change. They proposed that clients who experience more autonomous motivation are better able to engage in therapy tasks resulting from an internal sense of responsibility for the outcome (i.e., experience more success applying what they learn in therapy to make positive changes necessary for treatment success).

Several studies have investigated the unique contribution of autonomous and controlled motivation to therapeutic outcomes across various schools of psychotherapy. Research has indeed established that more autonomously motivated individuals demonstrate more willingness to effect change and greater therapy persistence. In line with the SDT framework for change, Zuroff and colleagues (2012) examined the role of autonomous motivation, controlled motivation, and autonomy support in the treatment of depression. Across three 16-week manualized treatment forms (Cognitive-Behavioural Therapy, Interpersonal Therapy, and

Pharmacotherapy with clinical management), the authors found that autonomous motivation, controlled motivation, and level of perceived therapist autonomy support at sessions 3, 8, 13, and post treatment predicted depressive severity in the following session. Moreover, higher perceived autonomy support predicted higher ratings of autonomous motivation. As the results were comparable across the three treatment conditions, it is likely that an SDT framework has some utility in identifying new potential common factors in psychotherapy efficacy.

In another investigation of the effect of common factors on psychotherapy outcome, McBride et al. (2010) examined working alliance and autonomous motivation in a sample of depressed outpatients who received a 16-week Interpersonal Therapy treatment. Results indicated that working alliance and autonomous motivation demonstrate a differential effect in treatment, depending on the amount of depression recurrence participants suffer. While both working alliance and autonomous motivation predicted more positive treatment gains, those with highly recurrent depression benefitted most from a better working alliance while those with less recurrent depression benefitted from both working alliance and autonomous motivation. Additionally, controlled motivation negatively impacted participants' likelihood of remission. Thus, the interplay between depression recurrence, working alliance, and autonomous motivation indicate that these factors hold clinical utility and should be monitored in order to inform treatment.

Mansour and colleagues (2012) also investigated the role of autonomous motivation in treatment outcome in a sample of typically treatment-resistant clients (those diagnosed with bulimia-spectrum eating disorders). The authors reported that those clients who possessed higher levels of autonomous motivation prior to treatment onset had lower scores post-treatment on a number of symptom specific measures, including eating preoccupation, binge eating, anxiety and depression, relationship to the self and others, and impulsivity. Thus, it appears that autonomous motivation is consistently predictive of positive therapeutic outcomes across a variety of treatment methods and diagnoses. This investigation found autonomous motivation to be predictive of outcome when autonomous motivation was measured prior to treatment. Theory would suggest that autonomy support during therapy would have an additional positive impact on outcome.

Autonomy Support

Autonomy support has been investigated as a causal mechanism for the development of autonomous motivation in individuals in a variety of situations (e.g., academics, sports, weight loss). Autonomy supportive individuals provide meaningful rationales, acknowledge negative feelings, use noncontrolling language, offer meaningful choices, and nurture internal motivational resources (Núñez & León, 2015). For example, when teachers were instructed on techniques to improve autonomy support in the classroom, engagement of students in the learning process was significantly higher than for those teachers who received no such intervention (Reeve, Jange, Carrell, Jeon, & Barch, 2004; Vansteenkiste et al., 2018). Pelletier, Fortier, Vallerand, and Briere (2002) found that sports coaches who were more control-oriented elicited more controlled forms of motivation in their athletes, whereas coaches who were autonomy supportive elicited significantly more autonomous motivation. Additionally, Williams et al. (1996) found that autonomous motivation for weight loss was predicted by the level of autonomy support perceived from the health care staff who were delivering the intervention.

More recently, the role of autonomy support as a tool for fostering a greater sense of autonomous motivation in psychotherapy clients has been explored. Therapeutic environments are said to be autonomy-supportive when the therapist downplays the pressure to enact specific behaviours and emphasizes encouraging clients to base their actions on personally meaningful motives and ideals (Ryan et al., 2010; Ryan & Ryan, 2019). Autonomy support can be said to be achieved when a client feels able to identify personally meaningful reasons to enact change and does not feel pressured to act in a certain way (Ryan et al., 2010; Ryan & Ryan, 2019).

Motivational interviewing (MI) is a psychotherapeutic intervention dedicated to the promotion of behaviour change (Miller & Rollnick, 2012) via increasing client motivation to change. In order to investigate the efficacy of motivational interviewing, Westra and Dozois (2006) conducted a study in which half of participants received a three session “pre-treatment” of motivational interviewing, followed by cognitive-behavioural therapy (CBT), and the other half received only the cognitive-behavioural therapy intervention. The authors found that cognitive-behavioural therapy responders were significantly more frequent in the motivational interviewing pre-treatment group compared to the no pre-treatment group. In an attempt to explain the efficacy of forms of therapy dedicated to the improvement of clients’ sense of internal volition, Markland, Ryan, Tobin, and Rollnick (2005) applied the SDT framework to motivational

interviewing. The authors suggested that motivational interviewing techniques seemed to encourage clients to develop an internal sense of motivation for therapeutic change, consistent with an autonomy-supportive environment. Furthermore, a motivational interviewing style of psychotherapy typically promoted the support of a client's basic psychological needs for autonomy, competence, and relatedness to others. Within motivational interviewing psychotherapy, the authors theorize that autonomy is promoted through nondirective questioning and reflection, competence through the delivery of case-relevant knowledge, and relatedness through the provision of unconditional positive regard (Markland et al., 2005; Ryan and Deci, 2008).

In addition, Tee & Kazantzis (2011) suggested that SDT might provide a sound theoretical basis for the benefits of collaborative empiricism (CE). Collaborative empiricism is a defining characteristic of cognitive therapy in which a client and therapist collaborate actively to pinpoint problematic situations and to test client's beliefs empirically through the designing, implementation, and evaluation of 'tests'. Tee and Kazantzis proposed that SDT could explain the mechanism through which collaborative empiricism moderates therapeutic outcome. According to the authors, collaborative empiricism supports client autonomy through providing a meaningful behaviour change rationale, minimized importance of external contingency reinforcement and the provision of choice in treatment, and the acknowledgement of negative feelings. Through this autonomy supportive environment, clients who also feel a high degree of competence to enact the behaviour change are then able to muster the volition to do so. Buckner and Schmidt (2009) also investigated the utility of pairing motivational enhancement therapy (MET) with cognitive-behavioural therapy. Participants (socially anxious clients) were assigned to either a motivational enhancement therapy for cognitive-behavioural therapy treatment condition or a control group. The authors found that those participants who received the motivational enhancement therapy intervention were significantly more likely to attend a first cognitive-behavioural therapy session. These participants also demonstrated significantly more interest in being contacted by a therapist for the purpose of scheduling an appointment.

Ryan and colleagues (2010) also applied the SDT framework to a variety of psychotherapies as an explanatory factor in the positive outcomes produced by each. For example, the authors suggest that within behavioural therapies, practitioners facilitate increased externally regulated motivation via external reinforcements and punishments in order to effect

behavioural change. Further, while not explicitly stated as intentionally autonomy-supportive, cognitive-behavioural practice guidelines typically review the importance of allowing clients to feel a sense of volition in treatment, personal choice, and an internal valuing of the process of therapy.

Competence and Relatedness Support

While autonomy support has been researched in various mental health contexts for its effect on autonomy satisfaction and the development of autonomous motivation, competence support and relatedness support, as well as the combination of the support of all three needs, has received sparse research attention. However, other branches of psychology (e.g., social psychology) have examined similar variables. For example, studies have provided participants with success versus failure narratives (likely affecting participants' competence needs) to examine the effect on goal pursuit (e.g., Higgins & Spiegel, 2004). Further, researchers have manipulated social acceptance versus exclusion narratives (likely affecting participants' relatedness needs) to examine wide-ranging behavioural outcomes (e.g., aggression towards innocent targets, cooperation, risk-taking, procrastination, analytical reasoning; Twenge & Baumeister, 2005).

To further address this gap in the research, Sheldon and Filak (2008) experimentally manipulated the support and thwarting of all three needs within a game-learning experience in a 2 x 2 x 2 factorial design. The authors found that participants who underwent competence and relatedness support conditions scored higher on need satisfaction, mood, intrinsic motivation, and objective game performance. In contrast, the autonomy support factor only moderated one of the competence support effects (i.e., when both competence and autonomy were thwarted, participants were far less likely to recommend the game to others). While this result did not fit with the authors' predicted outcomes, they hypothesized that autonomy support did not measurably affect their variables of interest (i.e., need satisfaction, mood, intrinsic motivation) because the autonomy support or thwarting manipulation was not as robust in the game-learning context. For example, supported participants picked the colour of game grid, and thwarted participants were not given a choice because it was 'required for experimental control' (this statement may have seemed normal to participants within a scientific study rather than on opportunity for choice that had been thwarted).

Working Alliance and Basic Needs Support in Psychotherapy

The association of working alliance with motivation has also been studied in the context of psychotherapy. Although working alliance and basic psychological needs support have not been used as interchangeable constructs, Keleher and colleagues (2017) investigated their commonalities. Results signaled that working alliance and basic needs support measures were likely tapping into the same underlying construct, with measures of basic needs potentially accounting for a wider breadth of the therapist and client interaction. There is evidence to suggest that working alliance correlates well with client and therapist-rated stages of change according to the Transtheoretical Model of motivation for change. For example, clients who are in the precontemplation (i.e., least motivated) stage of change tend to rate working alliance with their therapist as lower, while clients who endorse more advanced stages of change report a better working alliance and demonstrate significantly better post-treatment outcomes (e.g., Norcross, Krebs, & Prochaska, 2011; Rochlen, Rude, and Baron, 2005; Taft, Murphy, Musser, & Remington, 2004).

A good working alliance also seems to predict more positive treatment outcomes even when controlling for treatment modality, pre-treatment symptom severity, and baseline level of motivation (e.g., Ilgen, McKellar, Moos, & Finney, 2006), supporting the hypothesis that the relationship between therapist and client might improve engagement with- and motivation for therapy. Despite these consistent findings, little research has examined the reciprocal or causal influence of working alliance on motivation and vice versa over the course of treatment. Ilgen et al. (2006) found that positive alliance was particularly important for clients who presented with lower motivation for alcohol use disorder treatment. However, this research only measured the variables of interest at a few time points. Furthermore, the stages of change (Transtheoretical) model used in the majority of this research on the relationship between motivation and working alliance has been criticised for having descriptive but not explanatory power. The model has been said to be helpful for describing client motivation in the moment, but is difficult to use as an explanatory mechanism for client movement from a less motivated to more motivated state over time (Armitage, 2009). It is also difficult to identify through the Transtheoretical model the therapist and client factors that might influence a client's movement from one stage to the next.

Putting the Puzzle Pieces Together

SDT presents an evidence-based set of guidelines and principles that aim to increase client motivation to reflect on experiences and events in their lives, in order to make positive changes in their goals, behaviours, and relationships (Ryan & Deci, 2008; Ryan & Deci, 2017). The fulfillment of basic psychological needs and the perceived support for the fulfillment of these needs is essential to the development of an internal and personally meaningful sense of motivation for behaviour change. The principles of SDT readily lend themselves to application in many different treatment interventions, as treatment motivation and a supportive therapeutic environment are considered essential in many psychotherapy modalities (Ryan & Deci, 2008; Ryan & Deci, 2017).

While SDT provided a promising theoretical framework with which to begin evaluating evolving client motivation for- and engagement with psychotherapy, there are a number of limitations to past research and many unanswered questions. First, as alluded to above, a great deal of the research conducted in this area to date has concentrated on autonomy support (Rocchi et al., 2017). Theoretically, SDT proposes that competence support and relatedness support should have an equally essential role in contributing to movement from a less motivated to more motivated state (Deci & Ryan, 2000; Pomerantz, Cheung, & Qin, 2012). As such, these understudied interpersonal supportive behaviours should be afforded more attention. Accordingly, all three needs and needs-supportive behaviours should be measured simultaneously in order to determine whether there are distinguishable effects of each and to learn if and how each contributes to varying forms of motivation over time. Moreover, both supportive and thwarting behaviours should be examined (Rocchi et al., 2017; Van den Broeck et al., 2016). Merely failing to provide support for a basic need is conceptually distinct from actively thwarting that need (Bartholemew, Ntoumanis, & Thøgersen-Ntoumani, 2009; Sheldon & Filak, 2008; Van den Broeck et al., 2016).

Given the theoretical underpinnings of SDT (i.e. that needs satisfaction is central to the development of more internalized forms of motivation), it is probable that therapist basic needs support and resulting satisfaction is a significant precursor to stronger motivation for treatment. As previous studies have found strong links between client motivation, treatment completion and positive outcomes (e.g. Bados et al., 2007; Mansour et al., 2012; Zuroff et al., 2007, 2012), it is likely that this greater fulfilment of needs and resulting motivation is in turn a significant

contributor to persistence in psychotherapy and better therapeutic outcomes. Should this be borne out in future research, support of basic needs in treatment would be an important common factor to which psychotherapists would need to attend.

Study 1: Basic Psychological Needs Support Experimental Study

This study investigated the effect of the support or thwarting of basic psychological needs (autonomy, competence, relatedness to others) as articulated in SDT on motivation for and completion of emotionally demanding tasks. Our goal was to develop an analogue study for examining the effect of basic needs satisfaction in psychotherapy on motivation for treatment, engagement and persistence in treatment, and therapy homework completion.

As noted in the above literature review, it is theorized that if psychotherapeutic treatment supports the satisfaction of one's basic psychological needs and facilitates clients in satisfying their basic needs in other life domains, the treatment will more effectively promote autonomous motivation and well-being, and will likely result in lower levels of early termination. Basic psychological needs thwarting in psychotherapy would theoretically demonstrate the opposite effect. Thus, this study was designed to temporarily increase or decrease undergraduate participants' satisfaction of basic psychological needs within a particular domain in-lab, in order to examine corresponding changes in their level of autonomous and controlled motivation for an emotionally demanding task similar to therapy (i.e., a mindfulness meditation intervention for stress management). The needs in question were only supported or thwarted in the context of their satisfaction for this particular intervention. The mindfulness tasks (of which participants chose or were assigned to one of four) were completed over the course of a week following the in-lab portion of the study. Participants rated their needs satisfaction, level of motivation to complete mindfulness techniques, and mindfulness practice daily, and were asked to complete several brief motivation and basic psychological needs satisfaction measures online post-study.

Overall, the study aimed to address the following research questions:

1. What individual effect does the satisfaction of each of the basic needs have on participant motivation and intervention completion?
2. Does the temporary increase in satisfaction of the three basic psychological needs (autonomy, competence, and relatedness) result in greater intervention completion?

Conversely, does the temporary decrease in satisfaction of the three basic psychological needs result in lower intervention completion?

3. Does the supporting or thwarting of specific needs correspond with reported levels of autonomous or controlled motivation day to day for the intervention participants complete over the course of the week?

Our hypotheses were as follows:

1. Participants in needs support versus thwarting conditions will report greater basic needs satisfaction from pre- to post-study.
2. Greater reported needs satisfaction will result in more intervention completion.
3. Daily reported needs satisfaction and motivation to complete the intervention will be correlated (i.e., higher ratings of needs satisfaction will correspond with higher ratings of autonomous motivation and controlled motivation).
4. Autonomy support, competence support, and relatedness support will predict higher ratings of autonomous motivation (and controlled motivation to a lesser extent) and intervention completion.

Method

Participants

Participants ($N = 100$) were undergraduate students from the University of Waterloo who were recruited to participate in this study for course credit. Participants were able to view the study details on SONA (a university-based online research recruitment tool) and self-selected into the study. There were no limitations to participation in terms of age, gender, or other participant characteristics. Participants included 23 who identified as male, 75 who identified as female, and three who declined to provide their identified gender, with an average age of 20.10 ($SD = 1.71$).

Measures

Life Satisfaction and Frustration Scale (LSFS). The LSFS is a 24-item scale developed by Chen et al. (2015), designed to evaluate the degree to which a person's basic psychological needs are supported or thwarted generally in their life. Item responses are rated on a 5-point

Likert scale, ranging from (1) Not at all true to (5) Completely true. The original scale demonstrated good reliability on all subscales. Cronbach's alphas for the current data indicate good reliability within the satisfaction subscales of autonomy ($r_{xx} = .83$), relatedness ($r_{xx} = .86$), and competence ($r_{xx} = .91$), as well as within the thwarting subscales of autonomy ($r_{xx} = .84$), relatedness ($r_{xx} = .81$), and competence ($r_{xx} = .86$). Overall basic needs satisfaction and frustration subscales were significantly negatively correlated ($r = -.70, p < .01$).

Basic Psychological Needs Questionnaire – State (BPNQ-S; developed by study author). The BPNQ-S was comprised of four items: one each assessing participants' perceived autonomy, competence, and relatedness satisfaction, and motivation at the state-level (e.g., "I'm gaining confidence that I can make use of this technique."). The items were meant to be interpreted individually and are not summed to yield a scale score. The basic needs items were significantly correlated (correlations ranging from .40 to .46; see Table 1).

Autonomous and Controlled Motivation for Intervention – State (adapted from Zuroff et al., 2007; in-turn developed based on work by Williams et al. and the Rochester Group). The ACMI-S is a 6-item measure evaluating autonomous and controlled motivation specifically as experienced in the context of completing this mindfulness intervention.

This motivation measure was modified from a measure developed by Zuroff, Koestner, Moskowitz, McBride, Marshall, and Bagby (2007; adapted from Rochester Group and Williams' Treatment Self-Regulation Questionnaire). Confirmatory factor analysis (Keleher & Oakman, 2019) indicated that, at the first time-point, two factors were evident as predicted (autonomous and controlled motivation). Items 2, 4, and 6 comprise the autonomous motivation construct. Items 3 and 5 comprise the controlled motivation construct. Item 1 ("I feel like I should do something to reduce my level of stress"), while predicted to correlate well with the controlled motivation construct, instead correlated highly with the autonomous motivation items.

At endpoint, confirmatory factor analysis indicated once again that two factors were apparent in the measure (Keleher & Oakman, 2019). Items 2, 4, and 6 comprised the autonomous motivation scale as predicted. Items 1 and 5 correlated highly and were orthogonal to the autonomous motivation items, whereas item 3 correlated somewhat evenly with both autonomous and controlled motivation items. Despite the irregularities between time points in the correlation of the controlled motivation items, we decided to divide the overall measure into two subscales (autonomous motivation as measured by items 2, 4, and 6, and controlled

motivation as measured by items 1, 3, and 5). It is possible that some of the predictive power of the controlled motivation subscale was muted due to the correlation of item 1 (time point 1) and item 3 (endpoint) with autonomous motivation. However, previous research indicates that controlled and autonomous motivation are often strongly correlated regardless (Zuroff et al., 2007) and the items developed to measure autonomous motivation were consistent between time points. Cronbach's alpha indicated good internal consistency for the autonomous motivation subscale ($r_{xx} = .80$) and adequate internal consistency for the controlled motivation subscale ($r_{xx} = .63$). Autonomous and controlled motivation subscales were significantly correlated ($r = .57, p < .01$).

Perceived Stress Scale (PSS; adapted from Cohen, Kamarck, & Mermelstein, 1994).

This five-item scale measures perceived stress experienced by participants in the last week on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). Items include questions such as "In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?". Cronbach's alpha indicated good internal consistency ($r_{xx} = .77$).

Daily Intervention Questions. Participants were asked several questions daily regarding their participation in the mindfulness intervention on the previous day (i.e., whether they had completed mindfulness exercises, how long they spent on said exercises).

Post-Study Questionnaire. The final questionnaire included the daily intervention questions, the Life Satisfaction and Frustration Questionnaire, and a final question regarding overall number of minutes completing the mindfulness intervention over the week (participants were assured that they would not be docked participation credits for answering this item honestly). Participants were also asked to report their belief in the true nature of the study (i.e., was there an unstated purpose and what was it) and the strength of their belief that the study was examining what was purported at the initial lab meeting. Thirty-five participants (42.7%) did not suspect deception, 40 participants (48.8%) somewhat suspected the study had a different purpose than the purported one, and 7 participants (8.5%) strongly suspected the study had a different purpose. Those who indicated strong suspicion of a different study purpose than indicated listed the belief that i) the intervention probably would not relieve their stress, or ii) expressed frustration that they were not assigned the intervention they wanted. No participant described a suspected study purpose related to interpersonal support or thwarting. As these participants did not indicate suspicion of the true study purpose, we believed that they would not have altered

their participation in a manner that would bias their results (e.g., significantly alter their perceived needs satisfaction or motivation for the mindfulness task). A visual inspection of their data did not reveal any oddities that would suggest that their results were biased. Therefore, we opted to keep these participants in our final sample.

Procedure

Participants were randomly assigned to a condition that either supported or thwarted their basic psychological needs. Autonomy, competence, and relatedness were systematically either supported or thwarted, resulting in eight study conditions. Conditions (see Appendix A for lab scripts and Appendix B for condition materials) each included either a support or thwarting component of autonomy, competence, and relatedness, and these elements appeared in conditions in a fully crossed design (see below).

Condition	<i>Autonomy</i>	<i>Competence</i>	<i>Relatedness</i>
1	Support	Support	Support
2	Support	Support	Thwart
3	Support	Thwart	Support
4	Support	Thwart	Thwart
5	Thwart	Thwart	Support
6	Thwart	Support	Support
7	Thwart	Support	Thwart
8	Thwart	Thwart	Thwart

Figure 1. Study 1 conditions.

All participants attended a half hour in-lab meeting with a researcher. After reading the information letter and providing consent, they were asked to complete a measure of general basic psychological needs fulfillment and thwarting in their daily lives, as well as a measure of current stress level (see Appendix C for measures used). Participants were then provided with descriptions of four potential mindfulness meditation resources that they might be asked to use over the course of the next week. Choices included three 10- to 15-minute YouTube videos to be listened to twice or three times in the next week or a packet of readings to complete over the next week which introduce participants to mindfulness and describe techniques to beginners. Participants were informed that they would receive prorated course credit for the portions of the study they completed. They were informed that, while credit for completing the mindfulness intervention would only be given for the required half hour, they were welcome to practice the techniques as much as they wanted or would find useful.

Participants were randomly assigned to one of the eight basic needs support and/or thwarting conditions. They were asked to rate their preference of mindfulness intervention after the descriptions were provided. Participants were given a basic needs satisfaction and thwarting measure at the outset. All participants were provided with an explanation of the mindfulness intervention for stress management that they would be completing over the course of the next week and were asked to rate the four possible interventions (three YouTube videos and the packet of readings) in their order of preference, from one (most preferred) to four (least preferred).

Participants in conditions involving autonomy support chose their preference of intervention and were encouraged to practice the intervention at whatever point they chose over the next week. Participants in conditions involving autonomy thwarting were “randomly assigned” to the condition they rated as least appealing and were told to complete the intervention on specific days and times. Participants in conditions involving competence support were provided with information about mindfulness effectiveness and were guided through a meditation practice. Participants in conditions involving competence thwarting were provided only with a definition of mindfulness and were not guided through a mindfulness practice or given any additional instructions apart from what was delivered through the interventions themselves. Participants in conditions involving relatedness support received a brief, unstructured interview about life stress. Supportive feedback and on-campus resources for stress management were provided, and these participants received an email half-way through the week to check in, again validating their experience of stress. Participants in relatedness thwarting conditions were read to from a written script, with no inquiry about their personal experience of stress. They were given an information sheet about the negative effects of student stress and their check-in email was a form letter with [insert name] instead of their actual name.

Over the course of the week after the initial lab meeting, participants performed their mindfulness meditation intervention on their own. They were emailed a Qualtrics link daily which they followed to completed a questionnaire regarding their basic needs satisfaction (Basic Psychological Needs Questionnaire – State), motivation for completing the stress management intervention (Autonomous and Controlled Motivation for Intervention – State), perceived stress level (Perceived Stress Scale), and details about how long they used the intervention techniques for the previous day. Once one week had passed, participants were emailed another Qualtrics

link to complete post-study questionnaires (identical to baseline measures) regarding their level of basic psychological needs fulfillment and thwarting, and motivation to use the learned techniques in the future. Participants were also given the opportunity to inform researchers whether or not they misrepresented their completion of the mindfulness intervention in order to be granted study credits. This step was undertaken because researchers were not able to directly observe this portion of the study and wished to ensure that their data was not affected by participants' prioritizing of granted credits over data accuracy. Participants were assured that the number of credits they were to be granted or their SONA status would not be affected in any way by their answer. Once participants completed this final set of questions, they were provided with a debriefing information letter and consent form regarding the true purpose of the study and explaining the deception involved.

Results

Pre- and -Post Analyses

1. Did needs support conditions produce significantly higher state ratings of the need supported?

We conducted a series of one-way ANOVAs in order to determine whether our participants were sensitive to manipulations of autonomy, competence, and relatedness support immediately following the 30-minute in-lab meeting. There were no differences in ratings of baseline autonomy satisfaction between those in autonomy supportive or thwarting conditions, $F(1,98) = 0.01$, *ns*, nor in ratings of baseline competence satisfaction in competence supportive or thwarting conditions, $F(1,98) = 0.03$, *ns*, nor in ratings of baseline relatedness satisfaction in relatedness supportive or thwarting conditions, $F(1,98) = 1.83$, *ns* (see Table 2). We also conducted independent samples t-tests to examine potential group differences in in-lab needs satisfaction ratings between those participants who were assigned to either an all-needs-supported condition or an all-needs-thwarted condition. These tests were conducted to address the possibility that differences (or lack thereof) in needs satisfaction ratings were attributable to having a combination of needs supported or thwarted rather than the ratings being exclusively attributable to the support condition in question (e.g., for those in autonomy support conditions, some participants will have had competence support or thwarting components and some will have had relatedness support or thwarting components). Results indicated no differences between

all-needs-supported ($n = 9$) and all-needs-thwarted ($n = 14$) groups in the perceived satisfaction of autonomy (all-supported $M = 6.11$, $SD = 1.45$; all-thwarted $M = 6.07$, $SD = 1.44$), $t(21) = 0.06$, *ns*, competence (all-supported $M = 5.67$, $SD = 1.23$; all-thwarted $M = 5.79$, $SD = 1.58$), $t(21) = -0.19$, *ns*, or relatedness (all-supported $M = 6.22$, $SD = 0.83$; all-thwarted $M = 5.86$, $SD = 1.29$), $t(21) = 0.75$, *ns*, at baseline.

However, one-way ANOVAs conducted to examine the relationship between endpoint needs satisfaction and condition revealed some group differences (see Table 3). At endpoint, participants in autonomy supportive conditions rated their endpoint autonomy satisfaction as significantly greater than those in autonomy thwarting conditions, $F(1,92) = 4.24$, $p = .042$. In contrast, there were no differences between participant ratings of endpoint autonomy satisfaction in competence support or thwart conditions, $F(1,92) = 1.52$, *ns*, or relatedness support and thwart conditions, $F(1,92) = 0.00$, *ns*. Furthermore, participants in relatedness support versus thwarting conditions reported significantly higher endpoint *competence* satisfaction, $F(1,92) = 4.00$, $p = .048$. Conversely, participants in autonomy support versus thwarting, $F(1,92) = 0.00$, *ns*, and competence support versus thwarting, $F(1,92) = 2.10$, *ns*, conditions did not differ on ratings of endpoint competence satisfaction. Additionally, there were no differences in endpoint relatedness satisfaction ratings for participants in autonomy support versus thwarting, $F(1,92) = 1.68$, *ns*, competence support versus thwarting, $F(1,92) = 0.71$, *ns*, or relatedness support versus thwarting, $F(1,92) = 0.12$, *ns*, conditions.¹

Additionally, we repeated several independent samples t-tests to examine potential group differences in endpoint needs satisfaction ratings, between those participants who were assigned to either an all-needs-supported condition or an all-needs-thwarted condition. Once again, these tests were run to determine whether differences in endpoint needs satisfaction ratings were attributable to having a combination of needs supported or thwarted rather than the ratings being exclusively attributable to the support condition in question (e.g., for those in autonomy support conditions, some participants will have had competence support or thwarting components and some will have had relatedness support or thwarting components). Results indicated that

¹ The principle of familywise correction holds that alpha should be adjusted to be lower than the usual .05 level when conducting multiple tests within a “family,” in order to lessen the possibility of Type I error (e.g., Curran-Everett, 2000; Tukey, 1991). However, some critics (e.g., O’Keefe, 2003), argue that adjusting the alpha level owing to number of tests conducted inappropriately localizes Type I error by unjustly marking a set of tests for which alpha adjustment must be undertaken. We have chosen to forgo using a familywise correction.

participants in the all-needs-supported condition rated endpoint competence satisfaction significantly higher than those in the all-needs-thwarted condition, $t(21) = 2.66, p = .015$. There were no other differences in endpoint needs satisfaction (i.e., autonomy, relatedness) ratings between all-needs support or all-needs-thwarting conditions. However, power was a limitation in these analyses, as the all-needs-supported condition ($n = 9$) and the all-needs-thwarted condition ($n = 14$) encompassed a small number of participants.

2. Were needs satisfaction ratings (individually or combined) associated with higher ratings of autonomous or controlled motivation?

In order to investigate the predictive effects of baseline needs satisfaction on baseline motivation, regression analyses were conducted. In the model, we examined the contribution of the baseline perceived satisfaction of each individual need on baseline autonomous motivation at step 1, each combination of pairs of the needs via interaction at step 2 (i.e., autonomy and competence, autonomy and relatedness, competence and relatedness), and the interaction of all three needs in combination at step 3. At baseline (see Table 4), only the first step of the model (i.e., satisfaction of each individual need) was significantly related to autonomous motivation, $R^2 = .323, SE = 2.53, F(3,96) = 15.30, p < .001$. Interactions of needs in pairs (step 2) and the interaction of all three needs (step 3) did not predict ratings of baseline autonomous motivation over and above the contribution of the satisfaction of each individual need at baseline. As for controlled motivation at baseline (see Table 5), step 1 of the model was again the only significant predictor of controlled motivation, $R^2 = .259, SE = 3.01, F(3,96) = 11.16, p < .001$. Step 2 of the model was trending towards significance, $R^2 = .313, SE = 2.94, F(3,96) = 2.45, p = .069$, indicating the possibility that increased baseline needs satisfaction in more than one need might be associated with greater baseline controlled motivation. This effect seems to be driven most by the combination of competence and relatedness satisfaction at baseline, $R^2 = .298, SE = 2.94, F(1,93) = 5.32, p = .023$.

The same analyses were repeated for endpoint perceived needs satisfaction and endpoint autonomous and controlled motivation. In the model, we examined the contribution of the perceived endpoint satisfaction of each individual need on endpoint autonomous motivation at step 1, each combination of pairs of the needs via interaction at step 2 (i.e., autonomy and competence, autonomy and relatedness, competence and relatedness), and the interaction of all three needs in combination at step 3. Again, at endpoint (see Table 6), only Model 1 (i.e.,

satisfaction of each individual need) was significantly related to endpoint autonomous motivation, $R^2 = .260$, $SE = 2.00$, $F(3,90) = 10.56$, $p < .001$. Interactions of needs in pairs and the interaction of all three needs did not predict ratings of endpoint autonomous motivation over and above the contribution of the satisfaction of each individual need at endpoint. As for controlled motivation at endpoint (see Table 7), none of the tested models explained a statistically significant proportion of variance in the experience of controlled motivation.

3. Were ratings of perceived needs satisfaction associated with autonomous or controlled motivation?

Next, we examined the relationship between needs satisfaction and motivation at the initial in-lab meeting and at endpoint. Regression analyses indicated that higher baseline perceived needs satisfaction was significantly associated with higher baseline ratings of autonomous motivation, $R^2 = .323$, $SE = 2.53$, $F(3,96) = 15.30$, $p < .001$ (see Table 8). Specifically, participants who rated baseline perceived competence satisfaction as better experienced more baseline autonomous motivation, $\beta = .455$, $t(96) = 4.77$, $p < .001$. There was also a trend towards a significant association between baseline perceived relatedness needs satisfaction and baseline autonomous motivation, $\beta = 1.86$, $t(96) = 1.91$, $p = .059$. However, there was no significant association between baseline perceived autonomy satisfaction and baseline autonomous motivation, $\beta = .026$, $t(96) = .262$, ns . Similarly, higher baseline perceived needs satisfaction was significantly related to higher baseline ratings of controlled motivation, $R^2 = .259$, $SE = 3.01$, $F(3,96) = 11.16$, $p < .001$ (see Table 9). Specifically, higher baseline perceived competence satisfaction was again significantly associated with higher baseline controlled motivation, $\beta = .397$, $t(96) = 3.97$, $p < .001$. Baseline perceived autonomy satisfaction, $\beta = .048$, $t(96) = .463$, ns , and baseline relatedness satisfaction, $\beta = .161$, $t(96) = 1.57$, ns , were not significantly associated with controlled motivation at baseline.

We then examined the relationship between endpoint perceived needs satisfaction and motivation at endpoint. Regression analyses revealed that higher endpoint perceived needs satisfaction was significantly associated with higher endpoint ratings of autonomous motivation, $R^2 = .260$, $SE = 2.00$, $F(3,90) = 10.56$, $p < .001$ (see Table 10). As at baseline, participants who rated endpoint perceived competence satisfaction as better experienced more autonomous motivation at endpoint, $\beta = .466$, $t(93) = 4.38$, $p < .001$. Endpoint perceived autonomy and relatedness satisfaction were unrelated to endpoint autonomous motivation ratings. Finally, there

was no association between endpoint perceived needs satisfaction and controlled motivation at endpoint (see Table 11).

4. Did homework completion vary as a function of support versus thwarting conditions or perceived needs satisfaction?

One-way ANOVAs comparing all-needs-supported ($n=9$) versus all-needs-thwarted ($n=14$) conditions on mindfulness task completion over the course of the week indicated that participants in support conditions reported significantly greater task completion, $F(1,23) = 5.38$, $p = .030$ (see Table 12). Further, participants in relatedness support versus thwarting conditions reported significantly greater task completion, $F(1,100) = 8.75$, $p = .004$, and there was a trend towards significance in the same direction comparing autonomy support to thwarting conditions, $F(1,100) = 2.82$, $p = .096$. However, there appeared to be no significant difference between competence support and thwarting conditions in terms of task completion, $F(1,100) = 0.04$, *ns*.

5. Did the proportion of overall support or thwarting have an effect on outcome?

Our above results revealed the possibility that some of our needs support or thwarting interventions delivered in lab were underpowered. We speculated that combining conditions in which the majority (i.e., two of three or all three) of needs were either supported or thwarted would lead to significantly greater effects in needs satisfaction, motivation, and intervention completion. In essence, we wanted to examine whether feeling overall supported in one’s basic psychological needs would produce positive outcomes. To investigate this possibility, we collapsed the study’s 8 conditions into 2: those with two or more needs supported in-lab and those with two or more needs thwarted in lab. The two new conditions appear in the figure below.

Collapsed Condition Number	Original Condition Number	<i>Autonomy</i>	<i>Competence</i>	<i>Relatedness</i>
1 (2 or More Needs Supported)	1	Support	Support	Support
	2	Support	Support	Thwart
	3	Support	Thwart	Support
	6	Thwart	Support	Support
2 (2 or More Needs Thwarted)	4	Support	Thwart	Thwart
	5	Thwart	Thwart	Support
	7	Thwart	Support	Thwart
	8	Thwart	Thwart	Thwart

Figure 2. Collapsed Study 1 conditions.

We conducted a series of one-way ANOVAs in order to determine whether our participants were sensitive to manipulations of autonomy, competence, and relatedness support over the course of the study by computing a mean rating of participants' autonomy, competence, and relatedness needs satisfaction as reported over the course of the week. There were no differences in ratings of autonomy satisfaction between those in primarily supportive or thwarting conditions for autonomy, $F(1,98) = 0.71, ns$, nor in ratings of competence satisfaction, $F(1,98) = 0.00, ns$, nor in ratings of relatedness satisfaction, $F(1,98) = 0.00, ns$. We also conducted independent samples t-tests to examine potential group differences in mean needs satisfaction ratings (as aggregated over the course of the week) between those participants who were assigned to either an all-needs-supported condition or an all-needs-thwarted condition. Results indicated no differences between all-needs-supported and all-needs-thwarted groups in the mean perceived satisfaction of any one need.

Further, we conducted one-way ANOVAs comparing primarily needs supported versus primarily needs thwarted conditions on mindfulness task completion over the course of the week. Results indicated that participants in primarily supportive conditions reported significantly greater task completion, $F(1,99) = 4.035, p = .047$. Finally, an adapted version of the Perceived Stress Scale was used to enhance participant buy-in to the premise of the study, but also served as a measure of intervention outcome. An independent t-test indicated that participants in all needs-supportive versus all needs-thwarting conditions demonstrated significantly lower mean ratings of perceived stress aggregated over the week, $t(22) = -2.10, p = .047$.

Time-Series Multi-Level Model Analyses

Participants were asked to rate basic needs satisfaction and autonomous and controlled motivation every day over the course of the week, following the in-lab intervention. Hierarchical growth models were used to examine the relationship of basic needs satisfaction to daily ratings of autonomous and controlled motivation for intervention completion.

Examining trends of motivation over time.

First, we examined the effect of time on autonomous motivation to determine whether it increased in a linear, quadratic, or cubic trend from the beginning to the end of the week after the in-lab manipulation. Three models were run in which time was entered as a fixed effect to examine i) the linear trend, ii) the quadratic trend, and iii) the cubic trend. Time was also entered

as a random effect with a random intercept to test the assumption that participants' ratings of autonomous motivation demonstrated both a random intercept and a random slope. We chose a first-order autoregressive structure (AR[1] Heterogeneous), as the correlation between adjacent time points was assumed to be stronger, with correlations between scores becoming smaller over time. Results indicated that the quadratic trend was the best fit, demonstrating the lowest $-2LL$ value (2105.94). However, the model was not significant, $F(1, 327.34) = 1.15, ns$ (see Table 13). Autonomous motivation at baseline demonstrated significant variance in intercepts across participants, $\text{Var}(u_{0j}) = 5.86, \chi^2(1) = 4.33, p < .001$. The slopes also varied significantly across participants $\text{Var}(u_{1j}) = 0.42, \chi^2(1) = 3.50, p < .001$. In addition, the slopes and intercepts significantly negatively covaried, $\text{Cov}(u_{0j}, u_{1j}) = -0.50, \chi^2(1) = -3.95, p < .001$, indicating that as the intercept for autonomous motivation increases, the slope decreases (i.e., those who rate autonomous motivation higher at baseline do not experience as steep of an increase in autonomous motivation as those who rate it lower at baseline).

Similarly, we examined the effect of time on controlled motivation to determine whether it increased in a linear, quadratic, or cubic trend over the course of the week. Results indicated that the cubic trend was the best fit, demonstrating the lowest $-2LL$ value (2111.48). However, the model was not significant, $F(1, 294.43) = 1.73, ns$ (see Table 14). Controlled motivation demonstrated significant variance in intercepts across participants, $\text{Var}(u_{0j}) = 11.98, \chi^2(1) = 5.68, p < .001$. The slopes also varied across participants $\text{Var}(u_{1j}) = 0.40, \chi^2(1) = 3.67, p < .001$. Further, as above for autonomous motivation, the slopes and intercepts for controlled motivation significantly covaried, $\text{Cov}(u_{0j}, u_{1j}) = -0.37, \chi^2(1) = -3.09, p = .002$.

Relationship between needs satisfaction and motivation over time.

Next, we examined whether adding participant ratings of basic needs satisfaction (level 2 variable: mean score calculated from participant ratings over seven days) to these models would account for variance in participant ratings of autonomous motivation (level 1 variable: daily raw scores trending over the course of the week). First, we examined autonomous motivation. We entered a quadratic trend of time as a fixed effect, as well as participant mean ratings of each basic need (beginning with autonomy satisfaction in Model 1, adding competence satisfaction in Model 2, and finally adding relatedness satisfaction in Model 3). Results indicated that, while participant ratings of autonomous motivation did not significantly vary over time, participants' ratings of autonomy satisfaction, $F(1, 95.29) = 24.45, p < .001$, significantly predicted

autonomous motivation over the course of the week. Adding competence satisfaction to the model provided a significantly better prediction, $F(1, 93.33) = 37.18, p < .001$ ($\chi^2_{\text{Change}} = 2085.73 - 2054.57 = 31.16; df_{\text{Change}} = 9 - 8 = 1$; critical value for chi-square statistic with $df = 1$ is 6.63 for $p < .01$). The addition of relatedness satisfaction did not account for significantly more variance in autonomous motivation than that of autonomy and competence satisfaction, $F(1, 94.14) = 0.04, ns$ (see Table 15).

For controlled motivation (level 1 variable: daily raw scores trending over the course of the week), we entered a cubic trend of time as a fixed effect, as well as participant mean ratings of each basic need (level 2 variable: mean score calculated from participant ratings over seven days) progressively in Models 1, 2, and 3 as described above. Results indicated that participants' ratings of autonomy satisfaction did not significantly predict controlled motivation, $F(1, 93.41) = 3.51, ns$, nor did the addition of participant ratings of competence satisfaction, $F(1, 93.83) = 2.71, ns$, nor the addition of participant ratings of relatedness satisfaction, $F(1, 93.90) = 0.88, ns$ (see Table 16).

Condition effect on the relation of basic needs satisfaction to motivation over time.

Finally, we examined whether our conditions affected the relationship between needs satisfaction and motivation over the course of the week. Conditions were dummy coded to reflect whether they supported or thwarted a particular need (i.e., autonomy support vs thwarting; competence support vs thwarting; relatedness support vs thwarting). First, we focused on autonomous motivation. In all models, time was added as a quadratic fixed effect in the first step. Next, the condition was added as a fixed factor. Then, an individual need was added to the model as a fixed effect covariate. Finally, a fixed effect interaction term (condition * basic need) was added to the model.

Autonomy support vs thwarting conditions did not account for more variance in autonomous motivation than autonomy satisfaction alone, $F(1, 94.50) = 0.05, ns$, nor was the interaction between autonomy support vs thwarting and autonomy satisfaction a significant predictor of autonomous motivation, $F(1, 94.14) = 0.00, ns$ (see Table 17). Competence support vs thwarting conditions also did not account for more variance in autonomous motivation than competence satisfaction alone, $F(1, 91.02) = 2.05, ns$, nor did the interaction between competence support vs thwarting and competence satisfaction significantly predict autonomous motivation, $F(1, 91.30) = 2.18, ns$ (see Table 18). Finally, relatedness support vs thwarting

conditions did not account for more variance in autonomous motivation than relatedness satisfaction alone, $F(1, 91.20) = 1.11, ns$, nor was the interaction between competence support vs thwarting and competence satisfaction a significant predictor of autonomous motivation, $F(1, 91.37) = 1.01, ns$ (see Table 19).

Similar results were found when the controlled motivation dependent variable was entered. Autonomy support vs thwarting conditions did not have a significant effect on controlled motivation, $F(1, 93.42) = 0.03, ns$, nor did the interaction between autonomy support vs thwarting and autonomy satisfaction significantly predict controlled motivation, $F(1, 93.26) = 0.17, ns$ (see Table 20). Competence support vs thwarting conditions did not account for more variance in controlled motivation than competence satisfaction alone, $F(1, 93.73) = 2.40, ns$. However, the interaction between competence support vs thwarting conditions and competence satisfaction was trending towards significance, $F(1, 93.99) = 3.58, p = .061$ (see Table 21), indicating that competence support conditions were possibly contributing to stronger controlled motivation over the course of the week via higher perceived competence satisfaction. Finally, relatedness support vs thwarting conditions did not account for more variance in controlled motivation than relatedness satisfaction alone, $F(1, 93.25) = 1.34, ns$, nor was the interaction between relatedness support vs thwarting and relatedness satisfaction a significant predictor of controlled motivation, $F(1, 93.43) = 1.53, ns$ (see Table 22).

Study 1 – Discussion

The purpose of this study was to evaluate the effect of the support or thwarting of basic psychological needs (autonomy, competence, relatedness to others) on motivation for and completion of emotionally demanding tasks akin to those assigned during psychotherapy, like mindfulness. This study provided an analogue for examining the effect of basic needs support and satisfaction in psychotherapy on motivation for treatment, engagement and persistence in treatment, and therapy homework completion. Through our experimental manipulation we attempted to temporarily increase or decrease participants' satisfaction of basic psychological needs in-lab in order to examine corresponding changes in their level of autonomous and controlled motivation for a mindfulness meditation intervention for stress management.

1. Needs support conditions and needs satisfaction ratings.

Somewhat counter to our original predictions, there was no relation between condition and participant ratings of needs satisfaction following the manipulation at baseline. However, at endpoint, participants in autonomy support conditions reported significantly higher autonomy satisfaction compared to those in autonomy thwarting conditions, and participants in relatedness support versus thwarting conditions reported significantly higher *competence* satisfaction.

These results suggest that researcher support or thwarting of basic needs might have had a delayed relation to needs satisfaction. It is possible that autonomy satisfaction in a specific domain is only apparent when engaging in a required task independently (i.e., participants completing their chosen mindfulness practice at their chosen time) compared to when engaging in that task in a more controlled manner (i.e., participants completing an assigned task at an assigned time). Participants assigned to relatedness support conditions reported significantly greater competence satisfaction at endpoint. This result corresponds with the theoretical underpinnings of needs satisfaction as outlined by SDT. Relatedness support is considered a necessary nutriment for developing competence satisfaction (i.e., one is unlikely to develop competence in a specific domain without a warm and connected social environment; Sheldon & Filak, 2008). Further, the lack of relations between 1) relatedness support conditions and relatedness satisfaction; and 2) competence support conditions and competence satisfaction could indicate that the manipulations used in-lab were not robust enough to affect participant needs satisfaction in these domains.

2. Individual contribution of each basic need to motivation.

The baseline satisfaction of the combined set of individual needs was significantly related to baseline autonomous motivation. Combinations of needs in pairs and the combination of all three needs did not predict ratings of baseline autonomous motivation over and above the contribution of the satisfaction of each individual need at baseline. The same result was also true of baseline controlled motivation, although the combination of competence and relatedness satisfaction at baseline was trending towards predicting baseline controlled motivation. These results indicate support for the additive hypothesis of needs satisfaction contributing to intrinsic motivation (i.e., each need uniquely contributes to motivation, regardless of the level of satisfaction of other needs; Dysvik, Kuvaas, & Gagné, 2013). Our results suggest that needs satisfaction is not synergistic (i.e., each need being necessary, but not sufficient, in increasing

autonomous motivation) in predicting greater intrinsic motivation. Each individual need was found to be an important contributor to motivation in its own right.

However, it is also worth noting that this result could be related to measurement issues, as basic needs constructs in these analyses were assessed using single item measures. Correlation analyses of the three basic needs items (see Table 1) indicated that these items are not intercorrelated at ceiling, and that the items demonstrate differential validity in relation to motivation. For example, competence demonstrated a stronger correlation with our motivation item ($r = .89$) than with autonomy ($r = .43$; $z = 6.7$, $p < .001$) or relatedness ($r = .38$; $z = 7.12$, $p < .001$). We would expect that if each basic need item was measuring the same underlying construct, we would see external associations with other variables of the same magnitude and with no differential associations. Regardless, future research developing more elaborated measures of the three basic needs would be beneficial for establishing more robust construct validity, especially in relation to measuring basic needs satisfaction within a therapeutic relationship.

At endpoint, again, only the satisfaction of each individual need was significantly related to endpoint autonomous motivation. Conversely, endpoint controlled motivation bore no significant relationship to endpoint needs satisfaction. It is possible that endpoint controlled motivation in particular would not be related to needs satisfaction at endpoint because it would no longer be necessary to persist with the task if participants did not wish to do so. In essence, there might be fewer external consequences for discontinuing mindfulness practice and thus, it is possible that only more autonomous forms of motivation to continue engaging in mindfulness practice would be significantly affected by level of needs satisfaction.

3. Relation between needs satisfaction and motivation.

At baseline, higher perceived needs satisfaction predicted higher ratings of both autonomous and controlled motivation. Specifically, participants who rated perceived competence satisfaction higher at the end of the initial in-lab meeting experienced greater motivation in both autonomous and controlled forms immediately following the initial in-lab meeting. Surprisingly, there was no significant association between perceived baseline autonomy satisfaction and autonomous nor controlled motivation at baseline. Similar to the null relationship between needs support and satisfaction noted above (section 1, page 21), it is possible that autonomy support would not become relevant to motivation until participants began

to practice the intervention independently outside the lab, after the initial meeting. At endpoint, higher endpoint perceived needs satisfaction was significantly associated with higher ratings of endpoint autonomous motivation. Similar to baseline, participants who rated perceived endpoint competence satisfaction as better experienced more autonomous motivation at endpoint. Counter to our predictions, perceived autonomy and relatedness satisfaction at endpoint were unrelated to endpoint autonomous motivation ratings. Finally, there was no association between endpoint perceived needs satisfaction and controlled motivation at endpoint. This result again suggests that controlled motivation is less relevant to needs satisfaction when the requirement for task completion is removed (i.e., participation in the intervention is no longer required for course credit).

Competence satisfaction seemed to drive the relationship between needs satisfaction and motivation at both baseline and endpoint, with relatedness satisfaction corresponding somewhat to autonomous motivation at baseline. It is possible that participants' need for competence was more salient for the task of participating in a study for course credit, and thus this manipulation was more effective. Participants must complete studies for course credit, but they were able to self-select into this study based on interest, which might have contributed to their felt sense of autonomy in this domain regardless of condition. Knowledge of how to complete the tasks of this study might have been more important for motivation than choice. Further, participants might be expecting to be given limits to their choices in a study context (i.e., limits on their autonomy) and thus being assigned to complete a particular intervention at specific times might not be viewed as an impingement on their autonomy (e.g., Sheldon & Filak, 2008). Participants might also have been expecting to be instructed on the practice of mindfulness, as the study description indicated the goal of the research was to evaluate the effect of mindfulness on reducing stress. They may have self-selected into the study primarily expecting to learn more about mindfulness. According to Deci and Ryan (2000), "Perceived competence tends to enhance intrinsic motivation, although people must feel responsible for the competent performance in order for perceived competence to have positive effects on intrinsic motivation." If participants were self-selecting into the study for a personally relevant goal (i.e., to learn mindfulness techniques), their need for autonomy might have been satisfied enough for competence to play a more integral role in motivation. Thus, having their expectation of learning how to practice mindfulness thwarted might have been a more salient intervention than autonomy or relatedness thwarting. The lack of relation between

competence satisfaction and controlled motivation at endpoint indicates that perceived competence becomes irrelevant to this form of motivation once the obligation to engage in goal-directed behaviour disappears.

4. Homework completion and needs support.

Participants in the all-needs-support condition reported significantly greater completion of mindfulness homework than those in the all-needs-thwarted condition. Further, participants in relatedness support versus thwarting conditions reported significantly greater task completion, despite relatedness satisfaction's non-significant relation to motivation. Autonomy and competence support were unrelated to task completion, despite competence satisfaction being significantly related to participant motivation. These results indicate that needs support, and relatedness support in particular, may be an important contributing factor for engagement in emotionally demanding tasks regardless of perceived needs satisfaction or felt motivation. This possibility corresponds with findings in the existing body of research (e.g., Mallinckrodt, 2000) that individuals' perceptions of social support can be effectively unrelated to the amount of actual support provided by others (Lakey & Heller, 1988), and may be less a function of available support in the environment than characteristics of the perceiver (Lakey & Dickinson, 1994). Therefore, the interactional relationship between needs support, perceived needs satisfaction, motivation, and task completion would benefit from further study.

5. Proportion of support and task engagement.

There were no differences in ratings of autonomy, competence, or relatedness satisfaction between those in primarily supportive versus thwarting conditions. However, results indicated that participants in primarily supportive conditions reported significantly greater task completion than those in primarily thwarting conditions. Once again, these results appear to indicate that providing needs support to those attempting emotionally challenging behaviour change contributes to an individual's ability to enact that change. Interestingly, the perceived satisfaction of these needs does not necessarily follow from experiencing said support, even if support predicts task completion. Thus, the provision of needs support might be beneficial regardless of whether a person perceives their needs have been supported. It also stands to reason that the provision of needs support might not be relevant if the person perceives that their needs were supported.

6. Multilevel growth analyses of motivation over time.

We had hypothesized that, in conditions where more of participants' basic needs were supported than thwarted, autonomous (and to a lesser degree, controlled) motivation to complete the intervention would increase over the course of the week. No significant trends of changes in daily ratings of motivation emerged over the course of the week. In essence, there was not a discernable trend from less motivation (either autonomous or controlled) at the beginning of the week to greater motivation at the end of the week.

When accounting for basic needs satisfaction, autonomy and competence satisfaction significantly predicted participant daily ratings of autonomous motivation. Those who experienced more perceived autonomy and competence satisfaction were more autonomously motivated to complete the intervention from day to day. Relatedness satisfaction did not contribute to daily autonomous motivation over and above these other two needs. It is possible that relatedness satisfaction was a less salient need for participants in this context, as they were completing the intervention independently. In contrast, their perception of having choice and independence in their intervention completion and their confidence in their ability to complete the task correctly would be relevant from day to day in their completion of the study.

Participant ratings of basic needs satisfaction bore no relation to ratings of controlled motivation throughout the week. This result is in line with previous research which has suggested that controlled motivation is not an opposite of autonomous motivation on a continuum, but rather a separate construct. For example, other studies have found controlled motivation to be unrelated to outcomes while autonomous motivation was associated with positive outcomes (McBride et al., 2010).

Finally, we examined the effect of conditions supporting or thwarting each individual need on the perceived satisfaction of that need, and that need satisfaction's impact on daily motivation. Autonomy support versus thwarting, competence support versus thwarting, and relatedness support versus thwarting did not impact autonomous motivation. Further, there were no interactions between any of the needs support versus thwarting conditions and the satisfaction of that particular need in predicting autonomous motivation.

Results were similar for controlled motivation, indicating that for the most part, support versus thwarting conditions and their interactions with the satisfaction of the need being supported or thwarted were unrelated to ratings of controlled motivation over the study period.

Only the interaction between competence conditions (i.e., competence support versus thwarting) and competence satisfaction was trending towards a significant relation to controlled motivation. This result suggests that competence support conditions were possibly contributing to stronger controlled motivation over the course of the week via higher perceived competence satisfaction.

Limitations and Future Directions

There are several limitations to note in this study. First, we used a sample of undergraduate students and a psychotherapy-like task (mindfulness) as an analogue for a psychotherapy treatment population. While participant characteristics and study conditions bore some similarity to clients in a psychotherapy context, future research should examine these SDT variables of interest (e.g., basic needs support and thwarting, basic needs satisfaction, autonomous and controlled motivation) prospectively in a treatment setting with a sample of individuals receiving treatment for mental health difficulties. Although this format enabled us to recruit and run greater numbers of participants, we are unable to state with certainty that the results are predictive of those that might occur via a therapeutic relationship.

In addition, it is possible that some of our support interventions were less robust in producing the support and thwarting of basic needs we were aiming for. Further, the interventions were only implemented at one time point in the in-lab portion of the study. Future research should examine the effect of more consistent support or thwarting in a particular domain on peoples' engagement on emotionally demanding tasks in that domain, both pre- and post-intervention and over time.

Furthermore, participant recruitment presented a limitation. Participants self-selected into the study, and therefore those who were more motivated to complete a mindfulness intervention likely took part. Individuals who present for treatment might differ as they are attempting to change an emotional, cognitive, or behavioural issue and have less control over the treatment methods suggested by the therapist. Thus, the methods suggested to treat the presenting issue might be less desired or tolerable (affecting autonomy satisfaction), and these methods might be more difficult to learn and implement (affecting competence satisfaction). Further, relatedness might play a stronger role in a context where a trusting relationship, built and maintained over time, is necessary for clients to disclose difficulties and receive positive regard and validation in return.

Follow-Up Study

In Study 2, we extended the experimental analogue study reported in the previous section. Study 1's manipulations of competence and relatedness were weak, as evidenced by our results indicating participants in competence- and relatedness-supportive conditions did not report significantly higher satisfaction of those basic needs at baseline or post-study. These manipulations likely suffered from a small dose-response effect, in that support or thwarting of the basic needs was only delivered once by the researcher at the initial in-person meeting. Study 2 addressed this issue by having participants designate and interact with a supporting person (e.g., a friend, family member, romantic partner) more consistently over the course of a few weeks as they attempted to change a behaviour. We hypothesized that this increased "dose" of needs support (or thwarting) would result in a stronger effect size of basic needs support and thwarting on motivation and task completion.

Further, Study 1 participants demonstrated a ceiling effect for motivation in that they were generally very motivated to engage in mindfulness practice. For example, at baseline, participant means for autonomous ($M = 17.88$, $SD = 2.84$, ceiling score = 21) and controlled motivation ($M = 16.08$, $SD = 3.38$, ceiling score = 21) were quite high, with over a quarter of the sample indicating a ceiling score of 21 on the autonomous motivation subscale. Final measures indicated increases in both autonomous ($M = 18.72$, $SD = 2.28$) and controlled ($M = 16.76$, $SD = 3.35$) motivation. However, for 25 percent of participants, no increases in autonomous motivation from pre- to post were even possible. As one of our main outcome variables was motivation to engage in mindfulness based on the manipulation of basic needs support and subsequent satisfaction of basic needs, the influence of these variables on outcome was difficult to demonstrate. In Study 2, participants chose a behaviour (reduction in social media use) they were interested in changing imminently. While one of our outcome variables was a measure of motivation to engage in behaviour change, we believed that participants would vary in how motivated they were initially to begin the behaviour change process. The supportive or controlling behaviours from their chosen "supporter" were also hypothesized to be variable enough to allow for distinguishable effects on motivation.

Study 2: Interpersonal Relationships and Behaviour Change

This study aimed to investigate the relation between basic needs support via interpersonal relationships and motivation to engage in behaviour change. Previous research has suggested that consistent daily needs support or thwarting in an individual's environment may be the biggest contributor to the development of more or less autonomous forms of motivation over time (Deci & Ryan, 2000). In psychotherapy, a person's support system is likely a significant contributor to their likelihood of engaging in the necessary work of treatment between sessions. However, more evidence is needed to define the link between interpersonal basic needs support, needs satisfaction, motivation, and emotionally demanding task completion. Previous SDT research has posited that autonomous motivation leads to better psychotherapeutic outcomes via better treatment adherence, greater persistence in the face of difficulties, and greater internalization of new learning (Zuroff et al., 2017; McBride et al., 2010; Markland et al., 2005). Thus, research elucidating the link between basic needs support from significant others and motivation for emotionally demanding behaviour change is necessary.

Previous research has demonstrated that those who perceive less social support are more likely to experience psychological distress (Pierce, Sarason, & Sarason, 1996). Further, there is evidence in the existing literature that clients' interpersonal relationships affect their psychotherapy treatment outcomes. For example, several studies have suggested that depression recurrence is predicted by interpersonal difficulties (Joiner & Coyne, 1999; McCullough, 2000). According to McCullough (2000). It is possible that individuals with highly recurrent depression may experience lower levels of autonomy, relatedness, and competence in their relationships because they are more passive and submissive, which could in turn impact treatment outcome. Those with less recurrent depression are likely to have more interpersonal support (including autonomy and relatedness support) and therefore may i) have more autonomous motivation or ii) be more effectively able to use autonomous motivation to make treatment gains. McBride et al. (2010) found that, for patients with highly recurrent depression, autonomous motivation for treatment had no effect on outcome, while the therapeutic alliance had a significant effect. For those experiencing less recurrent depression, the authors found that therapeutic alliance was less important than autonomous motivation for treatment in predicting treatment outcome. They hypothesized that these individuals might have a stronger social support network outside of the

therapeutic relationship compared to patients who had a high recurrence of depression and, therefore, might be less reliant on the client–therapist alliance.

Past studies have found that those individuals who are more inclined to seek support from others during emotionally demanding times demonstrate less anxiety and depression, along with more vitality (Deci & Ryan, 2014; Ryan, La Guardia, Solky-Butzel, Chirkov, & Kim, 2005). These findings suggest that when people feel as if they can rely on close others (i.e., friends, romantic partners, family members) during trying times, they are emotionally healthier overall than their more emotionally-independent counterparts. Ryan et al. (2005) hypothesized that the relation of emotional reliance to well-being was demonstrated because those who willingly rely on others experience basic needs satisfaction. In essence, these individuals tend to feel closer and more cared for, and volitional in their actions. They also tend to perceive that their competence is supported by others in relation to their current circumstances.

Further, there appears to be a notable difference between individuals with regard to the people on whom they tend to rely during an emotionally demanding time (Ryan et al., 2005; Deci & Ryan, 2014). While people are likely to have multiple important interpersonal relationships, they tend to seek emotional support from these relationships to varying degrees. For example, in one study (Ryan et al., 2005), researchers found that undergraduate students relied emotionally on their mothers more often than their fathers during emotionally challenging situations. However, an association was also illustrated between perceived needs supportiveness of the parent in general and emotional reliance of participants on this parent, with students seeking emotional support more from fathers who were perceived as more needs-supportive. A similar pattern emerged with regards to best friends and romantic partners. Those who were perceived as more needs supportive by the participant were more likely to be sought out in times of upset, conflict, or elation for emotional support than those who were perceived as less needs supportive.

The focus of a majority of previous research investigating the link between basic needs support and the development of autonomous motivation has focussed primarily on autonomy support. Behavioural indicators of autonomy support in psychotherapy include recognizing the client’s unique perspective, acknowledging their feelings, limiting pressuring tactics, providing choice wherever possible, and delivering a meaningful rationale when choice is not possible (Zuroff et al., 2017). Further, research on the effects of needs support in the development of

autonomous motivation for and engagement with goal-directed behaviour has primarily focused on the provision of this support by authority figures invested in encouraging the person to meet the goal in question (e.g., teachers supporting students in academic pursuits; therapists supporting clients in engaging with treatment; employers supporting employees in work environments; Ryan & Deci, 2017). Basic needs support from a person's pre-existing interpersonal support network has not been examined in the context of this support's contribution to the development of motivation for emotionally demanding behaviour change. Common lore holds that having a supportive person encouraging behaviour change aids in a person's ability to achieve that change, but it is likely that the methods some individuals use to encourage behaviour change can be detrimental (i.e., needs thwarting behaviours).

The current study aimed to address this issue with a correlational design involving undergraduate students who identify a behaviour they would like to change imminently. These participants were asked to identify and seek support from a person in their life with whom they felt comfortable disclosing and were in contact with regularly. We hypothesized that higher levels of perceived basic needs support from a significant relationship would predict an increase in motivation to engage with behaviour change, as well as subsequent behaviour change.

We hypothesized that:

1. There would be a significant positive relationship between how needs-supportive participants rated their supporters and how motivated they felt to engage in behaviour change.
2. Participants who perceived their supporter to be more needs-supportive would engage in significantly more behaviour change.
3. The autonomous motivation of participants who perceived their supporter to be more needs-supportive than the supporters of other participants would increase significantly more than their controlled motivation over the two week study period. Accordingly, those who perceived their supporter to be less needs-supportive than the supporters of other participants would demonstrate an increase in controlled, but less so autonomous, motivation.

Method

Participants

Participants ($N = 122$) were undergraduate students from the University of Waterloo who were recruited to participate in this study for course credit. They were able to view the study details on SONA (a university-based online research recruitment tool) and self-selected into the study. A pre-screen question was used to identify the behaviour endorsed by the largest number of respondents as one they would like to begin changing over the next semester (i.e., Are you interested in changing any of the following behaviours over the course of this semester? Please select 'yes' for all that apply [Y/N to each of the following]: Attend more classes; Get more sleep; Reduce time spent gaming; Use your smart phone less; Spend less time on social media; Increase amount of exercise; Walk more; Reduce nail biting; Drink more water; Reduce spending; Cook at home more / eat out less]). Students who endorsed wanting to change the behaviour selected by the greatest number of respondents were able to self-select into study participation.

The behaviour that was endorsed by the most respondents in the pre-screen (decreasing social media use) was selected as the target for behaviour change in this study. Potential participants were invited to participate if they endorsed wanting to decrease social media use imminently. Participants were required to be at least 17 years of age and able to speak and understand English. There were no other limitations to participation in terms of age, gender, or other participant characteristics.

Measures

Behaviour Change Questionnaire (Pre and Post). This questionnaire was developed for this study to gather information on participants' goals for changing behaviour, self-reported details regarding current frequency and duration of social media use on average, and self-reported progress in achieving desired behaviour change goals (see Appendix E for all Study 2 measures).

Readiness to Change Questions. Three items were used to assessing respondents' current readiness to begin changing the behaviour in question. Questions were adapted from the Heather and Hönekopp (2008) Readiness to Change Questionnaire. Each item corresponded to either the precontemplation, contemplation, or action phase and was rated on 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The precontemplation item bore no

significant correlation to the contemplation or action items. The contemplation and action items shared a small correlation ($r = .23, p < .05$).

Autonomous and Controlled Motivation Questionnaire (adapted from Zuroff et al., 2007; in-turn developed based on work by Williams et al. and the Rochester Group). The ACMQ is a 6-item measure evaluating participants' autonomous and controlled motivation for changing the behaviour they identified at the study's outset. This measure was modified from a measure developed by Zuroff, Koestner, Moskowitz, McBride, Marshall, and Bagby (2007; adapted from Rochester Group and Williams' Treatment Self-Regulation Questionnaire). Items were ranked on a 7-point Likert scale, from 1 (strongly disagree) to 7 (strongly agree). Items included questions such as "By attempting to change a behaviour through this study I can gain course credit" and "I feel like I will personally benefit when I change this behaviour." Cronbach's alpha indicated good reliability (.79) for the autonomous motivation subscale and adequate reliability (.68) for the controlled motivation subscale. The autonomous and controlled motivation subscales were significantly correlated in our sample ($r = .41, p < .01$).

Characteristics of Person to Discuss Change With (Pre and Post). This questionnaire gathers information regarding participants' "supporter", chosen for the purpose of communicating with the participant in their attempts to enact their desired behaviour change. Questions include frequency and mode of contact and the relationship of the supporter to the participant.

Interpersonal Behaviours Questionnaire (IBQ). The IBQ is a 24-item measure developed by Rocchi, Pelletier, Cheung, Baxter, and Beaudry (2017). The measure evaluates an individual's perceptions of the interpersonal behaviour of others according to SDT, accounting for behaviours that support or thwart a person's basic psychological need for autonomy, competence, and relatedness. Several measure items have been modified to reflect both the pre- and post- nature of the study as well as the specific intervention that participants will be enacting (e.g., the item "The people in my life do not connect with me" was modified to read, "I believe that this person will not connect with me on my efforts to change."). Items are rated on a 7-point Likert scale, from 1 (do not agree at all) to 7 (completely agree). IBQ scales were found to have acceptable internal consistency, ranging from 0.75 to 0.81, were related to similar constructs (i.e., need satisfaction, need dissatisfaction, and well-being indicators) in the predicted directions, and the scale met the thresholds for convergent and divergent validity (Rocchi et al.,

2017). In the current sample, Cronbach's alpha indicated good reliability within the autonomy support (.86), autonomy thwarting (.82), competence support (.87), competence thwarting (.81), relatedness support (.78), and relatedness thwarting (.84) subscales. Overall support and thwarting subscales were significantly negatively correlated in our sample ($r = -.58, p < .01$).

Life Satisfaction and Frustration Scale. The LSFS is a 24-item scale developed by Chen et al. (2015), designed to evaluate the degree to which a person's basic psychological needs are supported or thwarted generally in their life. Item responses are rated on a 5-point Likert scale, ranging from 1 (not at all true) to 5 (completely true). The original scale demonstrated good reliability in all subscales. In our sample, Cronbach's alpha revealed satisfaction subscale reliabilities of .73 for autonomy, .78 for relatedness, and .84 for competence, as well as thwarting reliabilities of .75 for autonomy, .79 for relatedness, and .89 for competence. Overall basic needs satisfaction and frustration subscales were significantly negatively correlated in our sample ($r = -.75, p < .01$).

Procedure

Participants were invited to participate in the study if they endorsed a desire to change the behaviour selected by the largest number of respondents in the pre-screen questionnaire (i.e., decreasing social media use). In the baseline questionnaires, participants were asked to identify a person with whom they have a relationship and with whom they could discuss their behaviour change attempts, successes, and challenges. However, if a participant could not identify such a person, they were still invited to participate regardless. Their data ($n = 10$) was not included in the present analyses. Participants were encouraged to begin their behaviour change attempts at the outset of the study. Their interactions with their identified person or lack thereof comprised the study's active ingredients for our hypothesized effects.

All study participation took place on an online questionnaire platform (Qualtrics). Once participants provide digital consent to participate, they were asked to complete several baseline questionnaires (see Appendix E for Study 2 questionnaires). After the initial questionnaires were completed online, participants were instructed to attempt to reduce social media use according to their stated goal over the course of the next two weeks. They were also asked to task their identified person with communicating with them about their attempts, successes, and challenges in engaging in social media reduction, with no specific instructions on what tactics or behaviours

this person should use to support the participant. On Qualtrics, participants answered a daily question regarding their progress in reducing social media use. At the halfway point (one week in), participants were asked to complete several questionnaires regarding more detailed aspects of behaviour change achieved thus far, questions about their identified person's characteristics and style of interaction when discussing change attempts, and participant motivation to engage in behaviour change. At the end of the two-week period, participants were asked to complete post-study questionnaires (identical to baseline questionnaires; see Appendix E) on Qualtrics.

Results

Participants

Of the original 122 participants who completed the baseline, midway, and/or final questionnaires, 10 were removed from the final analyses as they did not identify a supporter to consult with about their behaviour change efforts. Further, three participants were removed from the analyses as they were significant outliers in their social media use (i.e., using social media for 10 or more hours per day). Remaining participants endorsed a daily average social media use of 3.63 hours ($SD = 1.68$). Participants ($N = 109$) included 20 males and 89 females with a mean age of 19.35 ($SD = 1.95$).

Data Cleaning

We computed standardized DF betas via linear regression on the independent variables used in our core analyses (i.e., baseline, midway, and final Interpersonal Behaviours Questionnaire; baseline, midway, and final Autonomous and Controlled Motivation Questionnaire), with both of our main dependent variables (i.e., percent reduction of social media use and ratings of progress). Using these standardized DF betas, we examined influence statistics via the Explore function in SPSS. For each analysis, we identified cases singled out as “extreme outliers” via boxplot graph. In these graphs, the box length spans the middle 50% of the values (from 25th to 75th percentile). SPSS defines cases that fall more than 1.5 box lengths (also known as the interquartile range) from the lower or upper hinge of the box as outliers. “Extreme” outliers are identified by SPSS when they demonstrate values more than 3 box lengths from either hinge. Each extreme case was examined in the data for unusual features (e.g., unrealistic social media reduction goals; indicators the participant did not engage fully with the

study or follow study instructions). We removed three participants who were outliers in their social media use prior to beginning the study (i.e., > 10 hours of use per day) and conducted our main analyses on this dataset. The patterns of social media use endorsed by these participants was believed to indicate a more severe, pathological-level problem with social media use, rather than an undesirable “bad habit” requiring minor behaviour change.

Preliminary Analyses

1. Did participants endorse having enacted behaviour change post-study?

Prior to conducting our main analyses, we examined participants’ endorsement of behaviour change progress at the end of the study. We aimed to ensure that our sample reported engagement with the main study tasks. We computed a score to reflect the match between participants’ social media use at baseline and their reported use at endpoint. We then computed a score which reflected their progress towards meeting their reduction goal as a percentage (i.e., if a participant aimed to reduce their use by 100 minutes at baseline and reported reducing their use by 50 minutes at endpoint, their score would be .50 to reflect that they met half of their reduction goal). Frequencies indicated that 50% of our sample reduced their use by 57% or more of their initial goal. Only 9% of our sample reported a social media use reduction of 10% or less (including negative percentages – i.e., increases rather than decreased in social media use) of their baseline goal. Accordingly, it appeared that our sample took advantage of an opportunity to make behavioural changes, invested in the intervention, and made progress, akin to our results from Study 1. Our participants endorsed significant dissatisfaction with their social media use and enacted attempts to change this behaviour. Therefore, we believe this study to be a useful analogue for emotionally demanding behaviour change that might be attempted in a therapeutic context.

Main Analyses

Two main dependent variables were used to measure outcome on the following items: “How much did you reduce your social media use over the last two weeks, as a percentage?” (i.e., Dependent variable 1: a rating of the percentage by which participants reduced their social media use), and “Please rate your progress in achieving behaviour change.” (i.e., Dependent variable 2: a rating from 1 to 10 on how successful participants felt they were at reducing their

social media use). The two dependent variables were significantly correlated, $r = .30$, $n = 102$, $p < .001$, but did not share so much variance as to effectively measure the same construct.

2. Did participants who perceived their supporter to be more needs-supportive engage in significantly more behaviour change?

Dependent Variable 1: Reduce Percent.

Hierarchical regressions were conducted to analyze whether our independent variables of interest (support and thwarting as measured by the Interpersonal Behaviours Questionnaire) predicted participants' percent reduction in social media use after controlling for the goal percentage reduction they set at the study's outset. For each of the following analyses, percent reduction at endpoint was the dependent variable, percent reduction goal at baseline was the control variable, and Interpersonal Behaviours Questionnaire support and thwarting were added in to examine the effect of needs support and thwarting on social media reduction once participant reduction goals were accounted for.

At baseline, participants' ratings of the anticipated supportive or thwarting behaviours (as measured by the Interpersonal Behaviours Questionnaire) of their designated motivator did not predict endpoint social media percent reduction, $F(2,83) = 0.35$, *ns* (see Table 23). However, on the midway (see Table 24) and final (see Table 25) questionnaires, participant Interpersonal Behaviours Questionnaire ratings of their supporters did predict the dependent variable.

At midway, goal percentage reduction in Model 1 significantly predicted percentage reduced at endpoint, $F(1, 70) = 4.60$, $p = .035$. In Model 2, participant midway Interpersonal Behaviours Questionnaire ratings were added and the Model was significant, $F(3, 70) = 4.38$, $p = .007$. We found that adding midway Interpersonal Behaviours Questionnaire ratings in Model 2 accounted for a greater percentage of variance in reduction of endpoint social media use over and above percent reduction goal at baseline, R^2 change = 0.10, F Change (2, 67) = 4.07, $p = .022$. Participant ratings of perceived supporting behaviours of their designated motivators at the midway point significantly predicted percentage reductions in social media use at the end of the two weeks, $B = 0.62$ ($SE = 0.26$), $p = .021$, controlling for percent reduction goal at baseline. Midway perceived thwarting behaviours were unrelated to endpoint percentage reduction of social media use, $B = 0.01$ ($SE = 0.22$), *ns* (see Table 24 for R^2 and B values for both Models).

At endpoint, a Model examining the relation of endpoint Interpersonal Behaviours Questionnaire ratings to endpoint percentage of social media use reduction, while controlling for

baseline goal percentage reduction, was found to be significant, $F(2, 81) = 3.11, p = .050$. In Model 1, baseline percent change goal significantly predicted percent reduction at endpoint, $F(1, 80) = 6.39, p = .013$. With the addition of endpoint Interpersonal Behaviours Questionnaire ratings, Model 2 was trending towards predicting percent reduction in social media use at endpoint but was not significant, R^2 change = 0.06, $F(2, 78) = 4.01, p = .075$. In Model 1, the control variable of goal percentage reduction at baseline accounted for a significant amount of variance in percentage reduced at endpoint, $F(1, 81) = 6.39, p = .013$. While Model 2 did not predict significantly more reduction in social media use than Model 1, percent change goal at baseline was significant, $B = 0.26 (SE = 0.11), p = .022$, and the endpoint supportiveness subscale of the Interpersonal Behaviours Questionnaire was trending towards predicting a greater endpoint percentage of social media reduction but was not significant, $B = 0.52 (SE = 0.27), p = .056$. Participants' endpoint ratings of the perceived thwarting behaviours of their designated motivators were unrelated to endpoint percentage reduction of social media use, $B = 0.01 (SE = 0.21), ns$ (see Table 25 for R^2 and B values for both Models).

Dependent Variable 2: Rate Progress.

Regressions were conducted to analyze whether our independent variables of interest (Interpersonal Behaviours Questionnaire support and thwarting) predicted participants' ratings of their success in reducing social media use on a scale of 1 to 10. At baseline, participants' ratings of the anticipated supportive or thwarting behaviours (as measured by the Interpersonal Behaviours Questionnaire) of their designated motivator significantly predicted their endpoint ratings of success in reducing social media use, $F(2, 96) = 3.80, p = .026$ (see Table 26). Baseline perceived supportiveness significantly predicted a higher rating of success in endpoint ratings of reduction of social media use, $B = .052 (SE = 0.19), p = .007$. Baseline perceived thwarting was unrelated to endpoint reductions in social media use, $B = .023 (SE = 0.16), ns$. At midway, participants' ratings of support and thwarting by their designated motivators was unrelated to their endpoint ratings of success, $F(2, 80) = 0.74, ns$ (see Table 27). However, at endpoint, Interpersonal Behaviours Questionnaire ratings of participants' designated motivators again significantly predicted their endpoint ratings of success, $F(2, 91) = 6.20, p = .003$ (see Table 28). Endpoint perceived supportiveness significantly predicted higher ratings of success at

endpoint, $B = .043$ ($SE = 0.16$), $p = .009$, but endpoint perceived thwarting was unrelated to endpoint success ratings, $B = -.004$ ($SE = 0.13$), ns .²

3. Did participant motivation predict behaviour change?

Hierarchical regressions were conducted to analyze whether our independent variables of interest (autonomous and controlled motivation) predicted participants' percent reduction in social media use after controlling for the goal percentage reduction they set at the study's outset. Participants' ratings of motivation at baseline, $F(2, 89) = 2.59$, ns , midway, $F(2, 80) = 0.15$, ns , and endpoint, $F(2, 89) = 0.56$, ns , were unrelated to their endpoint percentage reduction in social media use, when controlling for participants' percent reduction goal at baseline (see Tables 29, 30, and 31, respectively).

Additionally, linear regressions were conducted to analyze whether our independent variables of interest (autonomous and controlled motivation) predicted participants' ratings of their success in reducing social media use on a scale of 1 to 10. Participants' ratings of motivation at baseline, $F(2, 101) = 0.66$, ns , and midway, $F(2, 92) = 1.50$, ns , were unrelated to participant ratings of endpoint success. At endpoint, participants ratings of endpoint motivation significantly predicted their ratings of success, $F(2, 101) = 3.10$, $p = .050$. However, endpoint coefficients for autonomous, $B = .082$ ($SE = 0.06$), $p = .183$, and controlled, $B = .02$ ($SE = 0.06$), $p = .721$, motivation were not significant (see Tables 32, 33, and 34, respectively).

4. Was there a significant positive relationship between how needs-supportive participants rated their supporters and how motivated they felt to engage in behaviour change?

On the midway questionnaires, participant ratings of midway autonomous motivation were significantly predicted by the midway Interpersonal Behaviours Questionnaire, $F(2, 86) = 5.33$, $p = .007$. Specifically, participants who rated their designated motivators significantly higher on the midway support subscale reported greater autonomous motivation at midway, $B = 0.10$ ($SE = 0.04$), $p = .025$. Midway ratings of thwarting behaviours were unrelated to autonomous motivation at midway $B = -0.02$ ($SE = 0.04$), ns (see Table 35). Further, participant ratings of controlled motivation at midway were significantly predicted by the midway

² Regression analyses examining the influence of individual subscales of needs support (i.e., autonomy, competence, and relatedness) on our dependent variables yielded no significant results.

Interpersonal Behaviours Questionnaire, $F(2, 86) = 4.08, p = .020$. Specifically, participants who rated their designated motivators significantly higher on the midway support subscale reported greater controlled motivation at midway, $B = 0.10 (SE = 0.04), p = .014$. Midway thwarting behaviours were unrelated to controlled motivation at midway, $B = 0.01 (SE = 0.04), ns$ (see Table 36).

On the final questionnaires, participants ratings of endpoint autonomous motivation were significantly predicated by the endpoint Interpersonal Behaviours Questionnaire, $F(2, 91) = 13.47, p < .001$. Participants who rated their designated motivators significantly higher on the endpoint support subscale reported significantly greater autonomous motivation at endpoint, $B = 0.14 (SE = 0.04), p < .001$. Endpoint ratings of thwarting behaviours were unrelated to autonomous motivation at endpoint, $B = - 0.01 (SE = 0.03), ns$ (see Table 37). Further, participants' endpoint ratings of controlled motivation were significantly predicted by the Interpersonal Behaviours Questionnaire at endpoint, $F(2, 91) = 9.59, p < .001$. Participants who rated their designated motivators higher on the support subscale at endpoint reported significantly greater endpoint controlled motivation, $B = 0.14 (SE = 0.04), p < .001$. Endpoint ratings of thwarting behaviours were unrelated to controlled motivation at endpoint, $B = 0.01 (SE = 0.03), ns$ (see Table 38).

5. Do people who feel less motivation set smaller behavioural goals?

Pearson's correlations indicated no relationship between participants' baseline autonomous, $r^2 = 0.18, n = 109, ns$, or controlled motivation, $r^2 = 0.10, n = 109, ns$, and social media reduction goals identified at baseline. This non-significant relationship held for participants' ratings of autonomous, $r^2 = 0.03, n = 99, ns$, and controlled $r^2 = 0.05, n = 99, ns$, motivation at midway and their ratings of autonomous $r^2 = 0.02, n = 102, ns$, and controlled motivation $r^2 = 0.04, n = 102, ns$, at endpoint.

6. Did control variables of interest predict (or interact with main independent variables to predict) social media reduction or ratings of behaviour change success?

After centering all predictor variables used in the preceding analyses, we completed a number of hierarchical regression analyses to evaluate whether several control variables of interest influenced participants' percent reduction in social media use or ratings of their success in achieving behaviour change. The control variables included: i) average daily social media use

pre-study; ii) number of previous attempts to reduce use; iii) amount of time talking with their identified supporters about social media use during the study; iv) amount of time in total talking to their identified supporters over the course of the study. Each control variable was entered at step 1, either support and thwarting variables or autonomous and controlled motivation variables were entered at step 2, and interaction terms were entered at step 3. We aimed to evaluate whether our control variables interacted with our main predictors to contribute to significant changes in the dependent variables. Results indicated no significant contributions of control variables to outcome, and no significant interactions between control variables and our main predictors to account for variance in our dependent variables.

Study 2 – Discussion

The purpose of Study 2 was to further investigate the relationship between basic needs support and thwarting, motivation for behaviour change, and change itself. We hypothesized that our Study 1 needs support intervention was weak in that needs support or thwarting for behaviour change only occurred at one timepoint. This study aimed to capitalize on the more robust needs support and thwarting behaviours that occur within pre-existing interpersonal relationships. Participants were asked to assign someone with whom they had a relationship (e.g., roommate, romantic partner, friend, etc.) to the task of supporting them in their behaviour change efforts towards reducing social media use. We predicted that participants' chosen supporter would use a variety of behaviours and support methods to encourage participants' social media reduction, and that some participants would perceive their supporters' actions as more or less supportive and more or less thwarting in this arena.

1. Needs support and behaviour change.

We predicted that participants who perceived their supporter to be more needs-supportive would engage in significantly more behaviour change, and that the opposite effect would be evident for participants who perceived their supporter to demonstrate more thwarting behaviours. This hypothesis was partly supported. Results indicated that participants who anticipated or experienced more needs supportive behaviours from interpersonal relationships during the study experienced greater change according to both of our dependent variables (i.e., percent reduction in social media use; rating of progress towards behaviour change). These effects remained present even after controlling for participants' intended changes outlined at baseline, indicating

that interpersonal needs support is effective for encouraging behaviour change over and above goal setting. Thus, it is likely that recruiting support from a trusted source during an attempt to make a difficult change will have positive effects on a person's ability to enact that change. In contrast, no relationship was evident between participants' ratings of their supporters' thwarting behaviours and behavioural change outcomes. It is possible that, when asked to assign someone to the task of supporting their behaviour change efforts, people are inclined to select those they know will use more constructive and positive strategies and fewer controlling or frustrating methods. It is also possible that measurement issues contributed to the lack of observed relationship between thwarting behaviours and behavioural change. Thwarting in this context may be difficult to detect using an interpersonal questionnaire. For example, thwarting could take the form of subtle body language that might be perceived as a sign of disapproval or subtle control by participants and that could go unmeasured by the Interpersonal Behaviour Questionnaire.

2. Motivation and behaviour change.

We further hypothesized that participant autonomous and controlled motivation would predict their reduction of social media use over the course of the study. However, this hypothesis was not supported, as participant ratings of autonomous and controlled motivation bore no significant relationship to ratings of social media reduction. As participants self-selected into the study having identified social media reduction as a behaviour they were interested in changing imminently, it is possible that participant motivation was more uniform than that which might occur in people who are more ambivalent about change.

3. Needs support and motivation.

Despite the lack of relationship between motivation and outcome, we did find a significant relationship between support and motivation. Specifically, participants who perceived their supporters to be more needs supportive experienced greater autonomous and controlled motivation. Once again, perceived thwarting was unrelated to motivation. These findings are somewhat counter to our predictions, as we would expect basic needs support to contribute to significantly greater autonomous, but not controlled motivation. Basic needs thwarting would be expected to contribute to higher ratings of controlled motivation. However, autonomous and controlled motivation are often found to be positively correlated in the literature (McBride et al., 2010). Further, as cited in the Study 1 discussion, some studies have found controlled motivation

to be unrelated to outcomes while autonomous motivation was associated with positive outcomes (McBride et al., 2010). By the nature of our study, participants were enacting change in exchange for course credit. This external incentive to make behavioural changes might have encouraged higher endorsement of controlled motivation in our questionnaires.

Limitations and Future Directions

There are several limitations to note in this study. First, the sample we recruited was self-selecting and identified wanting to make an imminent change to a particular behaviour. Those who participated were likely different from the general population in this regard. It is possible that this factor influenced participant ratings of motivation for change and action towards reaching their goals. However, these features also reflect a similarity to a psychotherapy-seeking population and ensure that the sample is a suitable analogue. Additionally, the study was completed online and participants self-reported their progress towards behaviour change. While we requested information about participants' support-seeking interactions with their designated supporter (e.g., time spent interacting about social media use), we are unable to confirm how often participants actually spoke with their supporters about behaviour change or the depth of these conversations. Participants' judgements of their progress were also subjective. While they were asked to report, in hours and minutes, their social media use at various timepoints throughout the study, they were not required to track social media use in detail throughout the day over the course of the two-week study period. However, our dependent variables (i.e., percent reduction in social media use; rating of progress towards social media reduction goal) were also subjective measurements of participants' felt sense of goal achievement and are akin to psychotherapy clients' subjective sense of progress throughout treatment.

Future research in this domain would benefit from examining interpersonal support and thwarting in a psychotherapy context. This study was conducted with a problematic behaviour in mind (excessive social media use) that was meant to act as an analogue to a therapy treatment seeking population. In order to more accurately examine the role of SDT variables (e.g., basic needs support, autonomous and controlled motivation) in psychotherapy treatment outcome, researchers must examine these variables prospectively with a sample of individuals receiving treatment for mental health difficulties. It is likely that supportive (and possibly thwarting) behaviours from both a client's therapist as well as their pre-existing social relationships will

contribute to psychotherapy effectiveness. Further, it is possible that the negative effects of thwarting behaviours, while not observed in this study, would be more apparent in a sample of psychotherapy-seeking individuals. These clients are interacting with a variety of people on a daily basis who may or may not approve of their attempts to change behaviours, and who may use more controlling or thwarting behaviours to encourage or discourage change. It will be important to examine the interaction between a therapist's needs supportive behaviours and a clients' support system's needs supportive or needs thwarting behaviours.

Further, limitations in measurement may have contributed to some of our observed results. For example, our measurement of SDT variables (e.g., autonomous and controlled motivation, a six-item measure) demonstrated adequate reliability, but the validity of these measures could be more closely evaluated in future research involving SDT constructs in psychotherapy. Improving the measurement of these constructs would allow researchers to better understand the interrelation of needs support, needs satisfaction, and motivation in psychotherapy.

General Discussion

Over the last few decades, numerous research studies have confirmed that common factors found in all psychological intervention methods predict a significant amount of variance in treatment outcome (Martin, Garske, & Davis, 2000; Wampold et al., 1997). In fact, some authors controversially hypothesize that common factors could have even greater predictive power than individual treatment techniques used in any one psychotherapy orientation (e.g., Horvath & Symonds, 1991; Martin, Garske, & Davis, 2000; Safran & Muran, 2006; Wampold et al., 1997; Zuroff & Blatt, 2006). Nevertheless, there still exists a gap in our understanding of *how* diverse forms of psychotherapy lead to positive outcomes and therapy completion. In order to better understand factors that may contribute to these desirable outcomes, several authors have explored a Self-Determination Theory (SDT) framework for explaining therapeutic change (e.g., Mansour et al., 2012; McBride et al., 2010; Zuroff et al., 2007; Zuroff et al., 2012).

Psychotherapy treatment motivation and a supportive therapeutic environment are considered essential features of many psychotherapy modalities (Ryan & Deci, 2008). Given that SDT provides an overarching framework for understanding human motivation, development, and wellness (Ryan & Deci, 2008), the theory readily lends itself to application in many different

treatment interventions. SDT presents an evidence-based set of guidelines and principles that aim to increase client motivation to reflect on experiences and events in their lives, in order to make positive changes in their goals, behaviours, and relationships (Ryan & Deci, 2008). The fulfillment of basic psychological needs and the perceived support for the fulfillment of these needs is essential for the development of an internal and personally meaningful sense of motivation for behaviour change.

While SDT has provided a promising theoretical framework to understand evolving client motivation for- and engagement with psychotherapy, there were gaps apparent in the literature involving several important SDT variables. For example, autonomy support had garnered a great deal of research interest, but competence and relatedness support had been understudied (Rocchi et al., 2017). According to SDT theory, individuals would require competence support and relatedness support, in addition to autonomy support, to move from a less motivated to more motivated state (Deci & Ryan, 2000; Pomerantz, Cheung, & Qin, 2012). We endeavored to address this issue across two studies, in which we measured all three needs and needs-supportive or thwarting behaviours simultaneously. By doing so, we hoped to speak to whether there were distinguishable effects of the support of each need, and to learn if and how this support contributed to autonomous and controlled motivation over time. Moreover, we investigated both supportive and thwarting behaviours, as failing to provide support for a basic need is thought to be conceptually distinct from actively thwarting that need (Bartholemew, Ntoumanis, & Thøgersen-Ntoumani, 2009; Sheldon & Filak, 2008).

Given the theoretical foundation of SDT (i.e. that needs satisfaction is necessary for the internalization of motivation), we speculated that therapist basic needs support and resulting client satisfaction would be a distinguishable precursor to stronger motivation for treatment. As previous studies have found strong links between client motivation, treatment completion and positive outcomes (e.g. Bados et al., 2007; Mansour et al., 2012; Zuroff et al., 2007, 2012), we believed that this greater satisfaction of needs and resulting motivation would in turn be a significant contributor to persistence and positive outcomes in psychotherapy. To that end, we developed two analogue studies in order to examine our variables of interest in a context similar to that which clients might experience in psychotherapy (i.e., studies where participation necessitated emotionally demanding behaviour change).

Study 1 provided an analogue for examining the effect of basic needs support and satisfaction in psychotherapy on motivation for treatment, engagement and persistence in treatment, and therapy homework completion. Through our experimental manipulation we attempted to temporarily increase or decrease participants' satisfaction of basic psychological needs in-lab in order to examine corresponding changes in their level of autonomous and controlled motivation for a mindfulness meditation intervention for stress management. Study 2 expanded on the experimental analogue study by having participants designate and interact with a supporting person (e.g., a friend, family member, romantic partner) more consistently over the course of a few weeks as they attempted to change a behaviour. We hypothesized that, compared to Study 1, this increased "dose" of needs support (or thwarting) would provide a stronger effect size of basic needs support and thwarting on motivation and task completion.

Results indicated support for some of our original hypotheses, but also revealed a few surprising patterns. For example, in Study 1, *relatedness* support was often found to correspond with greater *competence* satisfaction. While this outcome was not directly predicted by our hypotheses (i.e., participants rating each basic need as more satisfied in conditions that supported that need), it can be understood in the context of the SDT basic needs satisfaction framework. In essence, relatedness support is considered a necessary element in the development of competence satisfaction (i.e., one is unlikely to develop competence in a specific domain without a warm and connected social environment; Sheldon & Filak, 2008).

In addition, competence support and satisfaction in Study 1 tended to drive the relationship between overall needs satisfaction and greater motivation in both autonomous and controlled forms. This pattern of results did not replicate the significant role of autonomy support found in previous research (e.g., Zuroff et al., 2012). We propose that this unexpected result can be understood via the unique circumstances involved in self-selecting into a research study. For example, participants may have self-selected into the study primarily expecting to learn more about mindfulness. Thus, competence support and thwarting manipulations may have been particularly salient, and autonomy thwarting manipulations may have appeared to participants as an understandable and predicted form of research design. It is likely that autonomy support would be a more salient variable in a psychotherapy context where autonomy support and satisfaction would come into play often and determine a client's treatment path (e.g., interventions selected based on most interfering symptoms or unique client goals).

In line with our predictions, our Study 1 results reinforced the additive hypothesis of needs satisfaction as it contributes to intrinsic motivation (i.e., each need uniquely contributes to motivation, regardless of the level of satisfaction of other needs; Dysvik, Kuvaas, & Gagné, 2013). We found each individual need to be an important contributor to motivation in its own right. Additionally, participants who experienced a greater proportion of needs support demonstrated more homework completion. As noted above, the focus of applying SDT principles to psychotherapy has been primarily centred on autonomy support and satisfaction, and these variables' relation to motivation. As more research signals the important contribution of both competence and relatedness satisfaction to the internalization of more autonomous forms of motivation and emotionally-demanding task completion, it will be important for researchers and clinicians to attend to the support of these basic needs.

We predicted, in both Study 1 and Study 2, that basic needs support would relate to significantly greater autonomous, but not controlled motivation, and that basic needs thwarting would be associated with greater controlled motivation. However, this result was consistently absent in our analyses. For example, in Study 1, autonomy support versus thwarting, competence support versus thwarting, and relatedness support versus thwarting did not impact autonomous motivation. Further, in Study 2, participants who perceived their supporters to be more needs supportive experienced both greater autonomous *and* controlled motivation. In order to make sense of these unpredicted outcomes, we reviewed the literature on the relation of autonomous and controlled motivation. Autonomous and controlled motivation are often found to be positively correlated (McBride et al., 2010). Further, in some of the available research, controlled motivation was found to be unrelated to outcomes while autonomous motivation was associated with positive outcomes (McBride et al., 2010). It is possible that the nature of our undergraduate sample and study incentives could explain the association of greater perceived needs support to higher ratings of controlled motivation. Participants in our samples engaged in change for course credit, which could constitute a noteworthy external incentive and therefore could account for higher ratings of controlled motivation. It will be important for future prospective research to evaluate the effect of needs support and satisfaction on motivation without external pay or credit incentives.

Further, and again diverging from our predictions, we found no relationship between participants' ratings of their supporters' thwarting behaviours and behavioural change outcomes

in Study 2. This conflicts somewhat with results from Study 1, which suggested that needs thwarting conditions contributed to lower task completion than needs support conditions. However, this relationship was driven primarily by relatedness support and thwarting. We propose that these Study 1 results ran counter to those in Study 2, as Study 2 participants may have been inclined to select individuals they predicted would use more positive strategies, fewer frustrating methods, and with whom they already had a pre-existing positive relationship.

Across Studies 1 and 2, participant ratings of autonomous and controlled motivation bore no significant relationship to ratings of behaviour change (i.e., mindfulness practice or social media reduction). We hypothesized that, in both studies, participant motivation was more uniform than that which might occur in a psychotherapy treatment population (i.e., those who may be more ambivalent about change). Participation was self-selected in both studies, with both subsets of participants demonstrating interest in the behaviour they were asked to change and in the prescribed intervention. Participant motivation was high and demonstrated little variation at baseline, which is unlikely to be the case with a psychotherapy treatment population.

Despite the null relationship between motivation and behaviour change in both studies, a significant relationship between perceived needs support and behaviour change emerged. Interestingly, results from both of our studies suggested that rated satisfaction of basic needs does not necessarily follow from experiencing perceived support of said needs, even if support predicts task completion. It appears possible that needs support, and relatedness support in particular, may be an important contributing factor for engagement in emotionally demanding tasks regardless of perceived needs satisfaction or felt motivation. Support for this hypothesis can be found in the existing literature (e.g., Mallinckrodt, 2000), which suggests that perceptions of social support can be effectively unrelated to the amount of actual support provided by others (Lakey & Heller, 1988). Perceived support may well be more related to the characteristics of the perceiver than reflecting actual support in one's interpersonal environment (Lakey & Dickinson, 1994). The interactional relationship between needs support, perceived needs satisfaction, motivation, and task completion would benefit from further study.

Taken together, while analogue in nature, these results lend further credence to the importance of attending to common factor variables present across most orientations of psychotherapy. As noted in the introduction, treatment-oriented research has primarily focused on developing manualized treatment methods, and has been designed and tested with participants

who meet very specific criteria and fall into discrete diagnostic categories (Ryan & Deci, 2008). However, treatments that address the process of change are particularly important in the treatment of new or unique problems because in such cases standardized treatments might not apply directly to clients' treatment needs. Further, while working alliance is a pan-theoretical and reliable predictor of positive therapeutic outcomes (Horvath & Symonds, 1991; Martin et al., 2000), it is not a comprehensive treatment method and much variance in treatment outcome is yet to be explained. Our results suggest that Self-Determination Theory can provide a framework for understanding a variety of relationship influences (i.e., basic needs support and thwarting, perception of needs support, needs satisfaction) on psychotherapeutic motivation and change. SDT variables may provide helpful guidance for incorporating flexible interventions, applicable across treatment orientations, which prioritize client autonomy, competence, and relatedness to others.

Limitations and Future Directions

Our studies have a number of limitations which could be addressed in future research. First, we relied on samples of undergraduate students and psychotherapy-like tasks (i.e., those requiring emotionally-demanding behaviour change) as an analogue for a psychotherapy treatment population. This format enabled us to recruit greater numbers of participants, as well as experimentally manipulate some variables of interest that would be unethical to manipulate within a psychotherapy context (e.g., a therapist intentionally thwarting basic psychological needs). However, due to the analogue nature of the population, we are unable to state with certainty that the results are predictive of those that might occur via a therapeutic relationship. For example, it is likely that relatedness support and satisfaction would have a particularly large influence in the context of a therapeutic relationship, built on trust and maintained over time, and required for clients to make difficult yet necessary disclosures.

Additionally, the samples we recruited were self-selecting and identified wanting to make an imminent change to a particular behaviour or complete a particular intervention. It is possible that these factors influenced participant ratings of motivation for change and action towards reaching their goals. A promising next step would involve prospectively evaluating these SDT variables of interest (e.g., basic needs support and thwarting, basic needs satisfaction, autonomous and controlled motivation) with a psychotherapy treatment population.

Furthermore, our pattern of results suggests that some of our Study 1 support and thwarting interventions were underpowered in producing corresponding effects on basic needs satisfaction. We partially addressed this issue in Study 2 by having participants recruit more consistent interactions with the person influencing their basic needs, as opposed to evaluating the effect of one in-lab set of supportive or thwarting interactions. In essence, we intended to capitalize on the more robust needs support and thwarting behaviours that occur within pre-existing interpersonal relationships. Study 2 results indicated some impact of this more consistent support or thwarting (e.g., a significant relationship between perceived needs support and motivation). Still, that Study 2 was completed online presents another limitation. We are unable to state with certainty how often participants actually spoke with their supporters about behaviour change or the depth of these conversations. It would be interesting to examine the effect of a more controlled, consistent, and salient set of support or thwarting interventions which could be manipulated experimentally (e.g., having participants interact with a researcher or confederate who supports or thwarts particular needs at multiple time points over the course of a study).

There would be great value in future research examining SDT variables (e.g., basic needs support and thwarting, basic needs satisfaction, autonomous and controlled motivation) in a psychotherapy context. In order to more accurately examine the role of these common factors in psychotherapy treatment outcome, researchers could use a prospective research design with a sample of individuals receiving treatment for mental health difficulties. It is likely that supportive (and possibly thwarting) behaviours from both a client's therapist as well as their pre-existing interpersonal social network will influence psychotherapy effectiveness. For instance, in Study 2, results supported our hypothesis that participants who perceived greater needs support from their assigned supporters reported greater reduction of social media use as well as higher ratings of behaviour change progress. This result remained after controlling for participants' baseline intended changes, suggesting that interpersonal needs support promotes behaviour change over goal setting alone. It is therefore probable that requesting support from one's trusted interpersonal circle during an attempt for change will influence a person's ability to enact that change.

Further, it is possible that the negative effects of thwarting behaviours, while not a powerful influence in these studies, would be more perceptible in a psychotherapy treatment

sample. In their personal social circles, psychotherapy clients are interacting with loved ones who may or may not approve of their behaviour change goals, and who may use more controlling or thwarting behaviours to encourage or discourage change. These interpersonal influences might interact with a client's experience of perceived support from the therapeutic relationship. Take, for example, a situation where a client is being discouraged by loved ones from being more assertive in relationships, and the therapist has suggested that this could be a primary therapeutic goal. The conflict between the opinions and guiding behaviours of these important relationship partners could heavily influence client ratings of perceived needs support or thwarting, needs satisfaction, as well as motivation for and completion of therapeutic tasks. Thus, a fruitful avenue of future study could involve examining the interaction between a therapist's and a clients' support system's needs supportive or needs thwarting behaviours.

Overall, it is clear that perceived support of individuals' basic psychological needs for not only autonomy, but also competence and relatedness to others, has a significant influence on their ability to make emotionally demanding changes. It will be important to examine how support or thwarting across relationships influences needs satisfaction, as well as the connection between this perception and motivation in a psychotherapy context. Regardless, support of all three basic psychological needs in treatment appears to be an important common factor to which psychotherapists could benefit from attending.

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Appendix A

Study 1: Basic Psychological Needs Study Lab Scripts

Autonomy Support / Competence Support / Relatedness Support Conditions

Thank you for coming in today!

As you might have read on SONA, this study is a one-week study on stress management through mindfulness meditation. You will be introduced to mindfulness techniques for reducing stress and will be asked to keep track of your intention to complete the intervention as well as how long you participated in the exercises each day.

Today you will be asked to fill out a few questionnaires and will learn about several potential mindfulness exercises, one of which you will be asked to complete over the course of the next week. You will be required to fill out short daily online questionnaires in the next week to track your intention to complete the exercises as well as your subjective stress level. In a week, you will be emailed a Qualtrics link with several questionnaires regarding your intention to continue using the techniques you've learned, completion of mindfulness exercises, and stress level. We will also be emailing you part way through the week to check in and ask how the mindfulness practice is going. Please provide your preferred email contact on this sheet *[provide sheet]*.

Participation in this study is voluntary, and **will take approximately 1.5 hours within a week of your time**. You will receive up to a total of 1.5 credits for completing all components of the study upon study completion. Credits will be pro-rated and depend on the elements of the study you complete. You will receive .5 credits for the half hour in-lab meeting. You will also receive .5 credits for a half hour mindfulness meditation intervention to be completed at your discretion within the next week. Finally, you will receive .25 credits for filling out the brief daily questionnaires (completion time will be 15 minutes total over the course of the week), and .25 credits for completing the final measures at the end of the study (completion time will be 15 minutes). You may decide to withdraw from this study at any time by advising the researcher, and may do so without any penalty. You may also choose to skip or leave blank any questions that you are uncomfortable answering without penalty. Credits will be manually awarded at the end of the study (after one week).

[Provide consent form, ask if have any questions]

First off, can you tell me what experience you have with mindfulness meditation?

Autonomy

There are a few mindfulness interventions that we're interested in for their effect on student stress management. We'd like you to hear briefly about each intervention and then rank them in order of preference (1 being your most preferred intervention, 4 being your least preferred). You'll be able to choose the intervention you'd be most interested in completing over the course of the next week. Feel free to choose the intervention that is most interesting to you and that you'd be most likely to participate in. Here are the possible interventions: [*Provide info sheet with brief descriptions – briefly show participants the YouTube clips and PDFs*]. Please rank your preferences on this sheet.

- *Provide participant with intervention of choice. If YouTube choice:* You will be emailed a link to the YouTube mindfulness video. *If PDFs:* You will be given these printouts to take home. They can also be emailed to you if you'd prefer.

You can complete the mindfulness meditation intervention at whatever point you'd like over the next week. You will receive .5 credits for half an hour of intervention participation. If you would like to use the intervention for more time, feel free! However, you will not receive credit for any additional mindfulness practice.

Each morning, you will receive a link to a questionnaire regarding your intention to participate in the intervention as well as questions regarding your use of the mindfulness techniques in the previous day. Please note that you do not have to use the intervention every day, and we expect that you will mark *did not participate in mindfulness meditation yesterday* on at least a few days as you will not receive credit for more than half an hour of mindfulness practice.

Competence

You've chosen / been assigned to the [*insert name of mindfulness intervention*]. We want you to feel like you have a good grasp of what mindfulness meditation is and how to begin using mindfulness techniques. Here is an information sheet with a summary of what mindfulness is as well as some common mindfulness techniques that can be used day to day. [*Go through sheet with participants, ask if they have any questions*]. I'm now going to play you a clip of the video you'll be watching to give you an idea of what you'll be doing this week. [*If PDFs:* I'm now going to give you the readings you'll be doing over the course of the week. Take a read through the first page of this article and let me know if you have any questions]. The techniques are pretty straightforward, but if you have any questions about mindfulness or how to practice it, feel free to ask or email me over the course of the week. As we expect most participants are beginners, we do not expect you to master mindfulness over the course of this week. We simply anticipate that, through these introductory materials, you will learn about mindfulness and start to practice mindfulness meditation this week.

Relatedness

Before we send you off to complete the study over the course of this week, I just wanted to check in about the level of stress you've been experiencing lately and to hear about some of the stressors you're anticipating in the coming weeks that might be on your mind. How would you rate your current level of stress? How is stress playing a role in your life right now? Is most of your stress school-related? Tell me about it. Do you have any particularly stressful situations coming up that are on your mind? *[Interview for 10 minutes – ensure you validate participant's level of stress; e.g., “that sounds tough,” “I can see how that would be stressful”]*

It sounds like you've got a few stressful situations coming up [tailor to participant interview responses]. I know this is a pretty stressful period for a lot of students – a lot of our participants have told us they're in a really similar position. In fact, we have some information here on student stress just to illustrate that you're not going through these feelings alone *[give Stress Management handout]*. I hope the next few weeks go well for you! Here are some on-campus resources on campus for dealing with stress *[provide Counselling Services info and Student Success Office info]*.

Finally, we just want to check in to see how you're feeling about this study to make sure we're being as helpful as we can to participants. Please complete this brief questionnaire *[give basic needs state questionnaire / Perceived stress scale / Autonomous&Controlled Motivation questionnaire]*. Thank you once again for coming in today! We'll be emailing you those daily questionnaires as well as checking in half way through the week to see how things are going. At the end of the week, you'll receive a link to complete final questionnaires. Please email or call us if you have any questions over the course of the week. Take care!

[Note to ORE: If participants appear severely distressed at any point in describing life stress, we will follow the procedures outlined in the Standard Operating Procedures attached. The SOP has been previously approved in previous studies (e.g., ORE# 19871) for assessing risk in participants. Research Assistants will be trained in risk assessment using this SOP.]

Autonomy Thwarting / Competence Thwarting / Relatedness Thwarting Conditions

Thank you for coming in today!

As you might have read on SONA, this study is a one-week study on stress management through mindfulness meditation. You will be introduced to mindfulness techniques for reducing stress and will be asked to keep track of your intention to complete the intervention as well as how long you participated in the exercises each day.

Today you will be asked to fill out a few questionnaires and will learn about several potential mindfulness exercises, one of which you will be asked to complete over the course of the next week. You will be required to fill out short daily online questionnaires in the next week to track your intention to complete the exercises as well as your subjective stress level. In a week, you will be emailed a Qualtrics link with several questionnaires regarding your intention to continue using the techniques you've learned, completion of mindfulness exercises, and stress level. We will also be emailing you part way through the week to check in and ask how the mindfulness practice is going. Please provide your preferred email contact on this sheet *[provide sheet]*.

Participation in this study is voluntary, and **will take approximately 1.5 hours within a week of your time**. You will receive up to a total of 1.5 credits for completing all components of the study upon study completion. Credits will be pro-rated and depend on the elements of the study you complete. You will receive .5 credits for the half hour in-lab meeting. You will also receive .5 credits for a half hour mindfulness meditation intervention to be completed at your discretion within the next week. Finally, you will receive .25 credits for filling out the brief daily questionnaires (completion time will be 15 minutes total over the course of the week), and .25 credits for completing the final measures at the end of the study (completion time will be 15 minutes). You may decide to withdraw from this study at any time by advising the researcher, and may do so without any penalty. You may also choose to skip or leave blank any questions that you are uncomfortable answering without penalty. Credits will be manually awarded at the end of the study (after one week).

[Provide consent form, ask if have any questions]

First off, can you tell me what experience you have with mindfulness meditation?

Autonomy

There are a few mindfulness interventions that we're interested in for their effect on student stress management. As we're interested in which interventions students would prefer if they had the choice, we'd like you to hear briefly about each intervention and then rank them in order of preference (1 being your most preferred intervention, 4 being your least preferred). However, because this is an experimental study, we'll be randomly assigning you to complete one of the interventions over the course of the next week. Here are the mindfulness interventions we're examining: *[Provide info sheet with brief descriptions – briefly show participants the YouTube clips and PDFs]*. Please rank your preferences on this sheet.

- *Provide participant with random intervention **ranked #4 (least appealing)**. You have been assigned to the *[insert mindfulness condition]*. *If YouTube video*: You will be emailed a link to the YouTube mindfulness video. *If PDFs*: You will be given these printouts to take home. They can also be emailed to you if you'd prefer.*

You must complete the mindfulness meditation intervention *or* readings just before bed on two *or* three days in the next week. We would prefer it if you did not save the interventions until the final few days and that you spread them out (e.g., do not complete them on consecutive days). You will receive .5 credits for half an hour of intervention participation. If you would like to use the intervention for more time, feel free! However, you will not receive credit for any additional mindfulness practice.

Each morning, you will receive a link to a questionnaire regarding your intention to participate in the intervention as well as questions regarding your use of the mindfulness techniques in the previous day. Please note that you do not have to use the intervention every day, and we expect that you will mark *did not participate in mindfulness meditation yesterday* on at least a few days as you will not receive credit for more than half an hour of mindfulness practice.

Competence

You've chosen / been assigned to the *[insert name of mindfulness intervention]*. The videos *or* readings will inform you what mindfulness meditation is and how to begin using mindfulness techniques. Here is an information sheet with a definition of mindfulness; please read through it. *[Let participants read sheet, do not ask if they have questions]*. I'm now going email you a link to the clip of the video you'll be watching. *[If PDFs*: I'm now going to give you the readings you'll be doing over the course of the week. If you would like me to email the readings to you as well, let me know]. The techniques can seem deceptively simple. However, they can be pretty tricky to get a grasp on for beginners. While we do not expect you to master mindfulness over the course of this week, we do expect that you will learn about mindfulness and begin to feel comfortable using the techniques. Just try it out, and you'll be able to report on how effective you feel the exercises are in the daily questionnaires.

Relatedness

Before we send you off to complete the study over the course of this week, I just wanted to give you some information on student stress. *Read off of the first page of the Stress Management sheet [give Stress Management handout].* I hope the next few weeks go well for you! Here are some on-campus resources on campus for dealing with stress *[provide Counselling Services info and Student Success Office info].*

Finally, we just want to check in to see how you're feeling about this study to make sure we're being as helpful as we can to participants. Please complete this brief questionnaire *[give basic needs state questionnaire / Perceived stress scale / Autonomous&Controlled Motivation questionnaire]*. Thank you once again for coming in today! We'll be emailing you those daily questionnaires as well as checking in half way through the week to see how things are going. At the end of the week, you'll receive a link to complete final questionnaires. Please email or call us if you have any questions over the course of the week. Take care!

[Note to ORE: If participants appear severely distressed at any point in describing life stress, we will follow the procedures outlined in the Standard Operating Procedures attached. The SOP has been previously approved in previous studies (e.g., ORE# 19871) for assessing risk in participants. Research Assistants will be trained in risk assessment using this SOP].

Appendix B

Study 1: Basic Psychological Needs Study In-Lab Study Materials

Mindfulness Meditation Interventions

1. 15-minute video (Mindfulness Meditation – Quick 15 Minute Stress-Relief Version):

- <https://www.youtube.com/watch?v=8v45WSuAeYI>

This mindfulness video will guide you through a 15-minute mindfulness meditation session focused on stress-relief. You will be asked to watch this video in its entirety twice over the next week.

Rank: ____

2. 12-minute video (Mindfulness Meditation Taster with Jon Kabat-Zinn):

- <https://www.youtube.com/watch?v=D5Fa50oj45s>

This mindfulness video will both introduce you to mindfulness concepts and the rationale behind mindfulness, as well as guide you through mindfulness meditation techniques. The video is 12-minutes. You will be asked to watch this video in its entirety twice over the next week, to spend 5 extra minutes practicing mindfulness on your own.

Rank: ____

3. Readings: Five Steps to Mindfulness / Introduction to Mindfulness Meditation: The Five Hindrances / Mindfulness in Everyday Life

These readings will provide an introduction to meditation and will provide instruction on some of the most commonly used mindfulness techniques. The readings will take approximately half an hour to complete.

Rank: ____

4. 10-minute video (Jack Kornfield: Forgiveness Meditation):

- <https://www.youtube.com/watch?v=PbHKCy4f6Dk>

In this 10-minute video, meditation teacher Jack Kornfield will guide you through a session of forgiveness mindfulness. This is a meditation to practice forgiveness of others and of oneself, and to seek forgiveness. You will be asked to watch this video in its entirety three times over the course of the next week.

Rank: ____

Check-In Emails

Relatedness Supporting

Hi *[actually insert name]*,

This is *[researcher]* checking in to see how the mindfulness meditation study is going. I hope your week has been going well and that you're enjoying the mindfulness meditation exercises through the study! *[If participant mentioned specific stressful school event coming up, enquire about it. Mention any piece of the interview that might show you remember who they are and are interested in how they're faring].*

Do you have any questions or feedback about the mindfulness intervention? Have a good week and thank you once again for participating in our study.

Sincerely,
[Researcher]

Relatedness Thwarting

Hi *[insert name – leave this as insert name]*,

This is *[researcher]* checking in to see how the mindfulness meditation study is going. I hope your week has been going well and that you're enjoying the mindfulness meditation exercises through the study!

Do you have any questions or feedback about the mindfulness intervention? Have a good week and thank you once again for participating in our study.

Sincerely,
[Researcher]

11. I feel capable at what I do.	1	2	3	4	5
12. I feel disappointed with many of my performances.	1	2	3	4	5
13. I feel my choices express who I really am.	1	2	3	4	5
14. I feel pressured to do too many things.	1	2	3	4	5
15. I feel close and connected with other people who are important to me.	1	2	3	4	5
16. I have the impression that people I spend time with dislike me.	1	2	3	4	5
17. I feel competent to achieve my goals.	1	2	3	4	5
18. I feel insecure about my abilities.	1	2	3	4	5
19. I feel I have been doing what really interests me.	1	2	3	4	5
20. My daily activities feel like a chain of obligations.	1	2	3	4	5
21. I experience a warm feeling with the people I spend time with.	1	2	3	4	5
22. I feel the relationships I have are just superficial.	1	2	3	4	5
23. I feel I can successfully complete difficult tasks.	1	2	3	4	5
24. I feel like a failure because of the mistakes I make.	1	2	3	4	5

Daily Questionnaires

1. I participated in the mindfulness intervention yesterday.
Yes / No
2. I spent _____ minutes participating in the mindfulness intervention yesterday.
0-5
6-10
11-15
16-20
21-25
26-30
Over 30 minutes

Basic Needs Satisfaction Scale – State

Please respond to each statement by indicating how true it is for you. Use the following scale:

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

In regard to practicing the mindfulness technique today:

1. I have a say in when and how to do the exercise. _____
2. I'm gaining confidence that I can make use of this technique. _____
3. I feel supported in my efforts by the study researcher. _____
4. I'm feeling motivated for the mindfulness practice session. _____

Autonomous and Controlled Motivation Questionnaire – State

There are a variety of reasons why people participate in mindfulness meditation. Please read over the statement below and indicate how much you agree or disagree with each reason, using the scale provided. Please mark your responses directly on the answer sheet.

I'm participating in the intervention because:

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree

- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. I promised the researcher I would complete the task and indicated I would follow the instructions. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Managing my life stress allows me to participate in other important aspects of my life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I would be disappointed with myself if I didn't. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I feel like I could personally benefit when I practice mindfulness. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. By engaging in meditation practice I can gain course credit. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Practicing mindfulness is an important choice that I really want to make to become less stressed. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last week. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

1. In the last week, how often have you felt nervous and “stressed”?

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

2. In the last week, how often have you felt that things were going your way?

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

3. In the last week, how often have you found that you could not cope with all the things that you had to do?

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

4. In the last week, how often have you felt that you were on top of things?

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

5. In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

conditions that support or detract from one's level and type of motivation. Did you notice your motivation to complete the mindfulness intervention varying from day to day?

[Yes / No]

We didn't tell you that the main variable of interest in this study was to try to create conditions that would support or detract from your level and type of motivation. We determined that it would be impossible to conduct our study design without masking the true purpose of our research. You will now be redirected to the post-study consent form. Please read over the post-study consent form for more information on the true purpose of the study as well as further information on our variables of interest.

Appendix D

Study 2: Online Basic Needs Study Materials

Study Completion Instructions

Thank you for agreeing to participate in our study. Over the next two weeks, we request that you begin to reduce your social media use. We ask that you identify specific goals for reduction in the online questionnaires that follow. Further, you will be asked to select a person in your life who you will task with talking with you about both your successes and your challenges in your attempts to reduce your social media use over the next two weeks (however, if you are unwilling or unable to identify a person to speak with about this, we still welcome you to participate in the study). The person should be someone with whom you are in contact regularly (i.e., at least three times per week) and feel comfortable disclosing changes to your social media use. We ask that you speak primarily with this person about your social media use over the next two weeks and answer all study questions regarding interactions with another person about behaviour change with this one person in mind. If you choose not to identify someone, we ask that you still attempt to change the behaviour in question and complete questionnaires on Qualtrics, but refrain from talking with anyone about the changes you are making or the process of change until the end of the study. You will be required to complete one daily item on Qualtrics (for which you will receive an email reminder) about the estimated time you used social media the previous day. After one week, you will be emailed a Qualtrics link to complete a brief set of questionnaires about your behaviour change attempts, motivation to continue with social media use reduction, and your interactions with your identified person about changing social media use. We hypothesize that your interactions with your identified person over the course of the study will influence your motivation for and success in engaging in behaviour change.

Reminders for study completion:

- Attempt to reduce your social media use.
- **If you selected a person** to communicate with about this:
 - Speak with them regularly (at least 3 times per week) about reducing your use
 - Try to talk mainly with this person about your change attempts
- **If you didn't select a person** to communicate with about this:
 - Try to hold off talking with others about your change attempts until after the study

Thank you for your participation!

Qualtrics Email Scripts

Daily Question Email Script

Hello, please follow the link below to complete the daily question for the Interpersonal Relationships and Behaviour Change study:

[link]

Reminders for study completion:

- Attempt to reduce your social media use.
- **If you selected a person** to communicate with about this:
 - Speak with them regularly (at least 3 times per week) about reducing your use
 - Try to talk mainly with this person about your change attempts
- **If you didn't select a person** to communicate with about this:
 - Try to hold off talking with others about your change attempts until after the study

Thank you for your participation!

Midway Questionnaires Email Script

Hello, please follow the link below to complete the midpoint questionnaires for the Interpersonal Relationships and Behaviour Change study:

[link]

Reminders for study completion:

- Attempt to reduce your social media use.
- **If you selected a person** to communicate with about this:
 - Speak with them regularly (at least 3 times per week) about reducing your use
 - Try to talk mainly with this person about your change attempts
- **If you didn't select a person** to communicate with about this:
 - Try to hold off talking with others about your change attempts until after the study

Thank you for your participation!

Final Questionnaires Email Script

Hello, please follow the link below to complete the final questionnaires for the Interpersonal Relationships and Behaviour Change study:

[link]

Thank you for your participation!

Appendix E

Study 2: Online Basic Needs Study Questionnaires

Pre-Screen Questionnaire

1. Are you interested in changing any of the following behaviours over the course of this semester? [Y/N to each]
 - a. Attend more classes
 - b. Get more sleep
 - c. Reduce time spent gaming
 - d. Use your smart phone less
 - e. Spend less time on social media
 - f. Increase amount of exercise
 - g. Walk more
 - h. Reduce nail biting
 - i. Drink more water
 - j. Reduce spending
 - k. Cook at home more / eat out less

Baseline Questionnaires

[*Please note, behaviour included in questionnaires will vary according to which behaviour is selected by the largest number of respondents in the pre-screen. For example, if the largest proportion of students indicate a desire to get more sleep over the next semester, the following questionnaires would be revised to replace “social media use” with “amount of sleep”]

1. SONA ID: [text box] * Your SONA ID will only be used to grant credits and match participant’s survey data. Once the study is complete, this information will be deleted* Please ensure that you enter your **SONA ID**, rather than your student ID.

Behaviour Change Questionnaire

1. How often are you spending time on social media currently? Please respond with an estimated average in hours and minutes **per day**: [text box]
2. With regard to social media use, what is your behaviour change goal over the next two weeks? Please be as specific as possible. If you predict your goal will take more than 2 weeks to achieve, what small behaviours will you enact to begin your work towards that larger goal? [text box]
 - Examples of goals aimed at reducing use (*please note, this is not an exhaustive list):
 - i. Reduce your time spent on social media by half an hour per day.
 - ii. Stop using one social media platform completely.
 - iii. Stop using social media at a particular point during the day (e.g., no social media during lectures or while in bed).
3. Which platforms do you use, and how frequently?
 - Instagram [%]
 - Facebook/Messenger [%]
 - Twitter [%]
 - Reddit [%]
 - Pinterest [%]
 - Tumblr [%]
 - YouTube [%]
 - Weibo [%]
4. Which platforms do you predict will be the most difficult to reduce use on [rank #]?
 - Instagram [rank #]
 - Facebook/Messenger [rank #]
 - Twitter [rank #]
 - Reddit [rank #]

- Pinterest [rank #]
- Tumblr [rank #]
- YouTube [rank #]
- Weibo [rank #]

5. How great a change would you like to make to your social media use over the next two weeks, as a percentage? For example, if you would like to reduce your usage to half of how often you currently use social media (e.g., from 2 hours per day to 1 hour per day), you would enter 50: [enter number from 0 – 100]
6. How many minutes fewer, on average, would you like to reduce your use by? [enter number in hours and/or minutes]
7. Have you attempted to reduce time spend on social media before? [Y/N]
 - a. How many past attempts have you made: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, >10]
 - b. How successful were past attempts?
[0 – no lasting change, 2 – small sustained change, 5 – large sustained change]
8. How confident are you that you can achieve the goal you set to reduce social media use over the course of this study? [0 – not at all confident, 2 – somewhat confident, 5 – very confident]

Readiness to Change Questionnaire

The following questions are designed to identify how you personally feel about your social media use right now. Please think about your current social media habits, even if you have begun to make changes. Read each question below carefully and then decide whether you agree or disagree with the statements. Please mark the answer of your choice to each question.

1 = Strongly Disagree 2 = Disagree 3 = Unsure 4 = Agree 5 = Strongly Agree

1. I am a fairly average compared to my peers in terms of the amount of time I spend on social media, so there is nothing I really need to change.
2. Sometimes I think I should cut down on or quit my social media use.
3. I am actually changing my social media habits right now (either cutting down or quitting).

Autonomous and Controlled Motivation Questionnaire (ACMQ)

There are a variety of reasons why people engage in behaviour change. Please read over the statement below and indicate how much you agree or disagree with each reason, using the scale provided.

I'm attempting to change the behaviour in question because:

	1 Strongly Disagree	2 Moderately Disagree	3 Slightly Disagree	4 Neutral	5 Slightly Agree	6 Moderately Agree	7 Strongly Agree
1. I'm making a commitment to participate in the study and indicated I would follow the instructions.	1	2	3	4	5	6	7
2. Changing this behaviour will improve other important aspects of my life.	1	2	3	4	5	6	7
3. I would be disappointed with myself if I didn't.	1	2	3	4	5	6	7
4. I feel like I will personally benefit when I change this behaviour.	1	2	3	4	5	6	7
5. By attempting to change a behaviour through this study I can gain course credit.	1	2	3	4	5	6	7
6. Changing this behaviour is an important choice that I really want to make to improve my life.	1	2	3	4	5	6	7

Characteristics of Person to Discuss Change With

1. Are you comfortable speaking with someone in your interpersonal circle about changing this behaviour? [e.g., friend, roommate, romantic partner, mother, father, brother, sister, grandparent, supervisor/teacher; acquaintance; other (please specify)]: Y/N
 - a. If Yes: Participants will be directed to the rest of this questionnaire
 - b. If No: Participants will be directed to a reduced version of the Qualtrics questionnaires that does not include the rest of this questionnaire or the Interpersonal Behaviours Questionnaire in baseline, midpoint, and post study questionnaire package,

2. Please identify an individual in your life with whom you 1) communicate regularly (i.e., at least 3 times per week) and will be available over the next two weeks; 2) would be comfortable disclosing the behaviour change you'd like to enact; 3) would be someone you could turn to for help when struggling to engage in this behaviour change:

[friend, roommate, romantic partner, mother, father, brother, sister, grandparent, supervisor/teacher; acquaintance; other (please specify)]

3. Gender of selected person: [Male / Female / Non-binary or third gender]
4. How frequently are you typically in contact (e.g., via text, phone, social media, in person, etc.) with this person?

[a few times per day; once per day; a few times per week; once a week; less than once a week]

5. How long per week do you typically interact (best estimate is okay)? [enter time in minutes or hours]
6. What is your primary mode of communication?

[in person, phone, text, social media, email, other (please specify: ____)]

7. What factors were important in selecting this person (select all the apply)?
[I feel comfortable disclosing my goals and struggles to this person; This is the person I talk to most often; This person sets and achieves their own desired goals regularly; This person has encouraged me in ways I found helpful in the past]

8. What methods do you predict this person will use to encourage you (select all that apply)?
[**Will not** pressure me to get things done; **Will** pressure me to get things done; **Will not** guilt me into acting; **Will** guilt me into acting; **Will not** empathize with my struggles; **Will** empathize with my struggles; **Will not** accept any excuses; **Will** go easy on me when I struggle]

9. Please explain in your own words why this person is your first choice for encouraging you in this behaviour change attempt: [text box]

Revised Adult Attachment Scale – Close Relationships Version

The following questions concern how you *generally* feel in *important close relationships in your life*. Think about your past and present relationships with people who have been especially important to you, such as family members, romantic partners, and close friends. Respond to each statement in terms of how you *generally* feel in these relationships.

Please use the scale below by selecting a number between 1 and 5.

1	2	3	4	5
Not at all characteristic				Very characteristic of me

1. I find it relatively easy to get close to people.
2. I find it difficult to allow myself to depend on others.
3. I often worry that other people don't really love me.
4. I find that others are reluctant to get as close as I would like.
5. I am comfortable depending on others.
6. I don't worry about people getting too close to me.
7. I find that people are never there when you need them.
8. I am somewhat uncomfortable being close to others.
9. I often worry that other people won't want to stay with me.
10. When I show my feelings for others, I'm afraid they will not feel the same about me.
11. I often wonder whether other people really care about me.
12. I am comfortable developing close relationships with others.
13. I am uncomfortable when anyone gets too emotionally close to me.
14. I know that people will be there when I need them.
15. I want to get close to people, but I worry about being hurt.
16. I find it difficult to trust others completely.
17. People often want me to be emotionally closer than I feel comfortable being.
18. I am not sure that I can always depend on people to be there when I need them.

Introversion/Extroversion Scale

Please read each of the statements below and indicate the extent to which each statement accurately describes you.

1	2	3	4	5
Very inaccurate description of me		Neither accurate nor inaccurate		Very accurate description of me

1. I feel comfortable around people.
2. I make friends easily.
3. I keep in the background.
4. I don't talk a lot.
5. I would describe my experiences as somewhat dull.
6. I know how to captivate people.
7. I don't like to draw attention to myself.
8. I am the life of the party.
9. I am skilled in handling social situations.
10. I have little to say.

20. Doubt my capacity to improve.	1	2	3	4	5	6	7
21. Encourage me to improve my skills.	1	2	3	4	5	6	7
22. Pressure me to do things their way.	1	2	3	4	5	6	7
23. Support the choices that I make for myself.	1	2	3	4	5	6	7
24. Not comfort me when I am feeling discouraged.	1	2	3	4	5	6	7

14. I feel pressured to do too many things.	1	2	3	4	5
15. I feel close and connected with other people who are important to me.	1	2	3	4	5
16. I have the impression that people I spend time with dislike me.	1	2	3	4	5
17. I feel competent to achieve my goals.	1	2	3	4	5
18. I feel insecure about my abilities.	1	2	3	4	5
19. I feel I have been doing what really interests me.	1	2	3	4	5
20. My daily activities feel like a chain of obligations.	1	2	3	4	5
21. I experience a warm feeling with the people I spend time with.	1	2	3	4	5
22. I feel the relationships I have are just superficial.	1	2	3	4	5
23. I feel I can successfully complete difficult tasks.	1	2	3	4	5
24. I feel like a failure because of the mistakes I make.	1	2	3	4	5

[link to separate survey to collect preferred email at which to receive Qualtrics links to other study questionnaires]

Please provide the email at which you'd like us to send the remainder of the study questionnaires (i.e., the daily question, midway questionnaires, and final questionnaires):

1. Email: [text box]

Daily Item

1. SONA ID: [text box] *Your SONA ID will only be used to grant credits and match participant's survey data. Once the study is complete, this information will be deleted* Please ensure that you enter your **SONA ID**, rather than your student ID.
2. Number of minutes spent on social media yesterday: [text box]

Reminders for study completion:

- Attempt to reduce your social media use.
- **If you selected a person** to communicate with about this:
 - Speak with them regularly (at least 3 times per week) about reducing your use
 - Try to talk mainly with this person about your change attempts
- **If you didn't select a person** to communicate with about this:
 - Try to hold off talking with others about your change attempts until after the study

Midway Questionnaires

- SONA ID: [text box] *Your SONA ID will only be used to grant credits and match participant’s survey data. Once the study is complete, this information will be deleted* Please ensure that you enter your **SONA ID**, rather than your student ID.

Autonomous and Controlled Motivation Questionnaire (ACMQ)

There are a variety of reasons why people continue to engage in behaviour change or maintain changes. Please read over the statement below and indicate how much you agree or disagree with each reason, using the scale provided.

I’m continuing attempts to change or maintaining change in the behaviour in question because:

	1	2	3	4	5	6	7				
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree				
1. I’m making a commitment to participate in the study and indicated I would follow the instructions.					1	2	3	4	5	6	7
2. Changing this behaviour is improving or will improve other important aspects of my life.					1	2	3	4	5	6	7
3. I would be disappointed with myself if I didn’t.					1	2	3	4	5	6	7
4. I am personally benefitting from changing this behaviour, or I feel like I will personally benefit from changing this behaviour.					1	2	3	4	5	6	7
5. By changing my behaviour through this study I can gain course credit.					1	2	3	4	5	6	7
6. Changing this behaviour is an important choice that I really want to make to improve my life.					1	2	3	4	5	6	7

Midway Change Progress Questionnaire

1. I have reduced my social media use since the study began [Y/N]
 - a. If Yes: Have you reduced your usage by the goal amount you set at the beginning of the study? [Y/N]
 - i. If Yes: Do you think you can sustain this change for the remainder of the study? [Y/N]
 - ii. If No:
 - b. If No: Do you intend to continue attempts to reduce your social media use over the course of this study? [Y/N]
2. How many minutes per day are you currently on social media, on average?
3. Please rate your progress towards your goal as a percentage: [enter number from 0 – 100]
4. I am satisfied with the amount of change I've made to my habits since the study began [Y/N]
 - a. If Yes: I would like to continue to reduce my social media usage further [Y/N]
 - i. If Yes: Please enter in minutes the amount of time you'd still like to reduce your usage by? [text box]
 - b. If No: Please enter in minutes the amount of time you'd still like to reduce your usage by? [text box]

19. Being distant when we spend time together.	1	2	3	4	5	6	7
20. Doubting my capacity to improve.	1	2	3	4	5	6	7
21. Encouraging me to improve my skills.	1	2	3	4	5	6	7
22. Pressuring me to do things their way.	1	2	3	4	5	6	7
23. Supporting the choices that I make for myself.	1	2	3	4	5	6	7
24. Not comforting me when I am feeling discouraged.	1	2	3	4	5	6	7

Post-Study Questionnaires

1. SONA ID: [text box] *Your SONA ID will only be used to grant credits and match participant's survey data. Once the study is complete, this information will be deleted* Please ensure that you enter your **SONA ID**, rather than your student ID.

Behaviour Change Questionnaire

1. What was the goal you had hoped to achieve regarding reducing social media use over the course of this study? [text box]
2. How often have you used social media over the last two weeks, on average per day? [enter time in hours and minutes]
 - a. Is this an increase, a decrease, or about the same as your usage before the study? [increase, decrease, same as before]
 - b. If decrease or same as before: How much did you reduce social media use over the past two weeks, as a percentage? [enter number from 0 – 100]
 - c. If increase: How much did your social media use increase over the past two weeks, as a percentage [enter number from 0 – 100]
3. Please rate your progress in achieving behaviour change:
-5 -4 -3 -2 -1 0 1 2 3 4 5 (- 5 = behaviour got worse/moved in opposite direction of that intended; 0 = no change; 5 = met goal)
4. Do you think you will continue to enact this change in behaviour post-study? [Y/N]
 - a. If Yes:
 - i. Will you continue to use the person you designated to support you in your efforts? [Y/N]
 - ii. Will you ask others in your life for support in enacting this change? [Y/N]

Autonomous and Controlled Motivation Questionnaire (ACMQ)

There are a variety of reasons why people will continue to engage in behaviour change post-study. Please read over the statement below and indicate how much you agree or disagree with each reason, using the scale provided.

I will continue to change or maintain changes in this behaviour, because:

	1	2	3	4	5	6	7
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1. I feel like I should continue to change or maintain change in the behaviour in question.	1	2	3	4	5	6	7
2. Changing or maintaining changes I made in this behaviour will improve other important aspects of my life.	1	2	3	4	5	6	7
3. I would be disappointed with myself if I didn't.	1	2	3	4	5	6	7
4. I feel like I have personally benefited by making changes in this behaviour.	1	2	3	4	5	6	7
5. Through my behaviour change attempts, I can show others I am serious about achieving my goal.	1	2	3	4	5	6	7
6. Changing this behaviour is an important choice that I really want to make to improve my life.	1	2	3	4	5	6	7

Characteristics of Person You Discussed Change With

1. Did you identify someone to discuss change with in the baseline questionnaires? [Y/N]
 - a. If Yes: Participants will continue with questionnaires below
 - b. If No: Participants will be directed to the section: ***Only for participants who did not identify a person to discuss change with at baseline*** and will skip the Interpersonal Behaviours Questionnaire

2. Please identify the individual you chose to motivate you to engage in this behaviour change:

[mother, father, brother, sister, grandparent, friend, roommate, romantic partner, supervisor/teacher; acquaintance; other (please specify):]

3. How frequently were you in contact with this person on average over the course of the study (e.g., via text, phone, social media, in person, etc.)?

[a few times per day; once per day; a few times per week; once a week; less than once a week]

4. How long on average per week did you interact (best estimate is okay)? [enter time in minutes or hours]

5. What was your primary mode of communication over the course of the study?

[in person, phone, text, social media, email, other (please specify: ____)]

6. How frequently did you speak with this person about your social media usage?

[several times per day, once per day, a few times per week, once per week, once over the course of the study, never; *If never*: Please state your reasons for not discussing your behaviour change efforts with this person {text box}]

7. How much time do you estimate you spoke with this person about your social media usage in total over the course of this study? [hours and minutes]

[Only for participants who did not identify a person to discuss change with at baseline]:

1. Did you discuss your attempts to reduce social media usage with anyone over the last two weeks? [Y/N]

[If Yes]:

- a. Who did you discuss this with? [select all that apply: mother, father, brother, sister, grandparent, friend, roommate, romantic partner, supervisor/teacher; acquaintance; other (please specify):]

- b. What was your primary mode of communication with these people over the course of the study?

[in person, phone, text, social media, email, other (please specify: ____)]

- c. How frequently did you speak with these people about your social media usage?

[several times per day, once per day, a few times per week, once per week, once over the course of the study, never; *If never*: Please state your reasons for not discussing your behaviour change efforts with this person {text box}]

- d. How much time do you estimate you spoke with these people about your social media usage in total over the course of this study? [hours and minutes]

- e. Are you planning on discussing your behaviour change attempts with anyone now that the study is complete? [Y/N]

20. Doubted my capacity to improve.	1	2	3	4	5	6	7
21. Encouraged me to improve my skills.	1	2	3	4	5	6	7
22. Pressured me to do things their way.	1	2	3	4	5	6	7
23. Supported the choices that I made for myself.	1	2	3	4	5	6	7
24. Did not comfort me when I was feeling discouraged.	1	2	3	4	5	6	7

Life Satisfaction and Frustration Scale

Below, we ask you about the kind of experiences you actually have in your life. Please read each following item carefully. You can choose from 1 to 5 to indicate the degree to which the statement is true for you at this point in your life.

.....1
2
3
4
5
Not true at
Completely true

1. I feel a sense of choice and freedom in the things I undertake.	1	2	3	4	5
2. Most of the things I do feel like "I have to."	1	2	3	4	5
3. I feel that the people I care about also care about me.	1	2	3	4	5
4. I feel excluded from the group I want to belong to.	1	2	3	4	5
5. I feel confident that I can do things well.	1	2	3	4	5
6. I have serious doubts about whether I can do things well.	1	2	3	4	5
7. I feel that my decisions reflect what I really want.	1	2	3	4	5
8. I feel forced to do many things I wouldn't choose to do.	1	2	3	4	5
9. I feel connected with people who care for me, and for whom I care.	1	2	3	4	5
10. I feel that people who are important to me are cold and distant towards me.	1	2	3	4	5
11. I feel capable at what I do.	1	2	3	4	5
12. I feel disappointed with many of my performances.	1	2	3	4	5
13. I feel my choices express who I really am.	1	2	3	4	5

14. I feel pressured to do too many things.	1	2	3	4	5
15. I feel close and connected with other people who are important to me.	1	2	3	4	5
16. I have the impression that people I spend time with dislike me.	1	2	3	4	5
17. I feel competent to achieve my goals.	1	2	3	4	5
18. I feel insecure about my abilities.	1	2	3	4	5
19. I feel I have been doing what really interests me.	1	2	3	4	5
20. My daily activities feel like a chain of obligations.	1	2	3	4	5
21. I experience a warm feeling with the people I spend time with.	1	2	3	4	5
22. I feel the relationships I have are just superficial.	1	2	3	4	5
23. I feel I can successfully complete difficult tasks.	1	2	3	4	5
24. I feel like a failure because of the mistakes I make.	1	2	3	4	5

Appendix F

Study 1 Tables

Table 1

Correlations of Items on the Basic Psychological Needs Questionnaire – State

	Autonomy	Competence	Relatedness	Motivation
Autonomy	--	.42**	.46**	.43**
Competence		--	.40**	.89**
Relatedness			--	.38**
Motivation				--

** $p < .01$; $N = 100$

Table 2

One-Way ANOVAs Evaluating Effect of Condition on Basic Needs Satisfaction at Baseline

Needs Satisfaction	Mean (<i>SD</i>)		<i>F</i>	<i>df</i>	<i>p</i>
	Autonomy Support	Autonomy Thwarting			
<i>Autonomy</i>	6.08 (1.19)	6.10 (1.23)	0.01	1,98	.912
<i>Competence</i>	5.52 (1.42)	5.83 (1.34)	1.29	1,98	.260
<i>Relatedness</i>	6.13 (1.03)	6.00 (1.27)	0.34	1,98	.561
	Competence Support	Competence Thwarting	<i>F</i>	<i>df</i>	<i>p</i>
<i>Autonomy</i>	5.98 (1.33)	6.19 (1.13)	0.71	1,98	.402
<i>Competence</i>	5.70 (1.41)	5.65 (1.38)	0.03	1,98	.865
<i>Relatedness</i>	6.09 (1.17)	6.06 (1.14)	0.02	1,98	.892
	Relatedness Support	Relatedness Thwarting	<i>F</i>	<i>df</i>	<i>p</i>
<i>Autonomy</i>	5.98 (1.28)	6.19 (1.18)	0.73	1,98	.394
<i>Competence</i>	5.72 (1.28)	5.62 (1.48)	0.13	1,98	.719
<i>Relatedness</i>	6.23 (0.91)	5.92 (1.31)	1.82	1,98	.180

Note. * $p < 0.05$, two-tailed.

Table 3

One-Way ANOVAs Evaluating Effect of Condition on Basic Needs Satisfaction at Endpoint

Needs Satisfaction	Mean (<i>SD</i>)		<i>F</i>	<i>df</i>	<i>p</i>
	Autonomy Support	Autonomy Thwarting			
<i>Autonomy</i>	6.26 (1.17)	5.72 (1.33)	4.24	1,92	.042*
<i>Competence</i>	5.36 (1.28)	5.36 (1.28)	0.00	1,92	1.00
<i>Relatedness</i>	6.55 (0.65)	6.34 (0.92)	1.68	1,92	.198
	Mean (<i>SD</i>)		<i>F</i>	<i>df</i>	<i>p</i>
	Competence Support	Competence Thwarting			
<i>Autonomy</i>	5.81 (1.49)	6.13 (1.07)	1.52	1,92	.221
<i>Competence</i>	5.57 (1.36)	5.19 (1.17)	2.10	1,92	.151
<i>Relatedness</i>	6.52 (0.77)	6.38 (0.82)	0.70	1,92	.403
	Mean (<i>SD</i>)		<i>F</i>	<i>df</i>	<i>p</i>
	Relatedness Support	Relatedness Thwarting			
<i>Autonomy</i>	5.84 (1.46)	6.12 (1.08)	1.12	1,92	.292
<i>Competence</i>	5.64 (1.24)	5.12 (1.26)	4.00	1,92	.048*
<i>Relatedness</i>	6.48 (0.76)	6.42 (0.84)	0.12	1,92	.730

Note. * $p < 0.05$, two-tailed.

Table 4

Hierarchical Multiple Regression Analyses Predicting Baseline Autonomous Motivation by Baseline Basic Needs Satisfaction

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.32***	8.73(1.59)***
	Autonomy		.07(.25)
	Competence		1.00 (.21)***
	Relatedness		.49(.26)
Model 2	Constant	.33	8.09(6.62)
	Autonomy		-.87(1.43)
	Competence		2.03(1.52)
	Relatedness		.71(1.69)
	Autonomy by Competence		.03(.20)
	Autonomy by Relatedness		.13(.25)
	Competence by Relatedness		-.19(.25)
Model 3	Constant	.33	17.55(21.18)
	Autonomy		-2.65(4.05)
	Competence		-.10(4.77)
	Relatedness		-.99(4.00)
	Autonomy by Competence		.42(.85)
	Autonomy by Relatedness		.44(.70)
	Competence by Relatedness		.18(.82)
	Autonomy by Competence by Relatedness		-.07(.14)

Note. *** $p < 0.001$, two-tailed.

ΔR^2 from Models 1 to 2 = .005. ΔR^2 from Models 2 to 3 = .002.

Table 5

Hierarchical Multiple Regression Analyses Predicting Baseline Controlled Motivation by Baseline Basic Needs Satisfaction

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.26***	6.68(1.89)***
	Autonomy		.14(.29)***
	Competence		.99(.25)
	Relatedness		.48(.31)
Model 2	Constant	.31	14.78(7.59)
	Autonomy		2.12(1.64)
	Competence		-3.55(1.74)*
	Relatedness		-.26(1.94)
	Autonomy by Competence		.10(.23)
	Autonomy by Relatedness		-.40(.28)
	Competence by Relatedness		.61(.28)*
Model 3	Constant	.33	51.51(23.98)*
	Autonomy		-4.80(4.59)
	Competence		-11.79(5.40)*
	Relatedness		-6.86(4.52)
	Autonomy by Competence		1.61(.96)
	Autonomy by Relatedness		.81(.80)
	Competence by Relatedness		2.04(.93)*
	Autonomy by Competence by Relatedness		-.26(.16)

Note. * $p < .05$, two-tailed; *** $p < 0.001$, two-tailed.

ΔR^2 from Models 1 to 2 = .054. ΔR^2 from Models 2 to 3 = .019.

Table 6

Hierarchical Multiple Regression Analyses Predicting Endpoint Autonomous Motivation by Endpoint Basic Needs Satisfaction

	Predictors	ΔR^2	$B(SE)$
Model 1	Constant	.26***	18.72(21)***
	Autonomy		-.22(.18)
	Competence		.84(.19)***
	Relatedness		.37(.31)
Model 2	Constant	.27	18.63(.26)***
	Autonomy		-.30(.20)
	Competence		.86(.22)***
	Relatedness		.58(.39)
	Autonomy by Competence		-.18(.21)
	Autonomy by Relatedness		.02(.22)
	Competence by Relatedness		.35(.30)
Model 3	Constant	.29	18.64(.26)***
	Autonomy		-.25(.20)
	Competence		.98(.23)***
	Relatedness		.63(.39)
	Autonomy by Competence		-.24(.21)
	Autonomy by Relatedness		-.17(.27)
	Competence by Relatedness		.42(.31)
	Autonomy by Competence by Relatedness		-.32(.24)

Note. *** $p < 0.001$, two-tailed.

ΔR^2 from Models 1 to 2 = .01. ΔR^2 from Models 2 to 3 = .01.

Table 7

Hierarchical Multiple Regression Analyses Predicting Endpoint Controlled Motivation by Endpoint Basic Needs Satisfaction

	Predictors	ΔR^2	B (SE)
Model 1	Constant	.01	16.75(.35)***
	Autonomy		-.18(.30)
	Competence		.23(.33)
	Relatedness		-.17(.53)
Model 2	Constant	.03	16.54(.44)***
	Autonomy		-.31(.34)
	Competence		.22(.37)
	Relatedness		.27(.67)
	Autonomy by Competence		-.24(.35)
	Autonomy by Relatedness		-.03(.38)
	Competence by Relatedness		.69(.51)
Model 3	Constant	.03	16.54(.45)***
	Autonomy		-.32(.35)
	Competence		.19(.40)
	Relatedness		.26(.67)
	Autonomy by Competence		-.23(.36)
	Autonomy by Relatedness		.02(.45)
	Competence by Relatedness		.67(.52)
	Autonomy by Competence by Relatedness		.08(.42)

Note. *** $p < 0.001$, two-tailed.

ΔR^2 from Models 1 to 2 = .02. ΔR^2 from Models 2 to 3 = .00.

Table 8

Multiple Regression Analyses Predicting Baseline Autonomous Motivation by Baseline Basic Needs Satisfaction

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.26***	8.73 (1.59)	5.48	.000***
Autonomy		0.07 (.25)	0.26	.794
Competence		1.00 (.21)	4.77	.000***
Relatedness		0.49 (.26)	1.91	.059

Note. *** $p < .001$, two-tailed.

Table 9

Multiple Regression Analyses Predicting Baseline Controlled Motivation by Baseline Basic Needs Satisfaction

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.26***	6.68 (1.89)	3.53	.001***
Autonomy		0.14 (.29)	0.46	.645
Competence		0.99 (.25)	3.97	.000***
Relatedness		0.48 (.31)	1.57	.119

Note. *** $p < .001$, two-tailed.

Table 10

Multiple Regression Analyses Predicting Endpoint Autonomous Motivation by Endpoint Basic Needs Satisfaction

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.26***	13.18 (1.72)	7.67	.000***
Autonomy		-0.22 (.18)	-1.25	.216
Competence		0.84 (.19)	4.38	.000***
Relatedness		0.37 (.31)	1.18	.243

Note. *** $p < .001$, two-tailed.

Table 11

Multiple Regression Analyses Predicting Endpoint Controlled Motivation by Endpoint Basic Needs Satisfaction

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.01	17.68 (2.92)	6.07	.001***
Autonomy		-0.18 (.30)	-0.59	.558
Competence		0.23 (.32)	0.70	.488
Relatedness		-0.17 (.53)	-0.31	.755

Note. *** $p < .001$, two-tailed.

Table 12

One-Way ANOVAs of Condition and Mindfulness Homework Completion

Condition	Mean (<i>SD</i>)	<i>F</i>	<i>df</i>	<i>p</i>
<i>All Needs Supported</i>	6.70 (.68)	5.38	1,23	.030
<i>All Needs Thwarted</i>	5.14 (2.03)			
<i>Autonomy Support</i>	6.32 (.19)	2.82	1,100	.096
<i>Autonomy Thwarting</i>	5.89 (.20)			
<i>Competence Support</i>	6.13 (.20)	0.04	1,100	.849
<i>Competence Thwarting</i>	6.08 (.18)			
<i>Relatedness Support</i>	6.51 (.20)	8.75	1,100	.000
<i>Relatedness Thwarting</i>	5.70 (.19)			

Table 13

Hierarchical Linear Growth Model of Autonomous Motivation Over Time

Fixed Effects	Est.	SE	<i>p</i>
Intercept	18.53	0.61	.000
Linear Slope	0.01	0.08	.907
Quadratic Slope	0.03	0.03	.285
Cubic Slope	-0.00	0.02	.816

Table 14

Hierarchical Linear Growth Model of Controlled Motivation Over Time

Fixed Effects	Est.	SE	<i>p</i>
Intercept	16.42	0.64	.000
Linear Slope	-0.04	0.08	.592
Quadratic Slope	-0.00	0.03	.963
Cubic Slope	0.02	0.02	.189

Table 15

*Hierarchical Linear Growth Model of Autonomous Motivation Over Time,
As Predicted by Basic Needs Satisfaction*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	9.55	1.29	.000
Quadratic Slope	0.01	0.01	.617
Autonomy Satisfaction	0.56	0.19	.005
Competence Satisfaction	1.02	0.18	.000
Relatedness Satisfaction	-0.05	0.27	.846

Table 16

*Hierarchical Linear Growth Model of Controlled Motivation Over Time,
As Predicted by Basic Needs Satisfaction*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	10.93	2.41	.000
Cubic Slope	-0.00	0.00	.722
Autonomy Satisfaction	0.15	0.36	.680
Competence Satisfaction	0.41	0.33	.219
Relatedness Satisfaction	0.47	0.50	.352

Table 17

*Hierarchical Linear Growth Model of Autonomous Motivation Over Time,
As Predicted by Autonomy Satisfaction and Autonomy Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	12.39	1.85	.000
Quadratic Slope	0.01	0.01	.596
Condition (Autonomy Support vs. Thwarting)	0.50	2.30	.829
Autonomy Satisfaction	0.92	0.30	.003
Condition X Autonomy Satisfaction	-0.01	0.37	.977

Table 18

*Hierarchical Linear Growth Model of Autonomous Motivation Over Time,
As Predicted by Competence Satisfaction and Competence Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	10.21	1.36	.000
Quadratic Slope	0.01	0.01	.592
Condition (Competence Support vs. Thwarting)	2.60	1.81	.156
Competence Satisfaction	1.44	0.24	.000
Condition X Competence Satisfaction	-0.48	0.32	.143

Table 19

*Hierarchical Linear Growth Model of Autonomous Motivation Over Time,
As Predicted by Relatedness Satisfaction and Relatedness Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	10.24	2.20	.000
Quadratic Slope	0.01	0.01	.605
Condition (Relatedness Support vs. Thwarting)	3.15	2.99	.295
Relatedness Satisfaction	1.26	91.69	.001
Condition X Relatedness Satisfaction	-.048	0.48	.319

Table 20

*Hierarchical Linear Growth Model of Controlled Motivation Over Time,
As Predicted by Autonomy Satisfaction and Autonomy Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	14.05	2.97	.000
Cubic Slope	-0.01	0.01	.583
Condition (Autonomy Support vs. Thwarting)	-0.63	3.66	.863
Autonomy Satisfaction	0.42	0.47	.375
Condition X Autonomy Satisfaction	0.24	0.59	.683

Table 21

*Hierarchical Linear Growth Model of Controlled Motivation Over Time,
As Predicted by Competence Satisfaction and Competence Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	15.95	2.40	.000
Cubic Slope	-0.01	0.01	.601
Condition (Competence Support vs. Thwarting)	-4.98	3.21	.125
Competence Satisfaction	0.10	0.42	.805
Condition X Competence Satisfaction	1.09	0.57	.061

Table 22

*Hierarchical Linear Growth Model of Controlled Motivation Over Time,
As Predicted by Relatedness Satisfaction and Relatedness Support vs. Thwarting Conditions*

Fixed Effects	Est.	SE	<i>p</i>
Intercept	8.91	3.42	.011
Cubic Slope	-0.01	0.01	.587
Condition (Relatedness Support vs. Thwarting)	5.38	4.65	.250
Relatedness Satisfaction	1.33	0.55	.017
Condition X Relatedness Satisfaction	-0.92	0.75	.219

Study 2 Tables

Table 23

Hierarchical Multiple Regression Analyses Predicting Endpoint Social Media Percent Reduction by Baseline IBQ Support and Thwarting

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.05*	33.88(5.17)***
	% Change Goal		.21(.10)*
Model 2	Constant	.06	34.33(25.44)
	% Change Goal		.21(.10)*
	Support		.06(.29)
	Thwarting		-.14(.24)

Note. * $p < .05$, two-tailed. *** $p < 0.001$, two-tailed.
 ΔR^2 from Models 1 to 2 = .01.

Table 24

Hierarchical Multiple Regression Analyses Predicting Endpoint Social Media Percent Reduction by Midway IBQ Support and Thwarting

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.06*	32.98(5.58)***
	% Change Goal		.23(.11)*
Model 2	Constant	.16*	-9.17(23.05)
	% Change Goal		.25(.10)*
	Support		.62(.26)*
	Thwarting		.01(.21)

Note. * $p < .05$, two-tailed. *** $p < 0.001$, two-tailed.
 ΔR^2 from Models 1 to 2 = .10.

Table 25

Hierarchical Multiple Regression Analyses Predicting Endpoint Social Media Percent Reduction by Final IBQ Support and Thwarting

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.07*	30.94(5.56)***
	% Change Goal		.28(.11)*
Model 2	Constant	.13**	-3.73(22.18)
	% Change Goal		.26(.11)*
	Support		.52(.27)
	Thwarting		.01(.21)

Note. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < 0.001$, two-tailed. ΔR^2 from Models 1 to 2 = .06.

Table 26

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Baseline IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.08*	-1.97(1.66)	-1.19	.239
Support		.05(.02)**	2.76	.007
Thwarting		.02(.02)	1.43	.155

Note. ** $p < .01$, two-tailed.

Table 27

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Midway IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.02	2.05(1.58)	1.30	.199
Support		.01(.02)	0.58	.563
Thwarting		-.01(.02)	-0.52	.608

Table 28

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Final IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.12	-0.29(1.34)	-0.22	.829
Support		.04(.02)**	2.69	.009
Thwarting		-.00(.01)	-0.04	.778

Note. ** $p < .01$, two-tailed.

Table 29

Hierarchical Multiple Regression Analyses Predicting Endpoint Participant Ratings of Behaviour Change Success by Baseline Autonomous and Controlled Motivation

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.05*	33.77(5.23)***
	% Change Goal		.22(.10)*
Model 2	Constant	.12*	51.44(16.03)**
	% Change Goal		.25(.10)*
	Autonomous		-2.03(.86)*
	Controlled		1.14(.66)

Note. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < 0.001$, two-tailed. ΔR^2 from Models 1 to 2 = .07.

Table 30

Hierarchical Multiple Regression Analyses Predicting Endpoint Participant Ratings of Behaviour Change Success by Midway Autonomous and Controlled Motivation

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.06*	33.36(5.57)***
	% Change Goal		.25(.11)*
Model 2	Constant	.07	28.07(13.51)*
	% Change Goal		.25(.11)*
	Autonomous		.08(.86)
	Controlled		.25(.93)

Note. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < 0.001$, two-tailed. ΔR^2 from Models 1 to 2 = .00.

Table 31

Hierarchical Multiple Regression Analyses Predicting Endpoint Participant Ratings of Behaviour Change Success by Baseline Autonomous and Controlled Motivation

	Predictors	ΔR^2	<i>B</i> (SE)
Model 1	Constant	.05*	33.77(5.23)***
	% Change Goal		.22(.10)*
Model 2	Constant	.03	24.59(13.08)
	% Change Goal		.22(.10)*
	Autonomous		-.25(1.00)
	Controlled		.86(1.00)

Note. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < 0.001$, two-tailed. ΔR^2 from Models 1 to 2 = .07.

Table 32

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Baseline Autonomous and Controlled Motivation

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.01	1.56(1.02)	1.53	.130
Autonomous		.06(.06)	1.15	.724
Controlled		-.02(.05)	-0.35	.255

Table 33

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Midway Autonomous and Controlled Motivation

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.03	1.98(0.77)	2.59	.011
Autonomous		.10(.06)	1.73	.087
Controlled		-.07(.06)	-1.21	.230

Table 34

Multiple Regression Analyses Predicting Endpoint Ratings of Success in Behaviour Change by Final Autonomous and Controlled Motivation

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.06	.66(0.74)	0.90	.370
Autonomous		.18(.06)	1.34	.183
Controlled		.02(.06)	0.36	.721

Table 35

Multiple Regression Analyses Predicting Midway Autonomous Motivation by Midway IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.11	11.11(3.77)	2.95	.004
Support		.10(.04)*	2.29	.025
Thwarting		-.02(.04)	-0.07	.584

Note. * $p < .05$, two-tailed.

Table 36

Multiple Regression Analyses Predicting Midway Controlled Motivation by Midway IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.09	8.56(3.52)	2.43	.017
Support		.10(.04)*	2.52	.014
Thwarting		.01(.04)	0.39	.697

Note. * $p < .05$, two-tailed.

Table 37

Multiple Regression Analyses Predicting Endpoint Autonomous Motivation by Endpoint IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.23	8.08(3.01)	2.68	.009
Support		.14(.04)***	4.02	.000
Thwarting		-.01(.03)	-0.32	.752

Note. *** $p < .001$, two-tailed.

Table 38

Multiple Regression Analyses Predicting Endpoint Controlled Motivation by Endpoint IBQ Support and Thwarting

Predictors	ΔR^2	<i>B</i> (SE)	<i>t</i>	<i>p</i>
Constant	.18*	6.61(3.13)	2.11	.038
Support		.14(.04)***	3.67	.000
Thwarting		-.01(.03)	0.19	.847

Note. *** $p < .001$, two-tailed.