

Examining the “Sadder but Wiser” Paradox: Are Those High in Dispositional Self-Reflection
Likely to Journal, and Do They Benefit?

Angela MacIsaac

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Supervisor: Dr. Aislin Mushquash

Second Reader: Dr. Dwight Mazmanian

External Examiner: Dr. Beth Visser

Abstract

Self-reflection is the tendency to reflect on one's thoughts, feelings, and behaviours. It has a strong foundation in psychology for conferring self-knowledge and self-awareness. Journaling is an example of an activity that requires much self-reflection, and as an intervention has positive effects on mood, wellbeing, and the ability to proactively ward off stress. Paradoxically, however, self-reflection may also be associated with mental health symptoms, possibly through its relationship with rumination. Gaps exist in the literature as to whether self-reflection predicts one's choice to journal, as well as whether self-reflection affects the extent to which journaling confers benefit. In the current study, participants ($N = 152$) had access to a smartphone app with various features, including a journal. They were encouraged to use the app throughout a 28-day period, choosing which features to use and for how long, and completed self-report measures at baseline, midpoint, and post-app periods. I hypothesized baseline self-reflection would predict journal usage, and that self-reflection would affect the extent to which journaling was associated with improvement in affect, self-regulation, and psychological wellbeing. Unexpectedly, using count regression models, self-reflection did not predict journal usage, though both rumination and keeping a journal outside of the study predicted the choice to journal. Multilevel models also revealed that, as expected, time spent journaling was associated with lower negative affect and higher self-regulation and psychological wellbeing over time, though some of these effects were diminished when accounting for time spent using other app features. Further, as hypothesized, higher baseline self-reflection was associated with greater improvement in psychological wellbeing the more one journaled, even when controlling for rumination. Findings highlight the benefit of journaling to promote wellbeing when self-reflection is high, although those higher in rumination may be more likely to engage in the behaviour to begin with.

Table of Contents

Abstract.....	2
Origins and Relevance of Self-Reflection as a Beneficial Psychological Attribute	8
Journaling as a Form of Self-Reflection that Promotes Self-Regulation	11
The Expressive Writing Paradigm.....	11
Beyond Negative Emotion: Journaling as a Complete Self-Regulation Strategy	14
The Accessibility and Ease of Use of Journaling.....	18
The Importance of Examining Who Chooses to Journal	19
Dispositional Self-Reflection and its Relation to Journaling Choice and Outcome	21
The Current Study	28
Method	31
Participants	31
Measures.....	31
Demographics	31
Self-Reflection and Insight Scale (SRIS)	32
Rumination-Reflection Questionnaire (RRQ).....	33
Journal-Keeping Status.....	33
Positive and Negative Affect Schedule – Short Form (PANAS-SF)	33
Abbreviated Dysregulation Inventory (ADI)	34
Difficulties in Emotion Regulation Scale – Short Form (DERS-SF).....	35
Ryff Psychological Wellbeing Scale (PWB).....	36
Smartphone App.....	37

Procedure.....	38
Data Preparation: App-Related Variables.....	40
Journal Usage	40
App Days.....	41
Other App Time.....	41
Statistical Analyses	42
H1: Self-Reflection Will Predict Journal Usage.....	42
H2: Journaling and Self-Reflection Will Jointly Influence Outcomes.....	45
Sample Size Calculation.....	50
Results.....	50
Descriptive Statistics.....	50
H1: Self-Reflection Will Predict Journal Usage.....	51
H2: Journaling Time and Self-Reflection Will Jointly Influence Outcomes.....	53
Affect.....	53
Self-Regulation.....	54
Psychological Wellbeing.....	55
Discussion.....	56
Who Chooses to Journal? Self-Reflection, Rumination, and Acceptability of an App-Based Journal.....	57
Self-Reflection Ties Journaling to Improved Psychological Wellbeing.....	59
Preliminary Evidence for Improvements in Affect and Self-Regulation.....	61
Strengths and Limitations.....	65

Future Directions.....	68
Conclusion.....	69
References.....	70
Table 1.....	84
Table 2a.....	86
Table 2b.....	87
Table 2c.....	88
Table 2d.....	89
Table 2e.....	90
Table 3.....	91
Figure 1.....	92
Appendix A - Class Email.....	93
Appendix B - Class Announcement.....	94
Appendix C - SONA Ad.....	95
Appendix D – Poster.....	96
Appendix E - Demographics.....	97
Appendix F - SRIS.....	98
Appendix G - RRQ.....	100
Appendix H - Journaling Habits.....	102
Appendix I - PWB.....	103
Appendix J - PANAS-SF.....	104
Appendix K - ADI.....	105
Appendix L - DERS-SF.....	106

Appendix M - Journal Feature	107
Appendix N - Journal Prompts	108
Appendix P - Consent Form	113
Appendix Q - Email Reminder to Use App	114
Appendix R - Email Reminder for Upcoming Appointment.....	115

Examining the “Sadder but Wiser” Paradox: Are Those High in Dispositional Self-Reflection Likely to Journal, and Do They Benefit?

One of the most profoundly human concepts in psychology is that of self-reflection: the ability to think about oneself and inspect and evaluate one’s thoughts, feelings, and behaviours (Grant, 2002). Engaging in self-reflection is a metacognitive activity, as it involves self-referential monitoring of an aspect of one’s own cognition (Moses & Baird, 1999). More simply put, self-reflecting consists of thinking about one’s own thinking. Self-reflection has historically been viewed as a beneficial activity, especially in the context of psychotherapy, in terms of its implications for conferring self-knowledge (Buss, 1980; Farber, 1989; Trapnell & Campbell, 1999), personal growth (Harrington & Loffredo, 2010), and resilience (Crane, Searle, Kangas, & Nwiran, 2019; Hauser & Allen, 2007). At the same time, however, self-reflection as a dispositional tendency is related to psychopathology and distress (Grant et al., 2001; Sauter et al., 2010).

The current study focuses on journaling, an activity that requires self-reflection and that shows considerable merit as a proactive self-regulation strategy (Cameron & Nicholls, 1998; King, 2001), one which many choose to implement in their daily lives (Duncan & Sheffield, 2008; Yukawa, 2008). Of interest was how dispositional self-reflection, with its paradoxical relationship to both adaptive and detrimental qualities, is involved in the choice to journal and the outcomes of this choice with respect to self-regulation, affect, and psychological wellbeing. Reviewed first are the origins and relevance of self-reflection as a beneficial psychological attribute, followed by journaling as a form of self-reflection that promotes self-regulation and wellbeing. What follows is an argument for examining whether self-reflection plays a role in the choice to journal and is involved in its beneficial outcomes.

Origins and Relevance of Self-Reflection as a Beneficial Psychological Attribute

The benefit of self-reflection is evident when considering its role in our successful adaptation in a highly social world. From an evolutionary perspective, self-reflection and other components of metacognition, such as theory of mind, have likely stemmed from recent human social evolution (Fonagy et al., 1991; Liotti & Gilbert, 2010). In the context of a social world, the development of self-reflection is intimately tied to being able to reflect on others' mental states. For example, in the context of the infant attachment relationship, the infant works toward eventually being able to represent the inner states that precede the physical actions of the caregiver, which is tied to the ability to also represent their own inner states (Damasio, 2010; Fonagy et al., 1991). An increasingly physically safe environment also provides the freedom to explore one's own thoughts and those of others as opposed to having to react instinctually in times of danger (Liotti & Gilbert, 2010), meaning we can take the time to self-reflect in order to plan out future actions and make better decisions (Damasio, 2010).

Psychotherapy evidently takes advantage of our evolutionarily adaptive tendency for self-reflection. Self-reflection is not often discussed explicitly in the context of the psychotherapy process, but most schools of psychotherapy share the common factor of exploration of the inner world of the client (Grencavage & Norcross, 1990). For example, often in psychotherapy the client attempts to step back from a personal experience as they reflect upon it (Coltart, 1988). Engaging in self-reflection purportedly increases self-knowledge, which in turn allows psychological growth (Buss, 1980; Trapnell & Campbell, 1999). It is also necessary for monitoring the progress and change that take place in psychotherapy (Grant, 2001). Perhaps the best demonstration of the relevance of self-reflection to psychotherapy is in its relation to a term denoting a penchant for psychological thinking that is prized in the therapy setting: that of

psychological-mindedness (Grant, 2001). Psychologically-minded people have an interest and ability for inquiring into and reflecting on the causes and meanings of the behaviours, thoughts, and feelings of both themselves and others (Farber, 1985; Grant, 2001; Hall, 1992); thus, self-reflection is a necessary component of this disposition. Previous research on psychological-mindedness advanced the hypothesis that those high in this disposition experience better psychotherapy outcomes (Conte et al., 1990; Grant, 2001; McCallum et al., 2003). For example, those scoring high in this disposition appear more emotionally aware than others (Farber, 1989). Self-reflection in the psychotherapeutic process is so valued by some that it has been proposed as a marker of whether a youth is developmentally ready to engage in the tasks required of cognitive behavioural therapy (Sauter et al., 2010).

Complementary to the idea that self-reflection is a beneficial psychological attribute, deficits in self-reflection have increasingly been assigned a key role in serious mental illness (Lysaker et al., 2011). Different forms of psychopathology may implicate different forms of impairment in self-reflection abilities (Dimaggio et al., 2009). Schizophrenia, for example, consists of a lack of ability to recognize and make sense of one's own mental states (Frith, 1992), which persist into the recovery period. Among individuals with schizophrenia, addressing self-reflection has been proposed as a necessary target of psychotherapy, with the aim of practicing and developing the capacity for increasingly complex acts of self-reflection (Lysaker et al., 2011). Another form of impaired self-reflection consists of deficits accessing and describing one's own personal memories. People with personality disorders often have a hard time engaging in this form of self-reflection and instead often disclose generalized, vague memories in the therapy setting that are less specific to the self (Dimaggio, 2011). Thus, deficits in self-reflection are implicated in a variety of psychological disorders.

Finally, while a lack of self-reflection ability may characterize different forms of psychopathology, the presence of self-reflection can be considered a strength that fosters resilience and self-regulation. For example, Crane et al. (2019) theorize that stress acts as a signal that there is a discrepancy between current demands and one's capacity for adaptation, and only through self-reflection can this be overcome. They assert that a self-reflection response enables one to examine the gaps that exist in one's coping resources and to learn from the stressful event, for example, by redefining the stressor as an opportunity for development or adapting coping strategies. Empirically, the theory that self-reflection is implicated in resilience to adversity is demonstrated through examination of those who have undergone adverse events. Borelli et al. (2014) examined the relationship between adolescents' perceived experiences of parental neglect and their attachment security to their parents. They discovered this relationship was moderated by the extent to which adolescents spoke about their childhood in a way that demonstrated a reflective stance toward both their own and their parents' mental states. The more reflective the content of their narratives, the more securely attached they were in the face of perceived neglect. Being able to reflect on both one's own and others' thoughts and feelings allows for understanding the reasons behind difficult experiences and integrating them into a coherent story (Borelli et al., 2014). Hauser and Allen (2007) similarly analyzed the narratives produced by adolescents who experienced adversity. They compared narratives of those who had overcome such experiences to become well-adjusted to the narratives of those who later on scored poorer on measures of attachment, social skill, relationships, and ego development. A common theme found in the 20 years of interviews with these well-adjusted individuals was an increasing depth of self-reflection to their life narratives. While promising, a limitation of these studies is that their design precludes examination of the directionality of the relationship between

self-reflection and resilience. This is problematic because an alternative explanation is that coping successfully with adversity may then foster the ability to reflect on one's life with a depth of clarity only achieved after the fact, as opposed to self-reflection capacity having a causal role in fostering coping. Thus, the true role of self-reflection ability in successful adaptation to stressful circumstances is yet to be revealed.

Journaling as a Form of Self-Reflection that Promotes Self-Regulation

The relevance of self-reflection to psychotherapy and adjustment suggests that it is something that should be practiced and cultivated in order to adapt in times of stress. There is a myriad of ways that one can engage in self-reflection besides psychotherapy, such as practicing mindfulness (Kemper, 2017) or thinking about self-reflective performance evaluation questions in professional settings (e.g., Conway et al., 2010; Cooper & Wieckowski, 2017; Gates & Sendiack, 2017; Zulfikar & Mujiburrahman, 2018). For example, self-reflection discussion questions such as, "What are some of the strengths that I demonstrated today?" (Lew & Schmidt, 2011, p. 524) are used in education to improve student metacognition and self-reflection. The focus of the current study, however, is on self-reflection in written form; namely, journal-keeping. Journaling is an intuitive and everyday example of how individuals engage in self-reflection. The evidence with respect to journaling not only reflects the general idea that self-reflection is involved in resilience, as previously mentioned, but it also makes a case that journaling is a proactive self-regulation strategy employed by choice that evidences longitudinal benefits for mood and wellbeing.

The Expressive Writing Paradigm

While the literature surrounding journaling in the intuitive sense of the word is relatively scant, much insight can be gleaned from the expressive writing paradigm, also called the written

disclosure paradigm. This technique was first developed by Pennebaker and Beall (1986) and consists of writing about a stressful or traumatic experience, with instructions to focus on one's deepest thoughts and emotions. Participants are randomized into either this condition or a control writing condition, where they write about neutral topics such as time-management or how they had spent the previous day, focusing only on objective facts and not emotions or thoughts (e.g., Lumley & Provenzano, 2003; Poon & Danoff-Burg, 2011). Thus, the expressive writing condition demands much self-reflection, while the control condition is devoid of it.

Pennebaker and Beall (1986) saw demonstrated health benefits in the undergraduates assigned to the expressive writing condition. Since then, the expressive writing paradigm has been used in many studies, with a prior meta-analysis finding an average effect size of $d = .47$ across psychological and physiological outcomes, and the most benefit occurring for student populations with respect to psychological wellbeing (Smyth, 1998). This paradigm also shows small but significant effect sizes for use with adolescents (Travagin, Margola, & Revenson, 2015). More recent studies have replicated the beneficial effects of expressive writing. Poon and Danoff-Burg (2011) studied a non-clinical undergraduate sample longitudinally over three timepoints, randomizing them to either the expressive writing condition or a control condition for each of the three timepoints, respectively. The students randomized to the expressive writing condition experienced better sleep quality, a decrease in physical and psychological symptoms, and an increase in positive affect one month after the intervention in comparison to the control subjects. In contrast, the control subjects experienced worsened sleep and an increase in some symptom domains.

The mechanisms by which self-reflection through writing confers benefit are complex and contested. Firstly, there is evidence that journaling interventions work by regulating negative

affect. Evidence indicates that this regulation does not seem to progress in a linear fashion, but that participants instead initially experience a period of heightened negative affect. Lumley and Provenzano (2003) studied college students with elevated somatic complaints and found that those in the expressive writing condition experienced an increase in negative mood overall throughout the 4 days of the experiment. Individuals who experienced the attenuation of this negative mood over time, however, experienced later increased grade point average (GPA). The controls experienced little change in mood, with less negative affect while the exercise was taking place, and any change in mood that was experienced was unrelated to change in GPA. These findings suggest that being able to use writing to first experience and then resolve negative mood is necessary to accrue benefit. This is consistent with Pascual-Leone et al. (2016), who analyzed affect before and after each expressive writing session, as well as the change in affect across multiple sessions. The authors found negative affect increased immediately after an expressive writing session compared to before the session, yet across days of the intervention negative affect decreased overall. While this study assessed individuals with unresolved traumas, it mirrors the results with non-clinical undergraduate students (Lumley & Provenzano, 2003; Pascual-Leone et al., 2016).

The idea that the act of self-reflection through expressive writing confers benefit by allowing an individual to first experience and then resolve negative affect seems to also extend to negative affectivity as a trait. Expressive writing or journaling may interact with one's overall general tendency toward negativity in the form of rumination or brooding. In first-year college students, Sloan et al. (2008) found that baseline levels of brooding moderated the long-term effects of the expressive writing intervention 2, 4, and 6 months later on depression, such that people higher in brooding achieved a greater decrease in depression scores longitudinally

through the intervention. Gortner et al. (2006) support this finding as the reductions in depression in their study were mediated by reductions in brooding, but only for people who were high in emotion suppression. Taken together, the studies suggest that the intervention works best for those who brood (Sloan et al., 2008) because it reduces brooding (Gortner et al., 2006), which suggests brooding as a mechanism of change for the writing intervention. These findings are in line with what Sloan et al. (2008) contend: that journaling encourages the acknowledgement of negative emotions, promotes problem-solving, and challenges hopeless cognitions like judgment of the negative emotions that are being reflected upon. Thus, journaling with a high level of self-reflection – that is, focusing on one’s deepest thoughts and emotions like the instructions in the studies call for – seems to be an effective strategy for the self-regulation of negative affect.

Beyond Negative Emotion: Journaling as a Complete Self-Regulation Strategy

An interpretation focusing solely on regulation of negative affect as the mechanism of journaling, however, is incomplete. As opposed to being restricted to negative affect and events, journaling can also be used to 1) build resilience for future events, and 2) focus on positives of experiences and bolster positive emotion. It is this robustness of journaling that suggests it is a viable and proactive self-regulatory strategy that can be implemented regularly, and which sets the stage for how a journaling intervention will be operationalized in the current study. With respect to the first point, as noted by King (2001) and King and Miner (2000), most studies have focused on writing in a reactionary manner by instructing participants to reflect on a past event, which assumes that past events are responsible for current behaviour. An important predictor of wellbeing, however, is also proactive coping (Sohl & Moyer, 2009), in which one anticipates how to best adapt to future events; thus, the utility of journaling as a beneficial form of self-reflection would be bolstered if it not only allowed regulation of negative emotion in reflecting

on the past, but also prepared one to deal with a future event by strengthening one's resilience. In this way, journaling could be considered a proactive self-regulatory strategy.

Research revising the expressive writing paradigm to instead guide individuals in anticipating future negative events indeed suggests benefits of this form of written self-reflection. Cameron and Nicholls (1998) showed that writing can be used with reference to future stress if it also involves making a plan for coping. Students were randomized to either a self-regulatory condition that involved writing about thoughts and feelings with respect to starting university and making a coping plan, or a disclosure condition in which they only wrote about their thoughts and feelings with no coping plan. Students who were optimists benefitted equally from both writing interventions whereas those who were pessimists needed the self-regulation condition, which included making the coping plan, to see benefit. In comparing this study with the findings that people who are higher in brooding benefitted from the expressive writing paradigm (Sloan et al., 2008), one can make the argument that brooding and pessimism (i.e., generally negative thinking) may only moderate the effect of writing when it comes to resolving past trauma, while this expressive writing alone does not leave these individuals with resources (i.e., coping mechanisms) for dealing with future stressors in which brooding or pessimism may again become a problem. Further, it seems that journaling confers benefit not just through regulation of negative affect focused on a past event, but also by fostering proactive self-regulation through anticipation of future events.

There is also evidence that journaling can promote positive experiences in addition to dampening negative emotion. Prior research focused on negative interpretations of events, or events that were traumatic and stressful (King, 2001; King & Miner, 2000). Indeed, the expressive writing paradigm is commonly used with people with post-traumatic stress disorder

(Sloan & Marx, 2004; Stockton, Joseph, & Hunt, 2014) and people who have experienced some sort of loss (Kovac & Range, 2000; Lepore & Greenberg, 2002). Journaling interventions more broadly have similarly been used primarily with populations who have experienced a stressful situation, such as women with a recent breast cancer diagnosis (Smith, Anderson-Hanley, Langrock, & Compas, 2005) and mothers of children with difficulties like autism spectrum disorder (Whitney & Smith, 2015). It is unsurprising that regulation of negative affect should be involved in the writing process when the focus of writing has often been on negative events or losses; however, there is also merit to using a more positively-focused or proactive framework to writing.

This positive focus was demonstrated by King and Miner (2000), who studied the benefit of reflecting on positive aspects of situations. In the standard fashion, they included a group of participants who underwent the typical expressive writing paradigm, in which they were asked to write with as much detail as possible and with one's deepest emotions and thoughts about the event. In addition to this group, however, they added an additional group of participants who were instructed to write in a way that captured the positive aspects of having worked through a traumatic event. This included how they had grown from the trauma and were better able to meet challenges in the future. Five months post-writing, both the positive group and the group that wrote about trauma in the traditional expressive writing manner evidenced improved health outcomes. Interestingly, despite what the research with the traditional expressive writing paradigm would suggest, mood changes as a result of the intervention did not impact resultant health outcomes. On the contrary, what mattered were the cognitive mechanism words used in the entries – or words that confer insight, like “realize”, “understand”, “because” – on health outcomes, such that participants in the positive writing group who used more of these words in

their entries evidenced better outcomes. These results were partially replicated by Lewandowski (2009), who had participants who had recently experienced a breakup focus on the positives or the negatives of the situation, finding those who focused on the positives experienced improved affect immediately after the intervention.

This has been further extended to writing about positive events. The positive writing paradigm is a further example of the way journaling not only dampens negative emotion but also promotes positive emotion, rendering it a robust self-regulation strategy. In the positive writing paradigm, participants write about a positive event in their lives and are told, like in the expressive writing condition, to focus on their deepest thoughts and emotions regarding the event. King (2001) had individuals write about their best possible future selves; that is, what their life would look like if they attained their goals and worked hard. Once again, this group attained similar health outcomes five months later as a group that wrote about trauma using the typical expressive writing paradigm. In addition, however, those who wrote about life goals experienced an increase in positive mood after writing sessions and higher psychological wellbeing three weeks after intervention, in comparison to the trauma group and the control group. Other studies have found similar benefits between expressive writing and positive writing on longitudinal physical and emotional health in those with mood disorders (Baikie, Geerligs, & Wilhelm, 2012) and non-clinical participants (Marlo & Wagner, 1999), although one study failed to find improvements in either group (Kloss & Lisman, 2002). The lack of a statistically significant difference between the two conditions – writing about a negative event and writing about a positive one – suggests that both provide some means of fostering self-regulation.

In sum, there is evidence for the benefits conferred by writing in a way that captures the positives of situations, such as re-interpreting past trauma, imagining a desired future, and

anticipating events while thinking about how one will cope. There is also some evidence that the positive writing paradigm is at least equal to the typical expressive writing paradigm with respect to outcomes in physical and mental health, although more research is needed. Any written self-reflection that enhances overall self-regulation should lead to benefits, whether through understanding past emotional reactions, how one has grown from a situation, or how one can cope in the future. As Greenberg, Wortman, and Stone (1996) suggested, writing about trauma likely spurs self-regulation processes as writers establish a sense of control over their emotions in their self-reflections. Of course, exposure likely plays a large role in the beneficial effects of reflecting on trauma (e.g., Hendriks et al., 2017) but the findings here also suggest that building everyday self-regulation and resilience can be achieved by exposing oneself to positive memories as well. The commonality between reflecting on trauma and reflecting on life goals is that both share the opportunity to learn about the self (King, 2001). Interestingly, this is consistent with the value placed on self-reflection in the broader field of psychology and psychotherapy, such that it allows individuals' increased self-knowledge to promote change.

The Accessibility and Ease of Use of Journaling

The benefit of written self-reflection, or journaling, as a tool for self-regulation is amplified by its ease of use. Smyth and Helm (2003) were the first to suggest that the expressive writing paradigm has much potential as a self-help intervention, but little research has examined this. Writing, they asserted, does not require a trained professional or any equipment, and would help those who do not have access to a therapist. All the individual needs is the ability to write, a quiet location, and the time to do it. Although Smyth and Helm (2003) restricted their discussion to the expressive writing paradigm specifically, there is merit to extending this to journaling in general, considering the benefits of journaling about things like future goals and positive aspects

of events. The ability of journaling to employ written self-reflection as a method of self-regulating emotion, coupled with its ease of availability and potential for frequent use, solidifies its place as a resilience-based, proactive mental health strategy. Some at-home journaling programs have been developed, although they are scarce. Progoff (1977) coined the intensive journal method, which involves writing as if dialoging with the people, events, and things in one's life, and is based on the work of Carl Jung. It is often taught in workshops or done individually (English & Gillen, 2001). Peterson and Mar (2004) developed the Self-Authoring Program which is completed on one's own time on a computer. This program, based in part on the work of King (2001), uses self-reflection on the past and present to build goals for an ideal future, with participants evidencing improvements in academic success (Morisano, Hirsh, Peterson, Pihl, & Shore, 2010).

It is important to promote proactive, self-regulatory interventions like journaling, especially considering the benefits have often been studied with university populations. This is ideal considering entering university is a transition point marked by increased stress and high levels of psychopathology (Ibrahim et al., 2013; Regehr et al., 2013). The need for reactive strategies meant to ameliorate such high levels of psychopathology may be obviated if more proactive strategies can be employed beforehand, as self-regulation can counter the effects of stress and low functioning to maintain wellbeing (Durand-Bush et al., 2015). Strategies that promote resilience that can be practiced daily through easily-accessible activities before stress or mental health problems worsen are thus beneficial. Further, it is likely there are dispositions that render journaling more applicable and useful for some individuals over others, and these traits should be identified.

The Importance of Examining Who Chooses to Journal

Interestingly, while journaling as an experimental condition has been the focus of much research, there is less recognition within the literature that individuals who choose to keep a personal journal or diary have already independently discovered the beneficial effects of writing. An implication of easily accessible self-regulation activities like journaling is that individuals freely choose to make them a regular part of their lives. While Pennebaker and Beall's (1986) first expressive writing experiment spurred a multitude of studies that randomly assigned participants to interventions like the expressive writing paradigm, this random assignment precludes any examination of personal choice. Indeed, many authors have suggested that research assessing spontaneous journaling as an everyday human tendency, as opposed to an experimental condition, is needed (Accardo, Aboyoun, Alford, & Cannon, 1996; Burt, 1994; Duncan & Sheffield, 2008). This is further warranted by how frequently the choice to journal is made; in one older study, 55% of the sample had ever kept a journal or diary in their lifetime and 10% kept one at the time of data collection (Accardo et al., 1996), and in a more recent Japanese sample, more than 25% of participants said they usually kept a regular diary (Yukawa, 2008). This number is consistently higher in females than in males (Burt 1994; Zammuner 2001); in one female undergraduate sample in the UK it was as high as 83.1% (Duncan & Sheffield, 2008). These studies also suggest that individuals who choose to journal use it for self-reflection and have motives around self-regulation and wellbeing. The most common motives include therapeutic value and recording emotional events (Accardo et al., 1996); reflecting on emotions and feelings, seeing oneself more clearly through adopting a different viewpoint, and talking with someone when one is blue (Zammuner, 2001); and to help one understand what they are feeling (Duncan & Sheffield, 2008; Zammuner, 2001). Journal content most popularly consists of emotions and emotional events (Accardo et al. 1996).

Given the evidence that many choose to keep a journal and their motives have to do with engaging in self-reflection for beneficial purposes, it is fitting that Burt (1994) described journaling as a “self-initiated coping strategy”. In addition to the needed conditions for journaling of time, location, and ability, then, one also needs the motivation to engage in this self-reflection. A seemingly unanswered question is why some individuals are motivated to journal regularly whereas others do not. Uncovering this would allow personalization of self-regulation strategies to individuals who are most likely to adhere to these strategies in the long-term without needing reminding. One study did examine personality differences between journal keepers and non-journal keepers (Accardo et al. 1996) but found no differences in personality measures of locus of control, self-concept, and group orientation versus self-sufficiency. Thus, the question remains unanswered as to what separates those who choose to keep journals from those who do not. Further, if there exist certain dispositions which predict the choice to journal, does this necessarily imply benefit accrued from that journaling? The following section explores traits that may confer both the choice to journal and outcomes of this choice.

Dispositional Self-Reflection and its Relation to Journaling Choice and Outcome

A logical place to start with identifying a disposition that predicts whether one is likely to journal and benefit from it is by looking at self-reflection itself. There is an important distinction between strategies that employ self-reflection, like journaling, and self-reflection as a personal disposition. One would expect that individuals who are self-reflective by nature would be more likely to choose journaling as a self-regulation strategy and would likely benefit from the match between personality and activity (Grant et al., 2002). Interestingly, preliminary findings have found this may not entirely be the case. In addition to measuring brooding, Sloan et al. (2008) measured baseline “reflective pondering” (similar to self-reflection) in first-year college students

and found that this trait did not moderate the extent to which the expressive writing paradigm improved later depression scores. One possibility is that since the expressive writing paradigm has participants focus on negative events, being self-reflective would not matter as much as brooding, since brooding is more directly implicated by negative emotions and events.

Another avenue to consider is whether self-reflective people are more likely to keep journals, even if it is true that this self-reflection may not moderate whether journaling confers benefit. Grant et al. (2002) hypothesized that since individuals who keep journals regularly monitor their thoughts, they should score higher on a measure of self-reflection and insight and be well-adjusted. Their measure, the Self-Reflection and Insight Scale (SRIS), defined self-reflection as “the inspection and evaluation of one's thoughts, feelings, and behavior” (Grant et al., 2002, p. 821). Insight, in contrast, is “the clarity of understanding of one's thoughts, feelings and behavior” (Grant et al., 2002, p. 821). They found only partial support for their hypotheses. While undergraduate students who kept journals did, indeed, score higher on the Self-Reflection scale, they were lower on Insight and higher in anxiety than those who did not keep a journal. In other words, individuals who keep a journal may be more self-reflective, yet they seem to have less clarity of understanding of the contents of this self-reflection, and instead more anxiety. Additionally, the theorized relationship between self-reflection and self-regulation did not manifest, and instead self-reflection correlated with negative outcomes and increased anxiety and stress.

These results suggest an alarming and puzzling disconnect between the beneficial outcomes thought to result from an activity that employs self-reflection by its very nature and being a self-reflective person by disposition. This finding that self-reflection, and possibly evening journaling, may be maladaptive (Grant et al., 2002) has been replicated. With respect to

journaling, Duncan and Sheffield (2008) also found that journal-keepers were higher in a scale of insomnia and anxiety than those who did not keep journals, although the effect only approached statistical significance. With respect to self-reflection, when Lyke (2009) grouped community members based on SRIS scores, there was no correlation between Self-Reflection and measures of happiness or satisfaction with life. Insight, on the other hand, positively correlated with subjective happiness ($r = .38$) and satisfaction with life ($r = .38$). Further, there was no interaction between Insight and Self-Reflection, such that one could be just as happy and satisfied regardless of whether they spent very little or a lot of time in self-reflection. Harrington and Loffredo (2010) replicated these results. They assessed the relationship between six measures of private self-focused attention, including the Self-Reflection and Insight scales, and both satisfaction with life and psychological wellbeing. Of all six predictor variables examined, only Insight statistically predicted satisfaction with life in addition to all six aspects of psychological wellbeing. On the other hand, only one aspect of psychological well-being was significantly related to Self-Reflection, which was Personal Growth ($r = .27$). Lastly, relationships have been replicated with respect to psychopathology and distress. The Emotional Symptoms scale of the Strengths and Difficulties Questionnaire has a weak, positive relationship with Self-Reflection ($r = .19$) but a negative relationship with Insight ($r = -.51$) in a youth sample that used a revised youth version of the SRIS (SRIS-Y; Sauter et al., 2010).

Why and how does self-reflection as a dispositional tendency confer negative outcome, considering self-reflection has such strong roots in psychotherapy, and is implicated in theories of self-regulation and resilience? Trapnell and Campbell (1999) looked at this problem and coined it the “self-absorption paradox”: a disposition to attend to and reflect on the self seems to increase self-knowledge at the cost of psychological wellbeing. Farber (1989) also described this

as the observation that people are often “sadder but wiser”, and this “depressive realism” dominated opinion for a time (Trapnell & Campbell, 1999). While self-reflection may truly result in greater distress as the paradox suggests, there are also many other possibilities. Individuals may score high in self-reflection simply because they journal, as opposed to journaling because they are self-reflective by disposition (Grant et al., 2002). It may also be the case that individuals score high in both distress and self-reflection concurrently simply because this self-reflection is a response to their distress that then dampens distress longitudinally. This would be consistent with theories that implicate self-reflection as a response to stress that confers later resilience (e.g., Crane et al., 2019). Both of these remain possibilities when longitudinal designs have not been employed.

Yet another possibility is that measures of self-reflection are confounded by constructs similar to self-reflection that are much more detrimental to wellbeing. Evidence of this came with examination of a measure similar to the SRIS: the Private Self-Consciousness Scale (PrSCS; Fenigstein, Sheier, & Buss, 1975). This scale is similar to the SRIS in its aim to measure one’s tendency to direct attention inwards (Grant et al., 2002), yet it too is also reliably associated with distress and psychopathology (Anderson, Bohon, & Berrigan, 1996). Investigations of this phenomenon found that the PrSCS may be confounding self-reflection with rumination. Trapnell and Campbell (1999) investigated and found that, in addition to psychopathology, the PrSCS correlated equally well with two seemingly distinct facets of the Big 5 personality traits: both openness to experience and neuroticism. Since these are two unrelated personality traits with no obvious link between them (Kovaleva, Beierlein, Kemper, & Rammstedt, 2013; Tsaousis & Kerpelis, 2004), it is odd that the PrSCS should be associated with both. Trapnell and Campbell (1999) argued that the PrSCS therefore fails to differentiate the

different motives one might have for engaging in self-reflection; for example, there is a difference between attending to the self for reasons of anxiety (neuroticism) and ones of simple epistemic curiosity about the self (openness to experience). Based on these dispositions, Trapnell and Campbell (1999) used items from the PrSCS to construct two scales: one that reflected epistemic, intellectual self-consciousness and one that reflected neurotic self-consciousness. These later came to be known as the Reflection scale and the Rumination scale, respectively, together forming the Rumination-Reflection Questionnaire (RRQ).

Trapnell and Campbell (1999) further found that their new Rumination scale explained the PrSCS correlations with distress, while the PrSCS correlations with intellectual traits, like need for cognition, openness to ideas, and right-wing authoritarianism, were explained by the Reflection items. Later research has confirmed these findings, with the Rumination scale of the RRQ being significantly negatively correlated with satisfaction with life and psychological wellbeing (Harrington & Loffredo, 2010). Reflection is positively correlated with Personal Growth, one aspect of psychological wellbeing, but not others, highlighting its affectively neutral roots. The SRIS does seem related to both the Reflection and Rumination scales of the RRQ. Harrington and Loffredo (2010) found the Self-Reflection scale to be highly positively correlated with the Reflection scale of the RRQ ($r = .78$) and to a lesser extent the Rumination scale ($r = .27$). Thus, the Self-Reflection scale of the SRIS likely taps self-reflection primarily, but also rumination.

Other authors have similarly distinguished reflection from rumination. Treynor et al., (2003) used a revised version of the Ruminative Responses Scale (RST; Nolen-Hoeksema, 1987), a measure of rumination, and extracted two factors which related to neutral items and negatively valenced items, respectively. The first factor was deemed Reflection, which consists

of a purposeful turning inward to try to problem-solve, while the other was deemed Brooding, similar to what is typically considered rumination. The authors found that Reflection correlated, although weakly ($r = .12$), with concurrent depression. While this was the case, the relationship changed drastically when looking longitudinally: baseline reflection was negatively related to depression one year later. Conversely, brooding positively predicted depression one year later. Lastly, initial depression scores predicted both reflection and brooding one year later. These findings suggest that reflection may help ameliorate psychopathology in the long term, and it may be rumination or brooding that is responsible for the negative effects both in the short-term and longitudinally.

Note that this collection of findings suggests that even when rumination is partialled out of reflection, as is the case with the Reflection scale of the RRQ, reflection assessed concurrently is not associated with Insight or many of the beneficial outcomes that Insight was associated with. The Reflection scale of the RRQ was not significantly related to the Insight scale (Harrington & Loffredo, 2010), and it did not result in the same high number of positive correlations with wellbeing as Insight did. At the same time, it seems self-reflection might reduce depression in the long term, potentially by conferring insight later (Treyner et al., 2003). This is consistent with the idea that self-reflection is used to help regulate distress as opposed to causing it, although the results thus far are limited to depression. It is also consistent with a model of self-regulation where stressors are theorized to be a trigger for learning and adaptation via self-reflection processes (Crane et al., 2019). Keeping in mind its association with the personality trait of openness to experience, self-reflection can accordingly be characterized as motivated by curiosity, self-knowledge, and a philosophical love for self-exploration (Trapnell & Campbell, 1999). Trapnell and Campbell (1999) put it concisely by remarking that rather than the idea that

individuals are “sadder and wiser” with respect to being high in self-reflection, they are instead sadder *or* wiser, as rumination and reflection are independent dispositions. Reflection on its own can thus be thought of as neutral in affect, perhaps a transitory period between the experience of negative events and gleaning insight from them later.

The fact that the Self-Reflection scale of the SRIS seems to confound self-reflection and rumination is unfortunate in terms of construct validity, but is logical if, in practice, individuals are likely to display both patterns of self-relevant pondering simultaneously. Even though self-reflection and rumination seem to be two distinct constructs in a theoretical sense, that does not mean that in a practical sense they are always distinguishable. Instead, the relationship between the two is complex. Trapnell and Campbell (1999) did find that the Reflection and Rumination scales correlated with each other, although weakly ($r = .22$), and as Treynor et al. (2003) noted, depression predicted both subsequent rumination and reflection, which suggests that they may occur together. More interestingly, however, Takano and Tanno (2008) hypothesized that any beneficial effects of reflection may be contaminated by the effects of rumination if people who self-reflect also tend to ruminate simultaneously. Using structural equation modelling, Takano and Tanno (2008) found self-reflection predicted subsequent rumination, whereas the opposite path did not hold true. Further, initially a positive association between reflection and depression scores was observed; however, this effect was mediated by rumination scores, such that when rumination scores were accounted for, a negative relationship existed between reflection and depression. This research suggests that any seemingly maladaptive association between reflection and outcomes like depression may be due to the presence of rumination, as it operates in tandem with self-reflection.

Thus, there are multiple sources of evidence that the journal-keepers who are high in Self-Reflection may be self-reflective but also ruminative in nature. The Self-Reflection scale correlates positively with both the Reflection and Rumination scales of the RRQ (Harrington & Loffredo, 2010), as reviewed above, and there is evidence that rumination and reflection correlate with each other (Tanno & Takano, 2009; Trapnell & Campbell, 1999) and are both predicted by depression, yet have differential effects on depression (Tanno & Takano, 2009; Treynor et al., 2003). For previous authors to have suggested, therefore, that self-reflection negatively affects mental health, and that it makes people “sadder but wiser”, may be misguided. Rumination may be the problem, not the self-reflection aspect. Many questions arise from these lines of research. Firstly, does dispositional self-reflection lead one to keep a journal, or is it rumination that motivates it? Secondly, if dispositional self-reflection predicts the choice to journal, what does this mean for the outcome of journaling for those high in dispositional self-reflection? A good fit between dispositional tendencies to self-reflect and using an activity that requires high levels of self-reflection may allow individuals to use their disposition to their benefit, or it may only lead to further rumination and promote negative outcomes.

The Current Study

There are two gaps in the literature and associated research questions that I aimed to fill, and they relate to 1) the choice to journal, and 2) the outcome of this choice. Firstly, regarding choice, previous research shows those who keep journals are higher in dispositional self-reflection (Grant et al., 2002), yet it is unknown whether dispositional self-reflection predicts future utilization of journaling or if individuals score high in self-reflection by virtue of their journaling behaviour when no longitudinal design has been implemented. Further, Grant et al. (2002) assessed journaling behaviour as dichotomous, whereas no study has looked at how much

one journals in a continuous fashion. Thus, the first research question was: Do baseline levels of dispositional self-reflection predict journal usage when provided with a variety of strategies for promoting self-regulation and resilience? I hypothesized that individuals high in baseline dispositional self-reflection, as measured by the Self-Reflection scale, would spend more time on this activity over the course of 28 days than individuals lower in self-reflection. Since individuals may already keep their own journals, it was expected that the relationship between self-reflection and time spent journaling would be especially prominent when introducing this activity to those who do not already keep their own journal. Answering this question had the potential to replicate Grant et al.'s (2002) finding of an association between self-reflection and journal keepers and would also extend it and fill a gap by implicating a certain directionality. Answering this first research question can help determine who is likely to choose to journal of their own accord and is consistent with a strengths-based focus (Weick, Rapp, Sullivan, & Kisthardt, 1989).

The second gap has to do with the outcome of journaling. Specifically, it is unknown how dispositional self-reflection affects the outcomes known to be associated with journaling, especially when associations with rumination are controlled for. If the answer to the first research question indeed indicates that dispositional self-reflection does predict the choice to later utilize a journal activity, the next logical question is whether this dispositional self-reflection is necessarily related to the outcomes conferred from this choice to journal. As discussed, journaling is associated with positive outcomes in psychological wellbeing (King, 2001; Smyth, 1998) and the self-regulation of affect (King, 2001; Lewandowski, 2009; Lumley & Provenzano, 2003; Pascual-Leone et al., 2016; Poon & Danoff-Burg, 2011). At the same time, dispositional self-reflection lacks an association with psychological wellbeing (Harrington & Loffredo, 2010; Lyke, 2009) and instead is associated with distress and negative affect

concurrently (Grant et al., 2002; Sauter et al., 2010; Treynor et al., 2003), but these associations are likely due to rumination acting as a confounding factor (Tanno & Takano, 2008; Trapnell & Campbell, 1999; Treynor et al., 2003). Very little research has looked at outcomes of dispositional self-reflection in a longitudinal manner (e.g., Treynor et al., 2003), and no research has examined outcomes of journaling in consideration of dispositional self-reflection.

Thus, the second research question is: When rumination is controlled for, does dispositional self-reflection augment the extent to which journaling confers beneficial outcomes in self-regulation, affect, and psychological wellbeing? I hypothesized journaling would confer beneficial outcome and this would be augmented by dispositional self-reflection, such that those higher in dispositional self-reflection should experience more benefit. This hypothesis was based on numerous factors. Firstly, a longitudinal design was employed, and the only study to examine longitudinal effects of dispositional self-reflection showed it reduced negative affect in the long run (Treynor et al., 2003). Secondly, baseline rumination was controlled for, and isolating self-reflection in this manner should reduce its associations with negative outcome (Tanno & Takano, 2008). Thirdly, the study design incorporated journaling prompts geared toward positive thinking, which is important considering those who self-reflect are also likely ruminating (Tanno & Takano, 2008; Treynor et al., 2003). Thus, given these components of the study design, self-reflection should serve to bolster the effects of journaling.

I tested these hypotheses within the context of a larger longitudinal study evaluating outcomes of a smartphone app designed to promote self-regulation and resilience. The app contains various features that participants can choose to use, including journaling, and participants had access to it for 28 days. The journaling feature consists of prompts meant to induce a positive, resilience-based focus, consistent with the research reviewed highlighting the

beneficial effects of writing with a positive focus (Baikie et al., 2012; King & Miner, 2000; King, 2001; Lewandowski, 2009), and antithetical to the depressive, negative thinking characterizing rumination (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). In addition to this app, participants self-reported their journaling habits since the need for an app with a journaling feature may be obviated if one already keeps a physical journal or diary in which they write regularly. To answer the research questions, I measured dispositional self-reflection and rumination at baseline, collected journal usage data throughout 28 days, and assessed outcomes of affect, psychological wellbeing, and self-regulation at baseline and 14 days (midpoint) and 28 days (post-app) of app usage.

Method

Participants

Participants were recruited as part of a larger study assessing outcomes of a smartphone app. Eligibility criteria included being an undergraduate student, owning an iPhone, and being able to speak/read/write English fluently. The final sample of 152 participants consisted of 115 female participants (75.66%) and 37 male participants (24.34%). The mean age of participants was 20.15 ($SD = 3.23$). Eighty-five (55.92%) were first-year students, 29 (19.08%) were second-year students, 22 (14.47%) were third-year students, 14 (9.21%) were fourth-year students, and 2 (1.32%) were fifth-year students. The number of participants required for adequate statistical power was assessed using simulation and is described in the statistical analyses section.

Measures

Demographics

The demographics questionnaire can be found in Appendix E. Demographics were assessed using 19 items inquiring about age, sex, gender, sexual orientation, ethnicity,

geographical location and living arrangements, student status, employment status, income, and relationship status.

Self-Reflection and Insight Scale (SRIS)

The SRIS (Grant, Franklin, & Langford, 2002) is provided in Appendix F. It is a 21-item measure answered on a 6-point Likert scale from “*strongly disagree*” to “*strongly agree*” and is designed to measure the independent but related constructs of self-reflection and insight. The Self-Reflection subscale consists of 12 items that measure one’s tendency to inspect and evaluate one’s thoughts, feelings, and behaviour. An example item from this subscale is “I frequently examine my feelings”. The Insight subscale consists of 8 items that measure the clarity of one’s thoughts, feelings, and behaviour (Grant et al., 2002). An example item is, “I usually have a very clear idea about why I’ve behaved in a certain way”. For the current study, the Self-Reflection scale was used in analyses. While there are other measures that assess similar constructs (e.g., the RRQ and the PrSCS), this measure was chosen as it is the only self-reflection measure which has been studied with journal-keepers (Grant et al., 2002), a finding that warrants replication. Further, while this measure likely captures both reflection and aspects of rumination in the Self-Reflection scale, these dispositions may commonly co-occur and are highly correlated, as reviewed in the introduction. The construct validity of the Self-Reflection subscale is evident in its associations with the RRQ and PrSCS (Harrington & Loffredo, 2010). The Self-Reflection subscale also demonstrates good reliability, with test-retest estimates of .77 over a span of 7 weeks, comparable to those of similar measures like the PrSCS (Grant et al., 2002). In two separate samples consisting of undergraduate psychology students, Grant et al. (2002) estimated Cronbach’s alpha coefficients of .91 and .71 for the Self-Reflection subscale. In the current sample, Cronbach’s alpha was .90, indicating high internal consistency.

Rumination-Reflection Questionnaire (RRQ)

The RRQ (Trapnell & Campbell, 1999) can be found in Appendix G. It is a 24-item measure answered on a 5-point Likert scale from “1 = *Strongly Disagree*” to “5 = *Strongly Agree*” and is designed to measure the constructs of Rumination and Reflection. The two subscales assess dispositional self-consciousness but refer to different motivations for this self-consciousness. The Rumination subscale consists of 12 items assessing neurotic motivation, such as, “I often find myself re-evaluating something I've done”. The Reflection subscale taps a form of reflection more based on openness to experience (Trapnell & Campbell, 1999), including 12 items such as “I love analyzing why I do things”. Only the Rumination subscale was used in the current study. This measure demonstrates construct validity as it is associated with a well-known measure of self-consciousness, the PrSCS. Further to this, it correlates with depression and anxiety (Trapnell & Campbell, 1999). In previous studies of undergraduate students, Cronbach's alpha coefficients were .90 and .89 (Trapnell & Campbell, 1999; Uttl, Morin, & Hamper, 2011). In the current sample, Cronbach's alpha was = .90.

Journal-Keeping Status

One item assessed participants' journaling habits prior to being introduced to the app since the need for the journaling feature of the app could be obviated if certain individuals already keep a physical journal or diary in which they write regularly. The question asked, “Do you currently keep a journal or diary on a regular basis in which you write about your thoughts and feelings (outside of an agenda book)?” (see Appendix H). This question is similar to that used in the study by Grant et al. (2002) which found that endorsement of this question was related to higher scores on the Self-Reflection scale.

Positive and Negative Affect Schedule – Short Form (PANAS-SF)

The PANAS-SF (Watson, Clark, & Tellegen, 1988) is provided in Appendix J. It is a 20-item measure answered on a 5-point Likert-type scale ranging from “*Very slightly or not at all*” to “*Extremely*”. It is used to measure the experience of a variety of positive and negative emotions. The Negative Affect and Positive Affect scales were used as two of the outcome measures in this study. Each scale contains 10 affective states and participants rate the extent to which they have experienced each one during a specified timeframe. Examples of Negative Affect items include “guilty”, “hostile”, and “jittery”, while Positive Affect scale contains items such as “excited”, “proud”, and “active”. For this study, the phrase “past two weeks” was used as the timeframe in question to match the study design of timepoints spaced two weeks (14 days) apart. Psychometric properties of the PANAS-SF were tested with a sample comprised of undergraduate students (Watson et al., 1988). The Negative Affect scale correlates positively with depression and anxiety (Watson et al., 1988), while these measures correlate negatively with the Positive Affect scale (Watson et al., 1988). When using the timeframe “past few weeks”, the closest to the timeframe used in this study, test-retest reliability was .58 for the Positive Affect scale and .48 for the Negative Affect scale over an 8-week interval (Watson et al., 1988). This highlights that affect is subject to change, and with such malleability being ideal for the current study since the aim is to assess change through an intervention. Watson et al. (1998) found coefficient alphas of .87 for both the Positive Affect scale and the Negative Affect scale in a student sample. In the current study, these estimates were similar at .89, .90, and .90 for the Positive scale for the three respective timepoints and .82, .87, and .87 for the Negative scale.

Abbreviated Dysregulation Inventory (ADI)

The ADI (Mezzich et al., 2001) can be found in appendix K. The ADI consists of 30 items rated on a 4-point Likert-type scale from “0 – *Never True*” to “3 – *Always True*”. It is a measure of psychological dysregulation, reflecting deficiency in regulation of three domains reflected by the Affect, Cognitive, and Behaviour scales. This measure was used to assess the outcome construct of self-regulation. In a sample of youth and undergraduates, Cronbach’s alpha values were in the .80 to low .90s range and split-half reliability estimates ranged from .76 to .93 (Mezzich et al., 2001). In another sample of adolescents, internal consistency estimates ranged from .85 to .88, and test-retest reliability for a 4-week interval ranged from .73 for the Cognitive scale to .87 for the Behaviour scale (da Motta et al., 2018). Construct validity is demonstrated by positive correlations between the Affect scale and the difficult temperament index of the Dimensions of Temperament Scale, as well as with the State-Trait Anxiety Inventory (Mezzich et al., 2001). The Behaviour scale correlates with Attention Deficit Hyperactivity Disorder symptoms and there is a negative correlation between the Cognitive scale and IQ and academic achievement (Mezzich et al., 2001). In the current study, the three subscales of the ADI were combined to form a total score out of 90. A total score was used in the original development of the ADI and showed good predictive validity (Mezzich et al., 2001). While the scale is typically examined at the subscale level, this was balanced with the need to limit the number of outcome variables to help control type I error (McDonald, 2014). Some support for this decision is evident in the high internal consistency of the 30 combined items, with Cronbach’s alpha values of .87, .88, and .89 for the three timepoints, respectively.

Difficulties in Emotion Regulation Scale – Short Form (DERS-SF)

The DERS-SF (Kaufman et al., 2016) can be found in Appendix L. This measure consists of 18 items rated on a 5-point Likert-type scale ranging from “*Almost Never (0-10%)*” to “*Almost*

Always (91-100%)”. It is a short-form version of the original DERS created by Gratz and Roemer (2004), which measures emotion regulation deficits. This measure was used as an additional proxy for self-regulation (Mezzich, Tarter, Giancola, & Kirisci, 2001). It was used in addition to the ADI because while journaling may assist in aspects of self-regulation assessed by the ADI, such as cognitive components (e.g., Burt 1994; King & Miner 2001), much of the literature focuses on affect regulation (e.g., Poon & Danoff-Burg 2018) which the DERS-SF can provide a more in-depth analysis of. The total score was used as the variable of interest in the current study as it demonstrates good reliability and validity. Kaufman et al. (2016) found the total score of the DERS-SF correlates with a wide range of measures of psychopathology in a fashion similar to the full version, which would be predicted on the basis that emotion regulation difficulties are a factor in many disorders (Kaufman et al., 2016). The DERS-SF also retains the factor structure of the original measure and correlates highly with it (Kaufman et al., 2016). In a college sample, Cronbach’s alpha was estimated at .89. In the study sample, this value was .90, .91, and .90, across the three timepoints, demonstrating excellent reliability.

Ryff Psychological Wellbeing Scale (PWB)

A shortened version of the PWB (Ryff, 1989) can be found in Appendix I. This shortened version of the PWB contains 21 items rated on a 6-point Likert scale from “*strongly disagree*” to “*strongly agree*”, where participants are asked to focus on the past 2 weeks. The three scales used in the current study were Environmental Mastery, Purpose in Life, and Personal Growth, containing 7 items per scale as opposed to 20 (Abbott et al., 2006; Ryff, 2014; Springer & Hauser, 2006). The Environmental Mastery scale measures one’s ability to choose and create environments that allow advancing in the world and active participation. This scale includes items such as, “In general, I feel I am in charge of the situation in which I live.” The Purpose in

Life scale measures one's beliefs that life has purpose and is meaningful, as evidenced by the presence of goals, intentions, and direction. This scale includes items such as, "I have a sense of direction and purpose in life." Finally, Personal Growth measures the extent to which one is continually developing, confronting new problems, self-realizing, and remaining open to new experiences. This scale includes items such as, "For me, life has been a continuous process of learning, changing, and growth."

Ryff (2014) asserts that this version represents a good compromise between scale length and respondent burnout, which are problems with longer versions, while retaining psychometric properties. In terms of distinctness of the three scales used in this study, Springer and Hauser (2006) found the intercorrelations of the three scales used in the current study to be .90 and higher, and found that these three scales, plus the Self-Acceptance scale, were all highly-correlated whereas the other two scales were not. Springer & Hauser (2006) suggest against considering the scales to be distinct measures, and in line with this notion, Abbott et al. (2006) found a revised model that included four of the original scales (including the three used in this study) in one second-order factor provided the best fit to their data. Based on these findings, and to reduce the number of separate analyses performed, the subscales were combined into a total score in the current study. Cronbach's alpha values were analysed to justify the use of a combined total score. The 21 items demonstrated good reliability when combined with $\alpha = .89$, $.90$, and $.90$ across the three timepoints, respectively.

Smartphone App

The JoyPopTM app was evaluated in a larger study (e.g., MacIsaac et al., 2020). The app was designed by resilience researchers and youth collaborators in the service of promoting resilience (Wekerle, 2019). It has an intuitive and responsive interface, with features that appeal

to youth, and offers immediate intervention if users experience negative moods (e.g., by suggesting activities known to help regulate or improve mood). More information about its development and features can be found at <https://youthresilience.net/joypop-app>. The feature of interest to the current study was the journal feature. The journal feature contains randomized prompts meant to put a positive angle on journaling that automatically appear upon opening this feature. Below the prompt there is space for participants to type as much as they wish. The feature also contains a space for creating a title for the journal entry, as well as an option to save the entry. Journals are saved to the calendar feature of the app, and participants can view past journal entries by accessing this calendar. See Appendix M for a visual depiction of the journal feature, as well as Appendix N for a complete list of the randomly generated prompts.

Participants could also access other features on the app which were not a focus of the study. The Shape Shifter game is similar to Tetris and was included to help foster self-regulation and for its beneficial effects with respect to negative visual imagery (e.g., related to trauma; Lau-Zhu et al., 2017; Rankin et al., 2018). The Rate My Mood feature was created to improve awareness and understanding of emotion (Hilt et al., 2011). The breathing exercises target physiological arousal (Arch & Craske, 2006). The Art feature was included because of the positive effects of doodling on memory and emotional expression (Andrade, 2009; Schott, 2011). Finally, the Circle of Trust feature allowed participants to connect with their support network.

Procedure

This study made use of the procedure of the larger study involving the app. Recruitment methods included emails and in-class announcements directed at various Lakehead University classes (Appendix A and B), the SONA system which students use to sign up for research studies (Appendix C), posters (Appendix D), and recruitment booths at various campus events.

Upon expressing interest in the study via email, participants were sent an information letter (Appendix O) and then signed up for an orientation session. Orientation sessions took place in a group format. During the session, informed consent was obtained (Appendix P) and participants were assigned an ID number to be used on questionnaires and in the app. They then downloaded the app and witnessed a presentation introducing the features of the app, which they followed along with using the app on their own device. Following the orientation presentation, participants completed all self-report measures listed above: Demographics, SRIS, RRQ, journaling questions, PWB, PANAS-SF, DERS-SF, and the ADI.

Participants then began app usage for the following 28 days and were encouraged to use it at least twice daily, once in the morning and once at night, but were otherwise free to choose how often they used the app and which features they wanted to use. This design allowed for assessing how often and for how long participants chose to use the journal of their own volition. They were sent two emails each day to reminding them to use the app (Appendix Q). During this period, they attended midpoint and post-app sessions to complete the outcome measures: the PWB, PANAS-SF, DERS-SF, and ADI. The midpoint session took place approximately 14 days following their initial orientation session and the post-app session another 14 days following that. The two timepoints allowed for examination of change in response to journaling. Individuals received reminder emails two days before each scheduled appointment (Appendix R). Participants received compensation in the form of \$30 for the baseline session, \$20 for the midpoint session, and \$40 for the post-app session (see procedures section below). In lieu of the \$30 compensation for the baseline session, participants could opt for 2 bonus points toward a psychology course.

App data was collected and uploaded to a server through the app itself as long as the participant was connected to WiFi or cellular data. The data consisted of a record of every time any app feature was accessed including when it was accessed and the duration it was used for. This data was stored and encrypted using Cloud storage hosted by Amazon Web Services.

Data Preparation: App-Related Variables

From the data collected through the app, variables pertaining to journal usage and usage of other features were created.

Journal Usage

To assess the first research question, that is, whether baseline levels of dispositional self-reflection predict the choice to journal, outcome variables pertaining to journal usage over the 28 days of the study were created. These were a) the total amount of time spent on the journal feature as summed across the times it was accessed over the 28 days, and b) a total count of the number of times the journal feature was accessed across the 28 days, herein referred to as total journal time and total journal count, respectively. In addition, however, additional variables characterizing “true” journaling were needed for the hurdle models used in analyses (described below). Specifically, the journal data was rife with instances in which the feature was “used” for a short period of time (e.g., 2 seconds) which could occur if a participant accidentally opened the feature. Further, every participant had to test out using the journal during their orientation session, which masked participants who never went on to use the journal of their own accord. To account for these false journaling sessions, additional variables were created by examining data from the day after orientation onward with a minimum time threshold established for a journal session to count as a true session. This threshold was 30 seconds and decided upon through pilot testing in which volunteers timed how long it took them to open the journal feature, read the

prompt, and type a few lines in response. There were indeed 81 participants who never met this threshold in a given session. Again, both the amount of time spent on and count of these true journaling sessions were totaled, resulting in two variables: true journal time and true journal count. Lastly, a fifth journaling variable pertained to whether a participant ever used the journal (or had a true journaling session), herein referred to as the choice to journal.

For the second research question, that is, does dispositional self-reflection augment the extent to which journaling confers beneficial outcomes, time spent journaling was again used, although operationalized slightly differently. Because multilevel modeling was used (see below), the variable used pertained to total time spent journaling as totaled cumulatively at baseline (where it was zero for all participants), midpoint, and post-app. In this case, the timepoints refer to the first day the participant logged on to the app and then 14 and 28 days later, regardless of when they actually completed the self-report measures as occasionally their laboratory sessions occurred slightly after the 14 and 28 days. The journal variable used in the multilevel modeling analyses is referred to as journaling throughout this document.

App Days

While participants were meant to use the app for 28 days, this was not always the case and some individuals stopped using the app prior to this. Specifically, 59 individuals stopped using the app before the 28-day mark; the majority of these individuals stopped at day 25 or later. A variable called “app days” was calculated to reflect the number of days between the first day the participant logged on to the app and the day corresponding to the last time they used the app. This variable was used in evaluating the first research question to account for any differences in journal usage that were due to differences in duration the app itself was used for.

Other App Time

A variable called “other app time” was calculated in order to assess whether any effects of journaling existed beyond effects of general app use. This variable represented the total amount of time that participants spent on the app outside of time spent using the journal feature. Again, this was totaled at baseline (zero for all participants) and 14 and 28 days into app usage.

Statistical Analyses

Data analyses were conducted using Stata. Total scores were calculated for each measure if at least half the measure was completed. Missing items within questionnaires were imputed with person mean imputation. Person-mean imputation tends to inflate reliability estimates but can produce unbiased estimates if the number of people with missing data and the missing data within each person’s measure is less than 15-20% (Bono et al., 2007; Downey & King, 1998). Further, for the second research question evaluating outcomes over time and thus requiring longitudinal self-report data, missing data were accounted for using maximum likelihood estimation (Jeličić et al., 2009), which is a preferred method of handling missing data and results in the most unbiased parameters and valid model fit (Dong & Peng, 2013; Enders & Bandalos, 2001; Leite & Beretvas, 2010). The extent of missing session/timepoint data is reported in the Results section.

H1: Self-Reflection Will Predict Journal Usage

To test my first hypothesis that self-reflection would predict journal usage, count regression models were used to analyze total journal time and total journal count. A visual inspection of the distributions of both outcomes revealed signs of dispersion; specifically, the data were skewed closer to 0 and sparse around higher journal usage amounts. For this reason, negative binomial regression models were considered in addition to regular Poisson regression because negative binomial regression includes a dispersion parameter which Poisson models

lack. Using a Poisson model in the presence of dispersion increases the chance of erroneous statistically significant results (Cameron & Trivedi, 1998). For both forms of journaling data, comparisons of model fit between a Poisson and negative binomial regression revealed that the negative binomial model had lower Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), indicating better fit. There is no agreed upon criteria for how much lower the indices should be (Singer & Willett, 2003), though Raftery (1995) suggests some criteria for BIC, including a difference of higher than 10 as very strong. In the current case, however, differences were quite large: for total journal time, AIC and BIC were 2040.37 and 2060.40, respectively, for the negative binomial model, but 125463.1 and 125478.1 for the Poisson version. Similarly, for total journal count, AIC and BIC were 891.69 and 909.76 for the negative binomial model but 1480.85 and 1495.91 for the Poisson version. Further, a likelihood ratio test of the assumption that the dispersion parameter = 0 was significant at $p < .001$ again supporting the use of a negative binomial model.

Predictors in the models, hereafter referred to as model A for total journal time as the outcome and model B for total journal count as the outcome, included self-reflection, rumination, journal-keeping status (yes vs. no), and sex. Both models also allow specifying an exposure variable to account for differences in how much of an opportunity to engage in the behaviour in question (i.e., journaling) existed. In this case, individuals stopped using the app at different times if they stopped attending study sessions or if they stayed in the study but decided to stop using the app overall. Thus, the exposure variable consisted of app days.

In addition to using negative binomial models, a hurdle model was used to analyze the true journal time and true journal count outcomes, hereafter referred to as models C and D, respectively. Hurdle models are useful because they model the decision to engage in a behaviour

at all, and then once the decision is made (i.e., the “hurdle” is cleared), a separate function models how much the behaviour is engaged in. This suggests there are really two processes going on in many behaviours: not only the process determining how much people journal as a rote amount on a continuous spectrum, but also a decision process in the choice to use the journal at all. There are likely factors that predict not just how much time people spend journaling, but also potentially independent factors separating those who journal at all versus those who choose not to. Hurdle models allow the predictors for each of these processes to differ if desired. In the current study, the first function consisted of a logistic regression predicting the choice to journal variable reflecting whether or not someone ever journaled, while the second function was a zero-truncated negative binomial regression model used to examine true journal time and true journal count only for those who did choose to journal. This negative binomial model must be zero-truncated as the value of the outcome will never reach zero since only people who engaged in journaling are examined (Zuur et al., 2009). The same predictors were used in the hurdle models as in models A and B: self-reflection, rumination, journal-keeping status (yes vs no), and sex.

Model Assumptions. The following assumption checks and diagnostic tests were performed for all models (the negative binomial models and hurdle model) used to test hypothesis 1 (Cameron & Trivedi, 1998; Hilbe, 2011). Model assumptions of independence of the errors and linearity between predictors and the transformed response variable (consisting of a log transformation in the case of negative binomial regression) were assessed with residual plots. In all models, a link function check was also performed to ensure the correct link function was specified, consisting of a log link in the case of the negative binomial models and the logit link for the logistic portion of the hurdle models, and to check for omitted or extraneous variables. Multicollinearity was also assessed by examining variance inflation factor and tolerance statistics

(Allison, 2012). Goodness of fit was evaluated with log-likelihood, and pseudo- R^2 values, and for the logistic portion of the hurdle models, Hosmer-Lemeshow goodness of fit. Leverage and influence statistics were also examined in conjunction with residual plots for all models. For model A, one point in particular was concerning as it had extremely large influence; indeed, its removal from the model resulted in drastically different coefficients and p -values, removing previously significant effects of various predictors, and the model fit improved slightly as indicated by the loglikelihood value.

H2: Journaling and Self-Reflection Will Jointly Influence Outcomes

To test my second hypothesis, that journaling would confer beneficial outcome and this would be augmented by dispositional self-reflection, multilevel modeling (MLM) was used. MLM is commonly used for analyzing longitudinal data. This was necessary for the current study as outcome variables were examined at baseline, midpoint, and post-app to assess change. MLM efficiently accounts for both between-person differences and within-person change over time. This is because data is organized in a nested fashion using multiple “levels”, such that the individual exists at the level-2 unit of analysis and some measure of time is nested within each individual at level 1. As such, variables can exist at the individual level without varying across time, or at the time-level so that each individual has time-varying scores. In the current study, time was operationalized with the journaling variable. This allowed time to vary for each participant, which is preferred to a metric of time that masks differences between individuals in how much time has elapsed, in whichever way time is being operationalized (Singer & Willett, 2003).

Using MLM in this manner was also chosen as opposed to using a conventional regression analysis with change scores, where the dependent variable is one’s follow-up score

subtracted from their baseline score. Change scores can be problematic for many reasons, including being subject to regression the mean and the effects of measurement bias, and floor and ceiling effects if one is already at the highest or lowest value on a scale and thus cannot improve or worsen, resulting in a change score of 0 (Harrell & Slaughter, 2019). Another practice is to use change scores and adjust for baseline scores; however, in observational studies this has been shown to inflate regression coefficients (Glymour et al., 2005).

A separate MLM was run for each of the five outcome variables (Negative Affect, Positive Affect, ADI, DERS-SF, PWB). The two primary predictors of interest were baseline Self-Reflection scores and journaling. Control variables also included Rumination scores as well as other app time. Certain variables were centered before analyses were conducted on the basis of making the intercept more interpretable (Hayes, 2013). Only self-report measures were centered because the app data variables (journaling, other app time) have real meaningful zeros. It should also be noted that in the MLM literature, there is debate as to whether variables should be centered on the cluster mean or grand mean, but this was not a relevant issue for the analyses at hand because all predictor variables needing centering were level-2 variables (Enders & Tofighi, 2007).

Models were built hierarchically following the steps of Peugh (2010). The first model tested the effect of journaling on the outcome of interest, followed by a model testing whether the effect of journaling held up when controlling for other app time outside of journaling, and lastly, a model testing whether the effect of journaling depended self-reflection, controlling for rumination. In this third model, a significant interaction effect was interpreted in terms of the slope of journaling; that is, testing whether the slope of journaling was significantly different from 0 for various levels of self-reflection: the minimum value, maximum value, mean, and one

standard deviation above and below the mean. Each successive model was tested for superior fit compared to the prior one with a likelihood-ratio test, except for the third model with all predictors and the interaction because the sample size changed by 1 due to missing data which renders a likelihood-ratio test inappropriate. Instead, log likelihood values and AIC were compared.

Steps and equations for model-building for each of the 5 separate analyses are as follows: First, the level 1 model was specified in its simplest form, the random intercept-only model, which is the most basic random effect that can be included in a multilevel model. This random intercept indicates that individuals vary in their baseline values of the outcome. Each individual's outcome score Y_{ti} equals their average outcome score, or intercept, β_{0i} , and an error term r_{ti} representing the deviation of the observed from predicted outcome. The intercept is equal to the grand mean of outcome scores across individuals (γ_{00}) and the error term u_{0i} , which is the deviation of the individual's score from γ_{00} .

$$\text{Level 1 model: } Y_{ti} = \beta_{0i} + r_{ti}$$

$$\text{Where, at level 2: } \beta_{0i} = \gamma_{00} + u_{0i}$$

Time was then added as the only level 1 predictor, which, in the current study, existed as the journaling variable. This created the first model used for hypothesis-testing, model 1, represented by the following equation:

$$Y_{ti} = \beta_{0i} + \beta_{1i}(JOURNAL_{ti}) + r_{ti}$$

Where, at level 2, in addition to the equation for β_{0i} already expressed above:

$$\beta_{1i} = \gamma_{10} + u_{1i}$$

The intercept β_{0i} , the equation for which is expressed previously, becomes conditional on journaling such that it is now the outcome score at baseline. The added coefficient for journaling,

β_{1i} , represents the rate of change over minutes of journaling, equal to the grand mean rate of change γ_{10} and a term reflecting individualized deviations in this slope u_{1i} . This random slopes term is optional in MLM, especially when there is no cross-level interaction, so its added value was tested with a likelihood-ratio test but it did not improve model fit and thus was excluded from the models lacking the interaction term.

Other app time was then added as a control variable to the model to assess whether the effect of journaling would remain significant. Adding this predictor formed the second model used for hypothesis-testing, model 2, expressed as:

$$Y_{ii} = \beta_{0i} + \beta_{1i}(JOURNAL_{ii}) + \beta_{2i}(APP_{ii}) + r_{ii}$$

Where, at level 2, in addition to the equations for β_{0i} and β_{1i} already expressed above:

$$\beta_{2i} = \gamma_{20} + u_{2i}$$

In the above equation, no random slopes term was included for other app time, so u_{2i} equals 0 in this study. The level 2 models are expanded by adding level 2 predictors to the equations for β_{0i} and β_{1i} . Level 2 means the predictors exist at the individual level, as opposed to the time level, and are measured only at baseline. The level 2 predictors consisted of Self-Reflection and Rumination. A cross-level interaction was also formed between Self-Reflection and journaling to test the hypothesis that those higher in dispositional self-reflection would benefit from journaling more. Heisig and Schaeffer (2018) have argued that a random slopes term for the lower-order level should always be included when there is a cross-level interaction to reduce the chance of type I error. Thus, a random slopes term u_{1i} for journaling was included for this final model. This formed model 3, the final model for each outcome:

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(SR_i) + \gamma_{02}(RUM_i) + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}(SR_i) + u_{1i}$$

The full combined model is as follows:

$$Y_{it} = \gamma_{00} + \gamma_{01}(SR_i) + \gamma_{02}(RUM) + \gamma_{10}(JOURNAL_{it}) + \gamma_{11}(SR)(JOURNAL_{it}) + u_{0i} + u_{1i}(TIME_{it}) + \gamma_{20}(APP_{it}) + u_{2i}(APP_{it}) + u_{0i} + r_{it}$$

All multilevel models were run using full information maximum likelihood estimation (FIML). Restricted maximum likelihood estimation (REML) provides less biased estimates of random effects (Bickel, 2007; Twisk, 2003) while FIML is considered superior for estimating fixed effects and must be used when hypothesizing about them (Twisk, 2003; Singer & Willett, 2003); further, the difference in estimates from these estimation methods grows increasingly smaller with a sufficient sample size. An independent residual covariance structure was specified for each model, which proved to be a good fit when comparing AIC and BIC indices of fit to other residual covariance structures such as unstructured, autoregressive, and exchangeable.

Multiple comparisons were controlled for using the Benjamini-Hochberg procedure. The issue of multiple comparisons could have been avoided by using a multivariate multilevel model analysis; however, such a procedure is not readily implementable in many statistical packages. Baldwin et al. (2014) devised a method that employs dummy variable coding but this becomes less feasible with more dependent variables. The issue of correcting for multiple comparisons with MLM has no straightforward answer. The Bonferroni procedure is often used but can be overly conservative when outcomes are highly correlated, as might be the case if outcomes are similarly affected by an intervention (Sedgwick, 2014). A Benjamini-Hochberg correction was opted for as it focuses on the false discovery rate as opposed to the familywise error rate (McDonald, 2014). The false discovery rate was set to .15 (McDonald, 2014).

Model Assumptions. MLMs require the same linear regression assumptions of homoskedasticity, independence of errors, and normality. These were visually assessed with

residual plots of residuals at both levels of the model as well as tests of normality. Deviance was also assessed in this manner.

Sample Size Calculation

To calculate the number of participants needed for adequate statistical power, a simulation approach was used. A simulation approach requires one to specify what a model that rejects the null hypothesis might look like and then run many replications of the model to see how often the null hypothesis is rejected (DeBruine & Barr, 2019; Hallgren 2014). Not only does a simulation allow estimation of power, but it is also beneficial in that it requires specifying the precise model and analysis plan in advance of the study (Arnold, Hogan, Colford, & Hubbard, 2011). Procedures followed that of Huber (2014) and Huber (2019). A simulated dataset was created that used random data for each variable and hypothesized parameter weights that would result in a significant effect of the interaction when tested with the multilevel model. This was then compared to the same model without the interaction term to assess whether the effect of the interaction in question was statistically different from zero. Then, a program was run that would simulate this comparison multiple times (C. Huber, personal communication, July 9, 2019). Running the simulation 1000 times indicated that a sample size of 100 participants resulted in statistical power of .88. This is likely optimistic, however, as the simulated parameters were idealistic, and real-world data are unlikely to be as perfect or adhere to the model assumptions (Hallgren, 2014). Further, there was little background information or data to inform the simulated parameters, and the true parameters are impossible to know (Hallgren, 2014). Given the results of the simulations, the final sample size of 152 participants was deemed sufficient.

Results

Descriptive Statistics

Responses to the journaling habits question indicated that of the 150 participants who answered this question, 35 individuals (23.33%) kept a journal or diary while 115 (76.67%) did not. Usage of the journal feature varied greatly and was highly positively skewed, with a mean of 26.71 minutes over the 28 days but a standard deviation of 187.58. Considering only individuals who had a non-zero value for the true journaling time variable, however, this mean was 53.57 minutes with a standard deviation of 271.11. Means and standard deviations for all self-report measures are presented in Table 1.

Retention throughout the study was good with 121 participants (79.61%) of the original 152 completing all three timepoints, while 31 (20.39%) missed one or more of the follow-up sessions, including four participants who explicitly withdrew from the study. Their data was retained for analyses up to the point of withdrawal. Twenty-seven participants had a post-app session that occurred after the 28-day mark; however, it seems the cessation of reminder emails at 28 days was effective, as these participants did not use the journal during the additional time.

H1: Self-Reflection Will Predict Journal Usage

In testing whether self-reflection predicted journal usage, with removal of the outlier from model A, only journal-keeping status positively predicted total journal time, $\beta = .65$, $p < .001$, 95% CI [.32, .97]. Counter to predictions, in incident rate ratio terms, keeping a journal increased the rate of total journal time by a factor of 1.92 compared to not keeping a journal. Unexpectedly, self-reflection was not a significant predictor, nor was rumination or sex. Although the full model was significant, $\chi^2(4) = 23.16$, $p < .001$, no other coefficients were statistically significant and McFadden's pseudo- R^2 remained small at .004, indicating a very small improvement over an intercept-only model and explaining little of the variability in total journal time. In model B, no outliers were removed. Again, counter to predictions, journal-

keeping status significantly positively predicted total journal count, $\beta = .79$, $p < .001$, 95% CI [.58, 1.00]; that is, keeping a journal increased the rate of total journal count by a factor of 2.20. No other predictors were significant and while the full model was significant at $\chi^2(4) = 56.14$, $p < .001$, McFadden's pseudo- R^2 was small at .021.

In hurdle model C, unexpectedly, rumination was a significant predictor in the logistic portion of the model (that is, the choice to journal), $\beta = .56$, $p = .040$, 95% CI [.03, 1.09]. The odds ratio was 1.75, meaning each unit increase in rumination predicted a 1.75 increase in odds of choosing to engage in a true journaling session at least once as opposed to never using the journal feature. Again, counter to predictions, journal-keeping status also positively predicted the logistic portion of the model, $\beta = 1.36$, $p = .003$, 95% CI [.47, 2.26]. The odds ratio for journaling habits was 3.90; that is, keeping a journal outside of the app increased the odds of choosing to engage in a true journaling session at least once by a factor of 3.90. In essence, both higher rumination and keeping a journal outside of the study increased the odds of deciding to journal. The logistic portion of the hurdle model was significant overall at $\chi^2 = 21.98$, $p = .001$, though the pseudo- R^2 for the model was low at .114. In the zero-truncated negative binomial portion of the hurdle model, however, no predictors emerged significant whether using true journal time or true journal count. Note that with both outcomes, the logistic portion of the hurdle model remains the same, as the binary variable indicating whether the journal was ever truly used does not change.

Because self-reflection was not related to journaling in any of the models, it was decided post-hoc to assess whether there was a relationship between self-reflection and journal-keeping status to attempt to replicate Grant et al. (2002) in some fashion. A Welch's t-test indicated those

who kept a journal outside of the app were indeed higher in self-reflection, $t(220.26) = 5.34, p < .001$.

H2: Journaling Time and Self-Reflection Will Jointly Influence Outcomes

The coefficients and standard errors for all fixed and random effects of each model are presented in Tables 2a-e. *P*-values are significant after controlling for multiple comparisons unless otherwise indicated.

Affect

In testing the hypothesis that journaling would confer beneficial outcomes in model 1, the journaling-only model, there was a significant effect of journaling, $p = .014$. This was such that negative affect decreased across the three timepoints as journaling increased, supporting the hypothesis. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(1) = 6.01, p = .014$. Contrary to hypotheses, however, in adding other app time to the model to create model 2 the effect was diminished, such that neither predictor was significant; however, the Wald test for the significance of the fixed effects overall was significant, $\chi^2(2) = 7.95, p = .019$. Model fit was expectedly not improved according to a likelihood-ratio test. Finally, the hypothesis that the beneficial outcomes conferred by journaling would be augmented by self-reflection was not supported, as in adding self-reflection, its interaction with journaling, and controlling for rumination to create model 3, the interaction effect of interest was not significant. There was a significant effect of rumination, $p < .001$, such that it was associated with higher negative affect overall. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(5) = 42.63, p = .000$. Comparisons of log likelihood and AIC indicated this third model had slightly improved fit indices than the lower-order models.

For the Positive scale, the hypothesis that journaling would confer benefit was not supported, as in model 1, there was no significant effect of journaling; a Wald test indicated the fixed effects were not significant overall. Adding other app time to create model 2, neither predictor was significant nor was the Wald test for the overall significance of the fixed effects, and model fit was not improved according to the likelihood-ratio test. Finally, in model 3, contrary to the hypothesis that benefit conferred by journaling would be augmented by self-reflection, the interaction effect of interest was not significant. There was a significant conditional effect of self-reflection, $p = .010$, and a main effect of rumination, $p < .001$. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(5) = 35.70$, $p < .001$. A comparison of fit indices indicated fit was slightly improved in model 3 compared to the lower-order models.

Self-Regulation

For the ADI, in testing the hypothesis that journaling would confer benefit in model 1, there was a significant effect of journaling, $p = .023$. As expected, self-regulation improved across the three timepoints as journaling increased. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(1) = 5.19$, $p = .023$. Adding other app time to the model to create model 2, counter to the hypothesis, the effect was diminished and neither predictor was significant; as such, the fixed effects for model 2 were not significant overall according to a Wald test and a likelihood-ratio test indicated the model did not improve fit compared to model 1. Finally, adding self-reflection, its interaction with journaling, and controlling for rumination to create model 3, the interaction effect of interest was not significant, contrary to the hypothesis that the benefit of journaling would be augmented by self-reflection. There was a significant conditional effect of self-reflection, $p = .001$, such that it was associated with better self-

regulation overall, and a main effect of rumination, $p < .001$, such that it was associated with worse self-regulation overall. The fixed effects for model 3 were significant overall with a Wald test of $\chi^2(5) = 53.09, p < .001$. Comparisons of log likelihood and AIC indicated this third model had improved fit indices over the lower-order models.

For the DERS-SF, in testing the hypothesis that journaling would confer benefit in model 1, there was a significant effect of journaling, $p = .05$. As expected, emotion dysregulation improved across the three timepoints as journaling increased, supporting the hypothesis. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(1) = 3.85, p = .05$. Adding other app time to the model to create model 2, the effect was unexpectedly diminished, and other app time was significant at $p = .02$, with increasing time spent on other features associated with improvements in emotion dysregulation over time. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(2) = 9.35, p = .009$. Model fit was improved compared to model 1; $\chi^2(1) = 5.41, p = .020$. Finally, adding self-reflection, its interaction with journaling, and controlling for rumination to create model 3, the hypothesis that the benefit of journaling would be augmented by self-reflection was not supported, as the interaction effect of interest was not significant. There was a significant conditional effect of self-reflection, $p = .021$, and a main effect of rumination, $p < .001$, such that it was associated with higher difficulties in emotion regulation overall. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(5) = 49.06, p < .001$. Comparisons of log likelihood and AIC indicated this third model had improved fit indices than the lower-order models.

Psychological Wellbeing

In testing the hypothesis that journaling would confer benefit model 1, there was a significant effect of journaling, $p = .012$. As expected, psychological wellbeing increased across

the three timepoints as journaling increased. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(1) = 6.34, p = .012$. Adding other app time to the model to create model 2 did not change this effect, further supporting the hypothesis; journaling remained significant at $p = .043$, while other app time was not a significant predictor, and as such, model fit was not improved significantly compared to model 1. Model 2 was significant, $\chi^2(2) = 6.43, p = .040$. Finally, adding self-reflection, its interaction with journaling, and controlling for rumination to test the hypothesis that the benefit of journaling would be augmented by self-reflection, the interaction effect was significant, $p = .038$. In support of the hypothesis, the interaction was such that journaling was associated with a significant rate of change in psychological wellbeing and this rate of change increased with higher levels of self-reflection. A depiction of this interaction is presented in Figure 1 and slopes and p -values are presented in Table 3. There was also a significant effect of rumination, $p = .000$, such that it was associated with lower psychological wellbeing overall. The Wald test for the significance of the fixed effects overall was significant, $\chi^2(5) = 48.65, p < .001$. Comparisons of log likelihood and AIC indicated this third model had greatly improved fit compared to the lower-order models.

Discussion

The elusive concept of self-reflection has been defined and operationalized in many ways, paradoxical in its ties to both self-awareness and psychological-mindedness yet also distress and anxiety. Its more modern relative, the concept of rumination, has further complicated the question of where the benefits of self-reflection lie. The current study sought to add clarity to the nature of self-reflection by exploring whether self-reflection predicts engagement in journaling, a potentially self-regulatory activity that employs self-reflection, and whether it affects benefits conferred by journaling. The primary research questions were whether self-

reflection would predict journal usage and whether benefits conferred by journaling would be augmented by self-reflection. It was hypothesized the self-reflection would predict journal usage and that the higher one's baseline self-reflection, the more improvement in outcomes should be seen as a result of journaling.

Contrary to hypotheses, self-reflection did not predict the amount of time or instances in which individuals journaled, while keeping a journal outside of the study predicted using an app journal feature in this manner. Further, when separating journal usage into whether the journal was used at all and, if so, how much it was used, rumination predicted the choice to journal, as did keeping a journal outside the study. Findings thus indicate high acceptability of a journal feature that uses positive prompts for individuals who already keep a journal considering they freely chose to engage with this feature as part of their overall app usage. The journal feature also seems acceptable to individuals who tend to ruminate even though the journal prompts should draw one away from rumination.

Journaling with the app was related to improvements in negative affect, difficulties in emotion regulation, and self-regulation overall, although these effects were diminished when accounting for time spent using other app features. Psychological wellbeing, on the other hand, improved with increased journaling, which remained significant even when accounting for usage of other app features, and improved to a greater extent for those with a greater tendency to self-reflect. The finding of a dose-response relationship between journaling and positive outcomes is encouraging for more widespread adoption of an app-based journal with positive prompts.

Who Chooses to Journal? Self-Reflection, Rumination, and Acceptability of an App-Based Journal

The observation that self-reflection did not predict the choice to journal, nor time or instances spent on it, is somewhat contradictory to Grant et al. (2002), who found those who kept a journal were higher in self-reflection as measured by the Self-Reflection scale than those who did not. At the same time, however, the current study did replicate Grant et al. (2002)'s results in the post-hoc finding that individuals who kept a journal outside of the study were higher in self-reflection, and these same individuals were more likely to use the journal feature of the app. Thus, there was an association between self-reflection and journaling, but not in the expected way with respect to use of the journaling feature itself. This could be for numerous reasons. For instance, although one strength of the study was refraining from assigning a prescribed amount of journaling, participants were encouraged to use the app twice per day and make use of all its features. As such, individuals may have used the journal as part of their overall app use even if they were not usually self-reflective. Nonetheless, the study design represents a compromise between implementing an intervention and allowing individuals the freedom to choose how much they engage with the activity being implemented, which is necessary for predicting the extent to which it will be adopted long-term without further instruction.

Against the notion that dispositional tendencies may have had a reduced role in the choice to journal, however, rumination was a significant predictor of the choice to have ever used the journal, though not how many times or the total length of time it was used. It is possible that those high in rumination were more drawn to the journal to transform their ruminating into something more productive via positively focused prompts. Whether rumination moderated the effect of the journal intervention was not the focus of the current study, but previous studies support the idea that writing could be beneficial for those who tend to ruminate (Gortner et al.,

2006; Sloan et al., 2008). The connection established between rumination and engaging in an activity that employs self-reflection suggests an interesting route for future research to explore.

A further significant predictor of journal usage, in terms of total time spent on it, number of instances it was engaged in, and whether or not the feature was every truly used, was keeping a journal outside the study, which was opposite to the hypothesis. In retrospect, however, this is an important finding. The fact that individuals who were already journal-keepers also found it acceptable to journal in app format lends support for the compatibility of these two modalities. Little research has been done to explore whether there are differences between mediums in the benefits conferred by journaling, even though studies have compared the merits of the two formats for data collection (i.e., diary studies; Green et al., 2006). While therapeutic approaches often take the route of writing with pen and paper (Resick et al., 2016), other writing-focused programs tend to utilize technology (Peterson & Mar, 2004). The current findings support the notion that those who journal in their regular lives using whichever format they find acceptable are also likely to find an app format acceptable. This acceptability is especially evident considering individuals were free to choose to journal as much or as little as they preferred, indicating that those who kept a journal outside the study truly desired to use the journal feature more than their non-journaling peers. It is these individuals and those who ruminate who may be more likely to adopt this form of journaling long-term as an everyday behaviour without further instruction. Individuals who keep a journal as part of their everyday life could also be encouraged to adopt the habit of writing with a prompt in mind to guide their writing.

Self-Reflection Ties Journaling to Improved Psychological Wellbeing

The most robust findings of the current study were the consistently demonstrated improvements in psychological wellbeing with increased journaling. This effect persisted even

when accounting for usage of other app features, which did not predict improvements in psychological wellbeing, and existed only for those whose tendency for self-reflection was average or greater. This finding supports the previous meta-analysis of the expressive writing paradigm which indicated the strongest effects were for students and the outcome of psychological wellbeing (Smyth, 1999). King (2001) also found positively-focused writing improved psychological wellbeing. One reason psychological wellbeing may have improved is the similarity in themes of the journal prompts to items used to assess the construct. Both the psychological wellbeing measure and the journal feature prompts contain items with positive themes including growth, mastery, looking to the future, and goals. Thus, one potential mechanism of change might have been simply having people think about facets of psychological wellbeing and what it means to be doing well that they might not have previously considered. In this sense it may be self-reflecting on these themes that promotes an increase in their relevance to one's life and self-concept over time.

Further, results suggested that one only benefitted from this journal-based reflection if they were a relatively self-reflective individual at baseline. Those who were not self-reflective did not benefit from journaling in terms of psychological wellbeing, contrary to the idea that the prompts may provide the impetus for self-reflection for those who do not engage in this pattern of thinking normally. Thus, one may need to have the motivation and desire to self-reflect in order to engage with prompts surrounding wellbeing. Alternatively, perhaps individuals lower in self-reflection still engaged with the prompts, but did not fully internalize the benefit of this journaling in a way that spurred change in their own lives and sense of wellbeing. Overall, the results with respect to psychological wellbeing support the hypothesis that the tendency for self-reflection can be used in a beneficial manner and to one's advantage when it comes to

journaling. The prompts may be a beneficial feature for fostering wellbeing that future research utilizing a journaling or writing intervention want to incorporate.

Results suggest that perhaps previously established effects of similar journaling interventions on psychological wellbeing (e.g., King, 2001; Smyth, 1999) may have only truly been evident for those with a certain level of self-reflection. Indeed, the Self-Reflection scale has previously been associated with the Personal Growth scale of the PWB, but no other scales of this measure (Harrington & Loffredo, 2010). The fact that self-reflection has been associated with psychological wellbeing previously, and moderated improvements in psychological wellbeing in the current study, are interesting considering the common link both self-reflection and psychological wellbeing have to psychotherapy as well as personal growth and change in general. Psychological wellbeing is meant to capture the meaning-making, self-actualizing aspect of what it means to be a fully functioning human being, reflecting an importance placed on reaching one's full potential as opposed to focusing on promoting happiness or positive emotions (Ryff, 2013). Similarly, self-reflection is purported to increase self-knowledge in the service of psychological growth (Buss, 1980; Trapnell & Campbell, 1999). Thus, both share themes of acquiring meaning from one's experiences and knowledge of oneself in the service of personal change. Similarly, both psychological wellbeing and self-reflection are meant to be neutral in affect yet tied to greater insight and emotional intelligence (Trapnell & Campbell, 1999; Ryff, 2013). In sum, potentially because rumination was controlled for, the results of the current study represent a reconnection of self-reflection to its original philosophical roots in fostering self-realization, as opposed to being tied to anxiety and distress.

Preliminary Evidence for Improvements in Affect and Self-Regulation

In addition to psychological wellbeing, I examined the effect of journaling on affect and self-regulation. Negative affect, self-regulation, and emotion regulation improved as a function of time spent using the journal. The journal feature in the current study differed from the expressive writing paradigm (Pennebaker & Beall, 1986) in writing instructions, choice of participation, modality, and frequency of writing, yet it evidenced some similar benefits. Not only this, but benefits were linked to journaling in a dose-response fashion. With respect to negative affect, reductions were consistent with Lumley and Provenzano (2003) and Pascual-Leone et al. (2016), who found that while negative affect often increased acutely after writing, it decreased in the long run. Since the instructions in the current journaling intervention were ones less likely to make individuals feel heightened negative affect, it is less likely that our participants experienced this acutely increased negative affect, yet they experienced similar results long-term.

A reduction in negative affect is also consistent with the theoretical mechanism of writing posed by Sloan et al. (2008), in that depression was reduced in their sample because writing allows one to acknowledge and challenge negative emotions. Interestingly, unlike its counterpart, improvement was not evident for positive affect in the current study. This contrasts with Poon and Danoff-Burg (2011) who similarly studied three timepoints spaced over a month and found improved positive affect even though participants were writing about past stressful events. This makes it more surprising that positive affect did not change considering the journal intervention contained prompts geared toward a positive focus and not a stressful past event. Further, Lewandowski (2009) theorized that because negative and positive affect are somewhat independent, a positively-focused writing intervention should not influence negative emotions, and indeed, they found increases in positive affect after a positively-focused writing intervention.

Findings in the current study go against both of these prior studies by demonstrating change in negative affect in response to positively-focused prompts. Again, however, these effects were nonexistent once accounting for combined usage of other app features. As such, it could be that reductions in negative affect were due to other specific features of the app such as the mood rating feature since the app offered ways to improve mood when participants indicated their mood was low. The role of other app features in influencing negative affect was not the focus of the current study but represents an interesting line of further investigation.

Findings with respect to improvements in self-regulation, prior to accounting for usage of other app features, are also in support of previous literature. When studies began to modify the traditional expressive writing paradigm to have a different focus other than past trauma, such as a positive one or writing about both future and past events, similar benefits were evidenced as the traditional paradigm (Cameron & Nicholls, 1998; King, 2000; King & Miner, 2000), suggesting writing as a broad, generalized strategy for self-regulation. For example, Cameron and Nicholls (1998) found journaling with a plan for coping with the future evidenced beneficial outcomes. Similarly, in the current study, the construct of self-regulation, which includes the ability to plan for the future and act with this in mind, showed improvements over time. The fact that self-regulation, including emotion regulation but also behavioural and cognitive, improved with journaling in the current study supports the idea put forth by Greenberg et al. (1996): that writing spurs self-regulatory processes by allowing the writer to gain a sense of control over emotions and experiences. Feeling a sense of control on multiple levels, including some sense of control over reactions to the past but also how the future might unfold, is likely an important part of why journaling is effective.

The effects of journaling on negative affect and self-regulation only existed prior to controlling for time spent using other features of the app, such as the deep breathing exercises or mood rating feature. When including this control variable, the effects of both time spent journaling and time spent on other app features were often non-significant, except in the case of emotion regulation where it was time spent on other features that predicted improvement. In some sense, this is unsurprising considering other features like deep breathing and rating one's mood are intimately tied to improving emotion regulation. It was important to control for time using the app that was not spent on journaling in case those who were journaling more were also more likely to make use of the app as a whole, and thus could be benefitting from the other app features and not necessarily the journal. At the same time, however, expecting journaling to remain a significant predictor of change in the face of the combined effect of a variety of other similar interventions may have been a difficult standard to meet. It is understandable that when each other activity had its own slightly unique function, the combined effect of these might diminish any effect of one sole activity. The rigorousness of including use of these other features renders the study unique, however, in that the other app features geared toward positive change but very different in content served as a sort of comparison intervention lacking in other studies. Previous studies have randomized individuals to differing writing conditions where one condition is designed to likely be more effective (e.g., Pennebaker & Beall, 1986; Poon & Danoff-Burg, 2011, Stockton et al., 2014), while in the current study the comparison condition was a variety of activities thought to be similarly effective for self-regulation, albeit likely through different processes than those implicated in journaling.

Further surprising, with the exception of psychological wellbeing, self-reflection did not moderate the extent to which journaling conferred benefit. It is possible that the guiding prompts

in the journal feature provided the minimum amount of self-reflection needed to foster change in affect and self-regulation, such that being self-reflective by nature was not a prerequisite for acquiring benefit. As such, the prompts could have been self-reflective enough that they assisted even the least self-reflective individuals in managing emotion, even if this journaling did not translate to a deeper sense of psychological wellbeing in a more wholistic sense. Taken together, there was robust improvement in psychological wellbeing with increased journaling for individuals who were self-reflective, whereas for other outcomes there was some initial evidence for improvement with journaling but self-reflection did not play a role. In some sense, these findings make sense considering the theorized relationship of self-reflection to facets of psychological wellbeing as discussed previously, while it was the journaling literature that implicated changes in self-regulation and affect. As such, self-regulation and affect may not require as great a degree of self-reflection to improve considering there are elements of self-regulation that are more physiological with less of a role for metacognitive capacities like self-reflection (Leary et al., 2006). Further, as mentioned, self-reflection is supposed to be affectively-neutral (Trapnell & Campbell, 1999) and as such may not have mattered for changes in emotion-related outcomes. This contrasts with psychological wellbeing, which is broader in its evaluation of one's life and current functioning as a whole and may thus require self-reflection. Along this line, at no point in the analyses conducted in this study was self-reflection associated with negative outcomes, contrary to previous research finding a relationship with anxiety and stress (Grant et al., 2002). This is likely partially because rumination was controlled for in all analyses.

Strengths and Limitations

The current study had many strengths that lend merit to the findings. Firstly, the use of a hurdle model allowed breaking down the decision process when it comes to engaging in journaling, such that journaling could be examined as both a categorical choice and a continuous behaviour. Being able to examine separate categorical and continuous processes represents a strength. Further to this, the current study consisted of a longitudinal evaluation that affords a greater degree of evidence of the directionality between journaling and associated outcomes, as opposed to concurrent associations which lack this element of temporality (e.g. Grant et al., 2002). While some longitudinal studies can suggest that being randomized to a writing condition is associated with improved outcomes, I was able to link such outcomes to a greater degree by measuring differences between individuals in how much journaling was engaged in, finding a direct dose-response relationship between journaling and improvements as opposed to analyzing journaling in the categorical fashion of either being in a writing or control condition. Using MLM with journaling as an individualized predictor with values unique to the individual, as opposed to simply using timepoint as the primary predictor, makes any argument that changes in wellbeing are due to the natural passage of time less tenable (Singer & Willet, 2003). The claim that outcomes are linked to journaling is also strengthened by the control variables included, especially with respect to controlling for the effects of the combined usage of all other app features. Finally, allowing individuals to journal for as long or as little as they preferred represents a major strength in translating research to the lives of everyday individuals, since interventions are only effective to the degree that they are acceptable and likely to be adopted. This is eloquently reflected in the observation that journaling may truly represent a “self-initiated” coping strategy (Burt, 1994). The significant findings with respect to improvements in

outcomes are, in a sense, more impressive considering they were ones based on journaling that was self-initiated.

Despite the many strengths, the current study was not without limitations. Most evident is that while the findings are informative for the usefulness of the journal feature under investigation, the findings might not fully generalize to the kind of journaling people typically engage in. Most individuals likely journal using a physical notebook, not an app, and for longer durations than would be feasible on an app. Further, physical notebooks may not contain prompts meant to foster thinking in a positive direction. It is possible that the effects of journaling, and of self-reflection on journaling, would be different had these prompts not existed. Perhaps the negative connotations of self-reflection would be evident without the positive prompts to guide it in a productive fashion. Though they may not generalize fully to typical journaling, results are still encouraging for the further implementation and more widespread adoption of the app and, more specifically, the journal feature. Additionally, encouraging individuals who do keep a journal to write with a specific focus or prompt in mind may be beneficial.

A second limitation exists with respect to the measures used. The ADI subscales and the three PWB subscales used in the study were combined to form total scales for the self-regulation and psychological wellbeing constructs. While this decision was made to limit the number of comparisons and chance of type I error rate, it differs from the usual approach for these measures. The three scales of the ADI are thought to represent distinct components of self-regulation; for example, using confirmatory factor analysis, da Motta et al. (2018) found a one-factor model fit their data poorly whereas the three-factor original model provided a good fit. Further, the separate scales have differential construct validity in some domains like aggression (da Motta et al., 2018). With respect to the PWB, no study combining the three specific scales

used in this study could be found. Cronbach's alpha values were assessed to ensure these total scores were appropriate.

Finally, another limitation is that to conduct the hurdle models, a somewhat arbitrary value had to be chosen as the cut-off point for what consisted of a true journaling session and not an accidental opening of the feature without true use of it. There is a possibility that with using a cut-off of 30 seconds, some individuals who did spend time reflecting on the prompt were missed, and others who were not engaging with the journal but left the feature open were erroneously captured. While the use of an app allowed the collection of a vast amount of data on real-time participant behaviour, challenges in understanding what level of engagement is attached to the quantitative usage data indeed exist.

Future Directions

Given the relative lack of recent research examining journaling as a self-initiated coping behaviour, and a lack of clarity in prior research on the nature of self-reflection, the current findings may inspire many different future research directions. Firstly, since rumination predicted the choice to use the journal, it would be useful to see whether those who ruminate benefit from the journaling intervention. Though this was not the focus of the current study, the data collected do allow examining this as a follow-up question. Further, it would be worthwhile to test the benefits of the journal as a standalone feature of an app and again assess naturalistic tendencies to engage with it. In addition, the positive findings of the current study suggest that individuals who use a journal could benefit from adding writing prompts to their routine; however, it would be beneficial to compare the current journal feature with one that eliminated the use of prompts to better clarify whether the prompts played a key role in the current findings. Different prompts could also be compared; for example, are individuals more likely to use the

journal with positive prompts compared to prompts from the expressive writing paradigm in which traumatic experiences are recalled? Finally, while the current study used both time spent journaling and a count of instances of journal usage as proxies for engagement with the journal, other ways of quantifying journal engagement that better assess the precise mechanism of change of journaling could be used in the future. For example, King and Miner (2000) found benefit depended on how many words signaling insight, such as “understand” and “realize”, were used in journal entries. Individuals may have journaled for similar amounts of time yet differed in the level of thought they put into journaling, a limitation pertaining to the use of hurdle models that has already been highlighted. Examining the effort and focus put into journaling would be important for future studies to consider.

Conclusion

Self-reflection is a ubiquitous process, one that is evolutionarily based and necessary for self-awareness and personal growth. The relative benefits and drawbacks of being highly self-reflective have been contested, with true effects confounded by the closely related concept of rumination. Here, it is demonstrated that journaling is an activity that engages self-reflective processes in a beneficial manner to improve various aspects of self-regulation and psychological wellbeing. Most notably, journaling improves psychological wellbeing for those who have a penchant for self-reflection. Accounting for the effects of rumination, this study provides clarity as to the nature of self-reflection and the benefits of journaling. Disseminating interventions such as the journal used in this study, while bearing in mind that it may be best suited for individuals whose dispositions are a good fit with the nature of the activity, would be a worthwhile endeavor.

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6_11

Table 1*Descriptive statistics for study measures across each timepoint.*

	<i>M</i>	<i>SD</i>
Self-Reflection Scale		
Baseline	55.62	10.94
Rumination Scale		
Baseline	3.80	.72
Positive Affect Scale		
Baseline	32.47	8.31
Midpoint	30.77	8.53
Post-App	30.53	8.93
Negative Affect Scale		
Baseline	23.57	7.16
Midpoint	22.23	7.67
Post-App	22.05	8.14
Abbreviated Dysregulation Inventory		
Baseline	32.62	12.87
Midpoint	31.93	12.83
Post-App	31.23	13.41
Difficulties in Emotion Regulation		
Baseline	43.22	13.65
Midpoint	39.18	13.24
Post-App	38.56	12.28

Psychological Wellbeing		
Baseline	53.22	15.81
Midpoint	51.57	14.52
Post-App	51.42	15.20

Table 2a

Coefficients/estimates and standard errors for the fixed effects of interest and random effects for the three iterations of the Negative Affect MLM.

Parameter	Model 1 – Journaling Time Only	Model 2 – Journaling, Other App Time	Model 3 – Journaling, Other AppTime, Self-Reflection, Rumination, Interaction
<i>Fixed Effects</i>			
Intercept	22.79 (.55) **	22.92 (.56) **	22.89 (.51) **
Journaling	-.01 (.002) *	-.004 (.003)	-.01 (.02)
Other App Time		-.0002 (.0002)	-.0002 (.0002)
SR			.03 (.05)
Rumination			3.93 (.73) **
J x SR			-.0009 (.002)
<i>Variance Components</i>			
Intercept	38.36 (5.29)	38.05 (5.26)	29.82 (4.31)
Residual	19.17 (1.68)	19.11 (1.67)	19.12 (1.67)
Slope			1.54e-16 (6.80e-16)

* $p \leq .05$

* $p \leq .01$

Note. SR = self-reflection; J x SR = interaction between journaling time and self-reflection.

Table 2b

Coefficients/estimates and standard errors for the fixed effects of interest and random effects for the three iterations of the Positive Affect MLM.

Parameter	Model 1 – Journaling Time Only	Model 2 – Journaling, Other App Time	Model 3 – Journaling, Other App Time, Self-Reflection, Rumination, Interaction
<i>Fixed Effects</i>			
Intercept	31.30 (.63) **	31.40 (.64) **	31.57 (.59)
Journaling	.0007 (.002) *	.002 (.003)	-.02 (.03)
Other App Time		-.0002 (.0002)	-.0002 (.0002)
SR			.14 (.06) **
Rumination			-4.60 (.84) **
J x SR			.004 (.003)
<i>Variance Components</i>			
Intercept	52.29 (6.95)	52.62 (6.99)	41.75 (5.78)
Residual	20.64 (1.81)	20.50 (1.79)	19.75 (1.78)
Slope			.006 (.007)

* $p \leq .05$

* $p \leq .01$

Note. SR = self-reflection; J x SR = interaction between journaling time and self-reflection.

Table 2c

Coefficients/estimates and standard errors for the fixed effects of interest and random effects for the three iterations of the Abbreviated Dysregulation Inventory MLM.

Parameter	Model 1 – Journaling Time Only	Model 2 – Journaling, Other App Time	Model 3 – Journaling, Other App Time, Self-Reflection, Rumination, Interaction
<i>Fixed Effects</i>			
Intercept	32.32 (.99) **	32.38 (1.00) **	32.37 (.87) **
Journaling	-.007 (.003) *	-.006 (.004)	-.07 (.04)
Other App Time		-.0001 (.0002)	-.00004 (.0002)
SR			-.27 (.08) **
Rumination			8.63 (1.24) **
J x SR			-.0003 (.004)
<i>Variance Components</i>			
Intercept	136.52 (17.24)	135.76 (17.21)	96.51 (12.78)
Residual	32.55 (2.86)	32.61 (2.87)	31.95 (3.01)
Slope			.007 (.02)

* $p \leq .05$

* $p \leq .01$

Note. SR = self-reflection; J x SR = interaction between journaling time and self-reflection.

Table 2d

Coefficients/estimates and standard errors for the fixed effects of interest and random effects for the three iterations of the Emotion Dysregulation MLM.

Parameter	Model 1 – Journaling Time Only	Model 2 – Journaling, Other App Time	Model 3 – Journaling, Other App Time, Self-Reflection, Rumination, Interaction
<i>Fixed Effects</i>			
Intercept	40.69 (.96) **	41.05 (.96) **	41.08 (.88) **
Journaling	-.008 (.004) *	-.002 (.005)	-.04 (.03)
Other App Time		-.0006 (.0003) *	-.0005 (.0002)
SR			-.19 (.08) *
Rumination			7.48 (1.25) **
J x SR			-.004 (.003)
<i>Variance Components</i>			
Intercept	119.34 (16.06)	116.76 (15.77)	89.57 (12.61)
Residual	52.09 (4.55)	51.62 (4.51)	51.27 (4.48)
Slope			5.82e-21 (2.39e-20)

* $p \leq .05$

* $p \leq .01$

Note. SR = self-reflection; J x SR = interaction between journaling time and self-reflection.

Table 2e

Coefficients/estimates and standard errors for the fixed effects of interest and random effects for the three iterations of the Psychological Wellbeing MLM.

Parameter	Model 1 – Journaling Time Only	Model 2 – Journaling , Other App Time	Model 3 – Journaling, Other App Time, Self-Reflection, Rumination, Interaction
<i>Fixed Effects</i>			
Intercept	94.55 (1.17) **	94.51 (1.18) **	94.52 (1.05) **
Journaling	.009 (.004) *	.008 (.004)	.06 (.02) *
Other App Time		-.000001 (.000004)	-.0000008 (.000004)
SR			.33 (.10) **
Rumination			-8.82 (1.51) **
J x SR			.005 (.003) *
<i>Variance Components</i>			
Intercept	193.44 (23.95)	193.09 (23.93)	146.40 (18.61)
Residual	38.10 (3.34)	38.13 (3.34)	37.90 (3.33)
Slope			1.04e-23 (3.55e-23)

* $p \leq .05$

* $p \leq .01$

Note. SR = self-reflection; J x SR = interaction between journaling time and self-reflection.

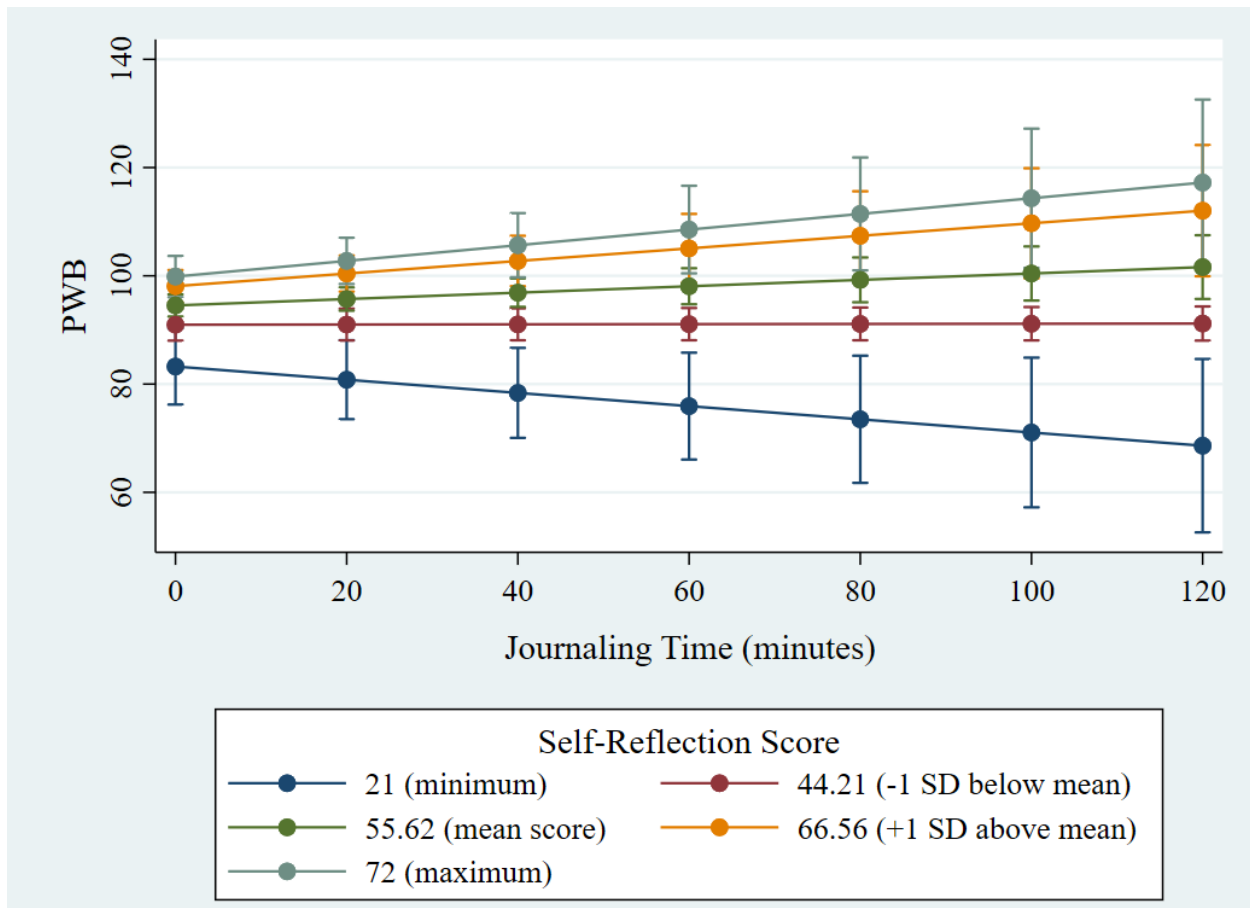
Table 3

Tests of slopes of journaling for each different levels of self-reflection for the two-way psychological wellbeing interaction.

<i>Self-Reflection Score</i>	<i>Slope of Journaling Time (Standard Error)</i>	<i>P-Value</i>
21 (minimum score)	-.12 (.06)	.054
44.21 (-1 SD below mean)	.002 (.005)	.737
55.62 (mean score)	.06 (.02)	.016
66.56 (+1 SD above mean)	.12 (.05)	.025
72 (maximum score)	.14 (.07)	.028

Figure 1

Psychological wellbeing scores by journaling over 28 days and baseline self-reflection.



Note. See Table 3 for slopes and p-values of lines. PWB = psychological wellbeing.

Appendix A - Class Email

Subject: Research opportunity – iPhone App and Resilience

Email Body:

Hello,

My name is ____ and I am part of Dr. Aislin Mushquash's research team in the Department of Psychology. This email is to let you know about a research study we are conducting on resilience among undergraduate students through the use of an iPhone App. Resilience is defined as a characteristic of an individual and their environment that provides the resources necessary for positive development and wellbeing. The App is designed to promote resilience by enhancing a person's abilities to understand and deal with their emotions effectively and to understand and enhance their mental organization skills. The study is designed to evaluate the impact that this App has on the resilience, wellbeing, mood, and adjustment of students.

To qualify for the study, you must be:

- An undergraduate student
- Have an iPhone
- Speak/read fluently in English

Participation will involve:

- Downloading and using the App for 4 weeks
- Completing questionnaires before, during, and after using the App
- Some questionnaires ask about difficult experiences and may be hard for some people to think about. Participants are free to skip questions they do not feel comfortable answering. If participants feel upset during the study, we have information available on relevant supports.

For participating, you would receive:

- Up to \$90
- If you are in a psychology course that offers bonus points, you could earn up to 2 bonus points plus \$60

Your participation in this study is entirely voluntary, and whether you choose to participate or not will not impact your academic standing in this or any other course. If you are interested, you can contact our research team for more information or to sign up by emailing LU.App.Research@gmail.com.

Thank you for your time.

Appendix B - Class Announcement

Hi everyone,

My name is _____ and I am part of Dr. Aislin Mushquash's research team in the Department of Psychology. I am here to let you know about a research study we are conducting on resilience among undergraduate students through the use of an iPhone App. Resilience is defined as a characteristic of an individual and their environment that provides the resources necessary for positive development and wellbeing. The App is designed to promote resilience by enhancing a person's abilities to understand and deal with their emotions effectively and to understand and enhance their mental organization skills. The study is designed to evaluate the impact that this App has on the resilience, wellbeing, mood, and adjustment of students.

To qualify for the study, you must be:

- An undergraduate student
- Have an iPhone
- Speak/read fluently in English

Participation will involve:

- Downloading and using the App for 4 weeks
- Completing questionnaires before, during, and after using the App
- Some questionnaires ask about difficult experiences and may be hard for some people to think about. Participants are free to skip questions they do not feel comfortable answering. If participants feel upset during the study, we have information available on relevant supports.

For participating, you would receive:

- Up to \$90
- If you are in a psychology course that offers bonus points, you could earn up to 2 bonus points plus \$60

Your participation in this study is entirely voluntary, and whether you choose to participate or not will not impact your academic standing in this or any other course. If you are interested, you can contact our research team for more information or to sign up by emailing LU.App.Research@gmail.com.

Thank you for your time.

Appendix C - SONA Ad

Study Name	Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App
Study Type	Standard (lab) study This is a standard lab study. To participate, sign up, and go to the specified location at the chosen time.
Credits	2 Credits
Duration	60 minutes
Description	<p>You are invited to participate in a study testing an iPhone App for undergraduate students. The App is designed to promote resilience by enhancing emotion regulation and cognitive organization skills. Resilience is defined as a characteristic of an individual and their environment that provides the resources necessary for positive development and wellbeing. Eligibility criteria: * Undergraduate student * Have an iPhone * Speak/read fluently in English. Participation will involve: * Downloading and using the App for 4 weeks * Completing questionnaires before, during, and after using the App. For participating, you will: * Receive up to \$90 *Some questionnaires ask about difficult experiences and may be hard for some people to think about. Participants are free to skip questions they do not feel comfortable answering. If participants feel upset during the study, we have information available on relevant supports. This study has 3 parts. A description, the duration, and the associated compensation of each are described below. Part 1 You will receive information on the App including its features and how to use it. You will also be asked to complete some questionnaires. This will take up to 1.5 hours and you will receive 2 bonus points (or \$30) Part 2 You will be asked to use the App at least twice/day for 4 weeks. You will also be asked to return 2 weeks after Part 1 to complete some questionnaires. This will take approximately 10 min/day + 0.5 hours. You will receive \$40 for Part 2 (\$20 for first 2 weeks, \$20 for second 2 weeks). Part 3 You will be asked to return 4-5 weeks after Part 1 to complete some more questionnaires. This will take approximately 0.5 hours and you will receive \$20. In total, the whole study will take you 6.5 hours and you will receive either (a) 2 bonus points and \$60; or (b) \$90. In addition to the description above, some participants will have an opportunity to participate in an interview about their experience using the App. This would occur during Part 3 and would last approximately 30 minutes. Participants would receive an extra \$10 for completing this interview.</p>
Eligibility Requirements	Undergraduate student; own an iPhone; speak/read fluently in English
Researcher	Aislin Mushquash
Principal Investigator	Aislin Mushquash
Deadlines	Sign-Up: 24 hour(s) before the appointment Cancellation: 24 hour(s) before the appointment

Appendix D – Poster

**iPhone App Research Study**

You are invited to participate in a study testing an iPhone App for undergraduate students. The App is designed to promote resilience by enhancing emotion regulation and cognitive organization skills.

Eligibility criteria:

- Undergraduate student
- Have an iPhone
- Speak/read fluently in English

Participation will involve:

- Downloading and using the App for 4 weeks
- Completing questionnaires* before, during, and after using the App

For participating, you will:

- Receive up to \$90

Principal Investigator:
Dr. Aislin Mushquash
Assistant Professor, Department of Psychology
aislin.mushquash@lakeheadu.ca

To sign up, contact
LU.App.Research@gmail.com

*Some questionnaires ask about difficult experiences and may be hard for some people to think about. Participants are free to skip questions they do not feel comfortable answering. If participants feel upset during the study, we have information available on relevant supports.

Appendix E - Demographics

<p>1. Your age: _____ years</p> <p>2. Your biological sex: _____</p> <p>3. Your gender: _____</p> <p>4. Your sexual orientation (choose one):</p> <p><input type="checkbox"/> Exclusively heterosexual</p> <p><input type="checkbox"/> Predominantly heterosexual, only incidentally homosexual</p> <p><input type="checkbox"/> Predominantly heterosexual, but more than incidentally homosexual</p> <p><input type="checkbox"/> Equally heterosexual and homosexual</p> <p><input type="checkbox"/> Predominantly homosexual, but more than incidentally heterosexual</p> <p><input type="checkbox"/> Predominantly homosexual, but only incidentally heterosexual</p> <p><input type="checkbox"/> Exclusively homosexual</p> <p><input type="checkbox"/> I wish to be recognized as _____</p> <p><input type="checkbox"/> Prefer not to say</p> <p>5. Your ethnicity: _____</p> <p>6. Your biological mother's ethnicity: _____</p> <p>7. Your biological father's ethnicity: _____</p> <p>8. Your country of birth: _____</p> <p>9. How long have you lived in Canada? _____ years</p> <p>10. Your year of study in university (e.g., 1st): _____</p> <p>11. Your major in <u>university</u>: _____ Note: "undecided" or "undeclared" may be listed as a Major</p> <p>12. Prior to starting university, where did you live:</p> <p><input type="checkbox"/> Thunder Bay</p> <p><input type="checkbox"/> In Northwestern Ontario but outside of Thunder Bay</p> <p><input type="checkbox"/> In Ontario but outside of Northwestern Ontario</p> <p><input type="checkbox"/> In Canada but outside of Ontario</p> <p><input type="checkbox"/> Outside of Canada</p> <p>13. Where do you live during the school year?</p> <p><input type="checkbox"/> With family</p> <p><input type="checkbox"/> In my own apartment by myself</p> <p><input type="checkbox"/> In an apartment or house with housemates</p> <p><input type="checkbox"/> In residence</p> <p>14. Check the option that best describes your current employment situation:</p> <p><input type="checkbox"/> I work full-time</p> <p><input type="checkbox"/> I work part-time</p> <p><input type="checkbox"/> I am unemployed</p> <p><input type="checkbox"/> other (please specify) _____</p>	<p>15. Check the option that best describes your current educational situation:</p> <p><input type="checkbox"/> I am a part-time student</p> <p><input type="checkbox"/> I am a full-time student</p> <p><input type="checkbox"/> other (please specify) _____</p> <p>16. This question does <i>not</i> ask about your annual <u>personal income</u>. Instead, it asks about your annual <u>family income</u>. In other words, indicate how much money was earned last year in the household where you were raised. Check the option that best describes your annual <u>family income</u> in Canadian dollars (before taxes, deductions, etc.):</p> <p><input type="checkbox"/> \$0.00 - \$19 999</p> <p><input type="checkbox"/> \$20 000 - \$39 999</p> <p><input type="checkbox"/> \$40 000 - \$59 999</p> <p><input type="checkbox"/> \$60 000 - \$79 999</p> <p><input type="checkbox"/> \$80 000 - \$99 999</p> <p><input type="checkbox"/> \$100 000 - \$119 999</p> <p><input type="checkbox"/> \$120 000 - \$139 999</p> <p><input type="checkbox"/> \$140 000 - \$159 999</p> <p><input type="checkbox"/> \$160 000 - \$179 999</p> <p><input type="checkbox"/> \$180 000 - \$199 999</p> <p><input type="checkbox"/> greater than \$200 000</p> <p>17. How many people are supported by your total annual <u>family income</u> (listed in question 16)? _____</p> <p>18. Your current romantic relationship status (check all that apply):</p> <p><input type="checkbox"/> single</p> <p><input type="checkbox"/> dating one person</p> <p><input type="checkbox"/> dating multiple people</p> <p><input type="checkbox"/> separated</p> <p><input type="checkbox"/> married</p> <p><input type="checkbox"/> divorced</p> <p><input type="checkbox"/> cohabiting (i.e., living with your partner)</p> <p><input type="checkbox"/> widowed</p> <p><input type="checkbox"/> other (please specify) _____</p> <p>19. Are you currently receiving treatment from a mental health professional (e.g., social worker, psychologist, counsellor)?</p> <p><input type="checkbox"/> Yes – if yes, for how long _____</p> <p><input type="checkbox"/> No</p>
--	---

Appendix F - SRIS

	Strongly Disagree	1	2	3	4	5	Strongly Agree
I don't often think about my thoughts	1	2	3	4	5	6	
I rarely spend time in self-reflection	1	2	3	4	5	6	
I frequently examine my feelings	1	2	3	4	5	6	
I don't really think about why I behave in the way that I do	1	2	3	4	5	6	
I frequently take time to reflect on my thoughts	1	2	3	4	5	6	
I often think about the way I feel about things	1	2	3	4	5	6	
I am not really interested in analyzing my behavior	1	2	3	4	5	6	
It is important for me to evaluate the things that I do	1	2	3	4	5	6	
I am very interested in examining what I think about	1	2	3	4	5	6	
It is important to me to try to understand what my feelings mean	1	2	3	4	5	6	
I have a definite need to understand the way that my mind works	1	2	3	4	5	6	
It is important to me to be able to understand how my thoughts arise	1	2	3	4	5	6	
I am usually aware of my thoughts	1	2	3	4	5	6	
I'm often confused about the way that I really feel about things	1	2	3	4	5	6	
I usually have a very clear idea about why I've behaved in a certain way	1	2	3	4	5	6	
I'm often aware that I'm having a feeling, but I often don't quite know what it is	1	2	3	4	5	6	

My behavior often puzzles me	1	2	3	4	5	6
Thinking about my thoughts makes me more confused	1	2	3	4	5	6
Often I find it difficult to make sense of the way I feel about things	1	2	3	4	5	6
I usually know why I feel the way I do	1	2	3	4	5	6

Appendix G - RRQ

Instructions:

For each of the statements located on the next two pages, please indicate your level of agreement or disagreement by circling one of the scale categories to the right of each statement. Use the scale as shown below:

Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	
1. My attention is often focused on aspects of myself I wish I'd stop thinking about	1	2	3	4	5
2. I always seem to be "re-hashing" in my mind recent things I've said or done	1	2	3	4	5
3. Sometimes it is hard for me to shut off thoughts about myself	1	2	3	4	5
4. Long after an argument or disagreement is over with, my thoughts keep going back to what happened	1	2	3	4	5
5. I tend to "ruminate" or dwell over things that happen to me for a really long time afterward	1	2	3	4	5
6. I don't waste time re-thinking things that are over and done with	1	2	3	4	5
7. Often I'm playing back over in my mind how I acted in a past situation	1	2	3	4	5
8. I often find myself re-evaluating something I've done	1	2	3	4	5
9. I never ruminate or dwell on myself for very long	1	2	3	4	5
10. It is easy for me to put unwanted thoughts out of my mind	1	2	3	4	5
11. I often reflect on episodes in my life that I should no longer concern myself with	1	2	3	4	5
12. I spend a great deal of time thinking back over my embarrassing or disappointing moments	1	2	3	4	5

13. Philosophical or abstract thinking doesn't appeal to me that much	1	2	3	4	5
<hr/>					
14. I'm not really a meditative type of person	1	2	3	4	5
<hr/>					
15. I love exploring my "inner" self	1	2	3	4	5
<hr/>					
16. My attitudes and feelings about things fascinate me	1	2	3	4	5
<hr/>					
17. I don't really care for introspective or self-reflective thinking	1	2	3	4	5
<hr/>					
18. I love analyzing why I do things	1	2	3	4	5
<hr/>					
19. People often say I'm a "deep", introspective type of person	1	2	3	4	5
<hr/>					
20. I don't care much for self-analysis	1	2	3	4	5
<hr/>					
21. I'm very self-inquisitive by nature	1	2	3	4	5
<hr/>					
22. I love to meditate on the nature and meaning of things	1	2	3	4	5
<hr/>					
23. I often love to look at my life in philosophical ways	1	2	3	4	5
<hr/>					
24. Contemplating myself isn't my idea of fun	1	2	3	4	5
<hr/>					

Appendix H - Journaling Habits

Do you currently keep a journal or diary on a regular basis in which you write about your thoughts and feelings (outside of an agenda book)?

Yes

No

Appendix I - PWB

Please indicate your degree of agreement over the last 2 weeks (using a score ranging from 1 -6) to the following sentences.

	Strongly Disagree						Strongly Agree
1. In general, I feel I am in charge of the situation in which I live.	1	2	3	4	5	6	
2. I am not interested in activities that will expand by horizons.	1	2	3	4	5	6	
3. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6	
4. The demands of everyday life often get me down.	1	2	3	4	5	6	
5. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6	
6. I have a sense of direction a purpose in life	1	2	3	4	5	6	
7. I do not fit very well with the people and the community around.	1	2	3	4	5	6	
8. When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6	
9. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6	
10. I am quite good at managing the many responsibilities of my daily life.	1	2	3	4	5	6	
11. I have a sense that I have developed a lot as a person over time.	1	2	3	4	5	6	
12. I don't have a good sense of what it is I'm trying to accomplish in life.	1	2	3	4	5	6	
13. I often feel overwhelmed by my responsibilities.	1	2	3	4	5	6	
14. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6	
15. I enjoy making plans for the future and working to make them a reality	1	2	3	4	5	6	
16. I have difficulty arranging my life in a way that is satisfying to me.	1	2	3	4	5	6	
17. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6	
18. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6	
19. I have been able to build a home and a lifestyle for myself that is much to my liking.	1	2	3	4	5	6	
20. I gave up trying to make big improvements or changes in my life a long time ago.	1	2	3	4	5	6	
21. I sometimes feel as if I've done all there is to do.	1	2	3	4	5	6	

Appendix J - PANAS-SF

<i>Indicate the extent you have felt this way over the past 2 weeks.</i>	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

Appendix K - ADI

Instructions: Below is a series of statements. Indicate how often they were true of you over the last 2 weeks by circling the number that best describes you.

		Never True	Occasionally True	Mostly True	Always True
1.	Little things or distractions threw me off.	0	1	2	3
2.	I got bored easily.	0	1	2	3
3.	I developed a plan for all my important goals.	0	1	2	3
4.	I stuck to a task until it was finished.	0	1	2	3
5.	I had difficulty remaining seated at school or at home during dinner.	0	1	2	3
6.	I lost sleep because I worried.	0	1	2	3
7.	When I was angry I lost control over my actions.	0	1	2	3
8.	I considered what would happen before I made a plan.	0	1	2	3
9.	I had difficulty keeping attention on tasks.	0	1	2	3
10.	Failure at a task or in school made me work harder.	0	1	2	3
11.	I couldn't seem to stop moving.	0	1	2	3
12.	I put my plans into action.	0	1	2	3
13.	I had trouble controlling my temper.	0	1	2	3
14.	Most of the time I didn't pay attention to what I was doing.	0	1	2	3
15.	I thought about my mistakes to make sure they didn't happen again.	0	1	2	3
16.	I got so frustrated that I often felt like a bomb ready to explode.	0	1	2	3
17.	There were days when I was "on edge" all the time.	0	1	2	3
18.	Once I had a goal I made a plan to reach it.	0	1	2	3
19.	I got into arguments when people disagreed with me.	0	1	2	3
20.	I got very fidgety after a few minutes if I was supposed to sit still.	0	1	2	3
21.	I slammed doors when I was mad.	0	1	2	3
22.	I was easily distracted.	0	1	2	3
23.	My mood went up and down without reason.	0	1	2	3
24.	As soon as I saw things were not working, I did something about it.	0	1	2	3
25.	I easily became emotionally upset when I was tired.	0	1	2	3
26.	I flew off the handle for no good reason.	0	1	2	3
27.	I thought about the future consequences of my actions.	0	1	2	3
28.	I spent money without thinking about it first.	0	1	2	3
29.	I spent time thinking about how to reach my goals.	0	1	2	3
30.	Often I was afraid I would lose control of my feelings	0	1	2	3

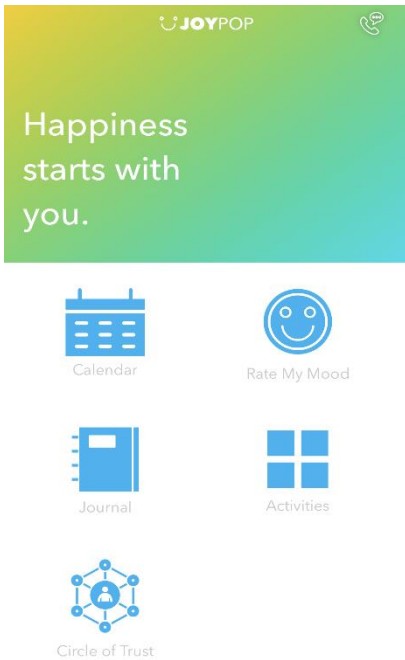
Appendix L - DERS-SF

Please indicate how often the following 18 statements applied to you over the last 2 weeks by choosing the appropriate number from the scale below (1 – 5).

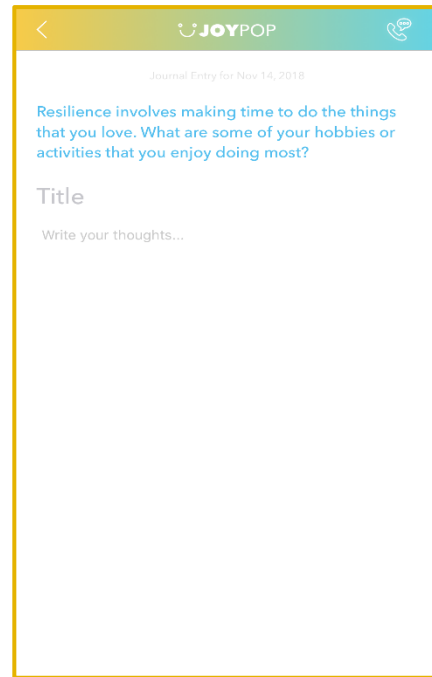
	Almost Never (0-10%)	Sometimes (11-35%)	About half of the time (36-65%)	Most of the time (66-90%)	Almost Always (91-100%)
1. I paid attention to how I feel.	1	2	3	4	5
2. I had no idea how I was feeling.	1	2	3	4	5
3. I had difficulty making sense out of my feelings.	1	2	3	4	5
4. I cared about what I was feeling.	1	2	3	4	5
5. I was confused about how I felt.	1	2	3	4	5
6. When I was upset, I acknowledged my emotions.	1	2	3	4	5
7. When I was upset, I became embarrassed for feeling that way.	1	2	3	4	5
8. When I was upset, I had difficulty getting work done.	1	2	3	4	5
9. When I was upset, I became out of control.	1	2	3	4	5
10. When I was upset, I believed that I would end up feeling very depressed.	1	2	3	4	5
11. When I was upset, I had difficulty focusing on other things.	1	2	3	4	5
12. When I was upset, I felt guilty for feeling that way.	1	2	3	4	5
13. When I was upset, I had difficulty concentrating.	1	2	3	4	5
14. When I was upset, I had difficulty controlling my behavior.	1	2	3	4	5
15. When I was upset, I believed that there was nothing I could have done to make myself feel better.	1	2	3	4	5
16. When I was upset, I became irritated with myself for feeling that way.	1	2	3	4	5
17. When I was upset, I lost control over my behaviours.	1	2	3	4	5
18. When I was upset, it took me a long time to feel better.	1	2	3	4	5

Appendix M - Journal Feature

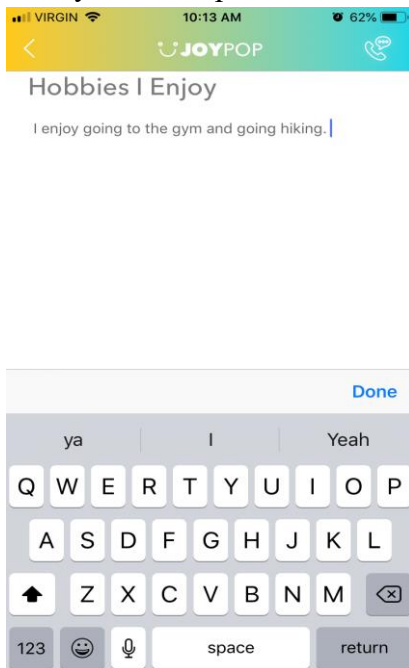
The journal feature is selected from the main menu.



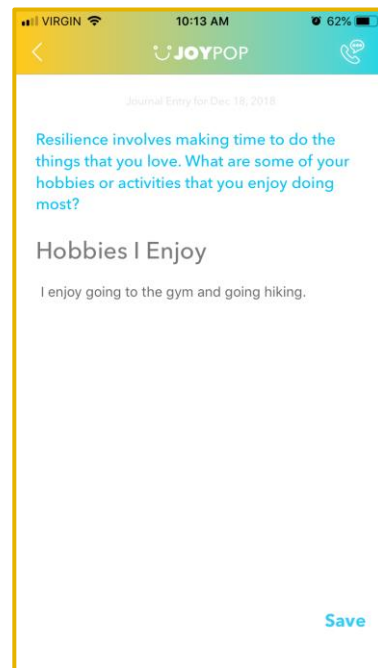
The randomly-generated prompt appears at the top of the screen.



Participants add a title and the body of their entry and then press “Done”.



They can then press “Save” at the bottom of the screen to save their journal to the calendar feature for later viewing.



Appendix N - Journal Prompts

- Did you bring a smile to someone's face today? What happened?
- Did you say something that allowed someone to feel better, or to heal?
- Did you release any anger that you have been holding on to today? How do you feel?
- Practicing gratitude is key to resilience. Reflect on the things that you are grateful for?
- Social support is so important to your mental wellness. Who are the people in your life that support you? How do they help you to thrive?
- Resilience involves being in aware and in-control of your emotions. What are some activities or strategies that you use to stay in check with your emotions and impulses?
- It is said that laughter is the best medicine. What is something that made you laugh this week and lifted your mood?
- Changes are a part of life; but they can also be difficult at times. What are some changes that you are currently experiencing and what are you doing to positively adapt to them?
- Resilience is about learning from your struggles and challenges you have previously faced. What are some challenges that you have turned into positive lessons?
- Seeking help when you are in need of support is not a sign of weakness. In fact, it shows that you are a self-aware individual. Where can you find support when you need it?
- There are so many beautiful reasons to smile everyday. What is something that made you smile today?
- Resilience involves making time to do the things that you love. What are some of your hobbies or activities that you enjoy doing most?
- Self-care is critical to your wellbeing. What are some ways in which you exercise self-care?

- When you are sad, “meh”, or angry, you might not want to talk about it. Doing positive activities can help. What are some activities that you do to help elevate your mood?
- Having dreams and goals are motivators to positive action? What are some of your dreams and goals?
- What is one event that you are looking forward to in the near future?
- Fill in the blank. Today I choose to be _____. Why do you feel this way today?
- What is something that surprised you lately?
- Nature can bring you peace and serenity. What is your favourite outdoor spot? Why?
- What is your most cherished possession? Why is this possession so important to you?
- You should talk to yourself like someone you love. What are some qualities that you love about yourself?
- What is something that you are most proud about this year?
- What is the most beautiful or inspiring thing that you have ever seen?
- What is your favourite memory of all time?
- What is one fear that you have overcome in the past? How did you do so?
- Sometimes people have sayings or mottos that they apply to their lives. What is a saying or motto that is most relevant to your life?
- As we develop, we are constantly changing and becoming more self-aware. What is one thing that you have recently learned about yourself?
- What is something that you would like to learn how to do?

Appendix O - Information Letter



Dr. Aislin Mushquash
 Assistant Professor
 Department of Psychology
 (807) 343-8771
 aislin.mushquash@lakeheadu.ca

Information Letter**Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App**

Dear Potential Participant:

You are invited to participate in our research study titled: *Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App*. Your participation in this study is entirely voluntary, and whether you choose to participate or not will not impact your academic standing at Lakehead University. Before you decide whether or not you would like to take part, please read this letter carefully to understand what is involved. After you have read the letter, please ask any questions you may have.

PURPOSE

The purpose of this research is to test a smartphone App designed to promote resilience in undergraduate students by supporting the development of emotion regulation and cognitive organization skills. Resilience is defined as a characteristic of an individual and their environment that provides the resources necessary for positive development and wellbeing. Intervening early to support resilience may help students reach their true potential and be a buffer against maladjustment.

The Principal Investigator of the research is Dr. Aislin Mushquash, Assistant Professor, Department of Psychology, Lakehead University. Dr. Christine Wekerle, Associate Professor, McMaster University, is a Co-Investigator. Angela MacIsaac, Shakira Mohammed, Elaine Toombs, Kristy Kowatch, and Jessie Lund are graduate student researchers in the Department of Psychology, Lakehead University under the supervision of Dr. Mushquash. Mary Cassano, Elizabeth Grassia, and Kaitlyn Kotala are research assistants under the supervision of Dr. Mushquash. This research is support by funding from the Canadian Institutes of Health Research.

WHAT IS REQUESTED OF ME AS A PARTICIPANT?

This study has 3 parts. A description, the duration, and the associated compensation of each are described below.

	Description	Duration	Compensation (Pre-Paid VISA)
Part 1	You will receive information on the App including its features and how to use it. You will also be asked to complete some questionnaires.	Up to 1.5 hours	\$30 *Or 2 bonus points towards psychology course grade
Part 2	You will be asked to use the App at least twice/day for 4 weeks. You will also be asked to return 2 weeks after Part 1 to complete some questionnaires.	10 min/day + 0.5 hours	\$40 (\$20 for first 2 weeks, \$20 for second 2 weeks)

Part 3	You will be asked to return 4-5 weeks after Part 1 to complete some questionnaires.	0.5 hours	\$20
	Total	6.5 hours	\$90

In addition to description above, some participants will have an opportunity to participate in an interview about their experiences using the App. This would occur during Part 3 and would last approximately 30 minutes. Participants would receive an extra \$10 for completing this interview.

WHAT INFORMATION WILL BE COLLECTED?

We will be collecting information from you during Parts 1, 2, and 3 of the study. Specifically, to determine the impact of the App, the questionnaires during Parts 1, 2, and 3 will ask questions about well-being, resilience, self-compassion, mood/mental health and substance use, emotion regulation, and coping skills. The questionnaires will also ask about difficult experiences you may have had in your life. Some of these questions may be difficult for some people to think about or may cause some temporary distress. You are not required to answer all questions and can feel free to skip questions that you are not comfortable answering. To determine the usability and utility of the App, information will also be collected from you via the App itself. Specifically, we will receive data related to the usage of the App (e.g., which features were accessed, time spent using the App). And finally, information about experiences using the App will be collected from some participants during the interview in Part 3. Interviews will be audio recorded to ensure accurate information is obtained.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

As a participant, you are under no obligation to participate and are free to withdraw at any time without penalty. You have the right to withdraw your data from the study up until the data collection phase of the study is complete. Beyond this point, there will be no way to connect you to your data. Your decision to participate will not affect your academic status. You will be given, in a timely manner throughout the course of the research project, information that is relevant to your decision to continue or withdraw. To withdraw from the study, contact Dr. Mushquash at aislin.mushquash@lakeheadu.ca or (807) 343-8771.

WHAT ARE THE RISKS AND BENEFITS?

There are no known harms associated with participating in the study. However, as mentioned above, some questionnaires will ask about difficult experiences you may have had in your life. Some of these questions may be hard for some people to think about. You are not required to answer all questions and can feel free to skip questions that you are not comfortable answering. Should you feel upset during or after the study, we encourage you to contact any of the following support services:

Lakehead University Student Health and Counselling (807) 343-8361	Thunder Bay Counselling Centre Walk-In Counselling (807) 684-1880	Good2Talk 24-hr Student Helpline 1-866-925-5454	Thunder Bay 24-hr Crisis Response (807) 346-8282
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On the questionnaires, you may also endorse participating in some illegal activity (e.g., underage drinking, drug use). The information that you provide will not be shared with anyone outside of the research team. One exception is the unlikely event that our research records were subpoenaed by a Judge. To mitigate any potential risk of information pertaining to participants' illegal activity being accessed, your name will not be included on the questionnaires. Only a participant ID number will be included. The list linking participant ID numbers to participant names will only be retained for the period of data collection (estimated to be approximately 6-8 months). This list will be kept in a locked filing cabinet in Dr. Mushquash's laboratory. The list will be shredded once the data collection phase of the study is complete.

The primary benefits of the study are for society and for the advancement of knowledge. Specifically, this study will provide information on the utility and usability of the App to support resilience in students transitioning to university.

For participating in the study, you will receive up to \$90. For students in an eligible psychology course, you will receive 2 bonus points towards an eligible psychology course grade + up to \$70. See Table above for more information.

HOW WILL MY CONFIDENTIALITY BE MAINTAINED?

Confidentiality will be maintained throughout the study. You will be provided an ID number at the beginning of the study. All data (questionnaires and the App data) will contain only this ID number. Paper copies of the questionnaires will be kept in a locked filing cabinet and will only be identified by ID number. The list linking your name to your ID number will be kept in a locked filing cabinet in Dr. Mushquash's laboratory. Upon completion of the data collection phase of the study, this list will be destroyed.

WHERE WILL MY DATA BE STORED?

Paper copies of the data will be kept in a locked filing cabinet in Dr. Mushquash's laboratory. App data will be stored on a password-protected server and then a password-protected hard drive. Audio recordings will be stored on a password-protected hard drive. The electronic database (containing data from the paper copies of data and App data) will be stored on a password protected hard drive. In accordance with Lakehead University's policy, data will be retained for at least 5 years following the completion of the research.

HOW CAN I RECEIVE A COPY OF THE RESEARCH RESULTS?

It is anticipated that peer-reviewed journal articles will be published based on the results of this study. Portions of the findings from the study will also likely be presented at national or international scholarly conferences. All findings will be presented in summary form without identifying information of participants. If you would like to receive a summary of the findings following the completion of the study, mark 'yes' on the consent form and indicate your preferred email address. Individual results (e.g., scores on specific questionnaires) will not be made available to participants.

RESEARCHER CONTACT INFORMATION:

Dr. Aislin Mushquash
Assistant Professor
Department of Psychology
Lakehead University
(807) 343-8771
aislin.mushquash@lakeheadu.ca

RESEARCH ETHICS BOARD REVIEW AND APPROVAL:

This research study has been reviewed and approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team, please contact Sue Wright at the Research Ethics Board at (807) 343-8283 or research@lakeheadu.ca.

Appendix P - Consent Form



Dr. Aislin Mushquash
 Assistant Professor
 Department of Psychology
 (807) 343-8771
 aislin.mushquash@lakeheadu.ca

Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App

MY CONSENT:

I agree to the following:

- ✓ I have read and understand the information contained in the Information Letter
- ✓ I agree to participate
- ✓ I understand the risks and benefits to the study
- ✓ That I am a volunteer and can withdraw from the study up until the data collection phase of the study is over, and may choose not to answer any question
- ✓ That if I participate in the interview during Part 3, my interview will be recorded to ensure accurate information is obtained
- ✓ That the data will be securely stored in a locked filing cabinet in Dr. Mushquash's laboratory and/or on a password protected hard drive for a minimum period of 5 years following completion of the research project
- ✓ I understand that the research findings will be made available to me upon request
- ✓ That my name will not be included on my questionnaires but will be linked to my participant ID number until the data collection phase of the study is over
- ✓ All of my questions have been answered and I can contact the Principal Investigator with further questions

By consenting to participate, I have not waived any rights to legal recourse in the event of research-related harm.

Name (Please Print) _____

Signature _____

Date _____

I would like to be sent a summary of the results of this study: Yes ___ No ___

If "yes" please provide your e-mail address:

Appendix Q - Email Reminder to Use App

Good [Morning/Evening],

You are currently enrolled in the study titled: Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App. This is a reminder to log on and use the App at the **start** of your day. Reminder that the App can be used when you:

- Wake up and before you go to sleep
- Want to collect your thoughts, figure out your feelings, or express yourself
- Want to play a game
- Want to connect to your support network

If you have any questions or concerns, please contact the research team at LU.App.Research@gmail.com or the Principal Investigator, Dr. Aislin Mushquash at aislin.mushquash@lakeheadu.ca.

Sincerely,

Resilience App Research Team

Appendix R - Email Reminder for Upcoming Appointment

Subject:

Part 2/3 – Research Reminder

Email Body:

You are currently enrolled in the study titled: Promoting Resilience in Undergraduate Students: Implementation and Evaluation of a Resilience App. This is a reminder that you have an upcoming appointment on [insert date/time/location]. During this appointment, you will be asked to complete some questionnaires and will receive your compensation. If this time no longer works for you, please respond to this email and we can schedule another time. We look forward to seeing you.

If you have any questions or concerns, please contact the research team at LU.App.Research@gmail.com or the Principal Investigator, Dr. Aislin Mushquash at aislin.mushquash@lakeheadu.ca.