PLAN QUALITY AND THE ENHANCEMENT OF
IMPLEMENTATION INTENTION INTERVENTIONS FOR PHYSICAL ACTIVITY

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of the requirements for the
dergade of Doctor of Philosophy

by

Scout M. Kelly

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Dissertation written by

Scout M. Kelly

B.A., University of Puget Sound, 2008

M.A., Kent State University, 2014

Ph.D., Kent State University, 2017

Approved by

John Updegraff, Ph.D. ________________, Chair, Doctoral Dissertation Committee

Judith Gere, Ph.D. ________________, Members, Doctoral Dissertation Committee

John Gunstad, Ph.D. ________________

John Dunlosky, Ph.D. ________________

Jacob Barkley, Ph.D. ________________

Accepted by

Maria Zaragoza, Ph.D. ________________, Chair, Department of Psychological Sciences

James L. Blank, Ph.D. ________________, Dean, College of Arts & Sciences
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CHAPTER I
INTRODUCTION

Physical activity is a vital component of a healthy life, as it offers a number of mental and physical health benefits and helps prevent type 2 diabetes, obesity, cardiovascular disease, and osteoporosis (Haskell et al., 2007; Warburton, Nicol, & Bredin, 2006; Yusuf et al., 2004). The US Department of Health and Human Services (2008) recommends that adults aged 18 to 64 years should engage in 150 minutes per week of moderate-intensity aerobic physical activity, 75 minutes per week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate and vigorous aerobic activity. Many people fail to meet these guidelines for physical activity, and while adherence to these guidelines tends to become worse with advancing age, the trend of declining physical activity appears as early as the transition to emerging adulthood (ages 18-25; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Indeed, approximately 45% of emerging adults fail to meet these national aerobic activity guidelines (Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 2015). Finding ways to help underactive emerging adults increase their physical activity is of vital importance. The proposed study seeks to extend current understanding of the role of plan quality in the effectiveness of planning interventions and to test whether plan quality and subsequent physical activity can be improved though a short online training.

The Intention-Behavior Gap

While a great deal of research has examined the factors that motivate people to intend to change their behavior, the last decade has seen a surge of research activity examining ways to get
people past intention and into action (Gollwitzer & Sheeran, 2006; Schwarzer, 2008; Sniehotta, 2009; Webb & Sheeran, 2006). Perhaps not surprisingly, people’s behaviors are not always congruent with their intentions for healthy behaviors. Indeed, anyone who has tried to change a health behavior has likely struggled to do all the things they mean to do—from going on a run after a long day of work to saying no to a coworker’s homemade cookies. These anecdotal experiences are also corroborated by research; a meta-analysis of the relationship between intentions and behaviors found that medium-to-large increases in intentions only lead to small-to-medium increases in actual behavior (Webb & Sheeran, 2006). This difference in what people intend to do and what they actually do has been termed the intention-behavior gap.

Understanding the intention-behavior gap and how to improve people’s efforts to control or self-regulate their health behaviors is now a primary focus within health psychology research (Mann, de Ridder, & Fujita, 2013).

One main obstacle to improving people’s efforts to self-regulate is that when people attempt to consciously exert self-control (e.g., resisting temptation), they become more likely to fail at exerting self-control at a later time (Baumeister & Heatherton, 1996; Baumeister, Vohs, & Tice, 2007; Inzlicht & Schmeichel, 2012). While early research suggested that self-control was a limited resource that requires time to replenish (Baumeister et al., 2007), recent research argues that shifts in motivation and attention occur during the exertion of self-control which reduce likelihood of later self-control success (Inzlicht & Schmeichel, 2012). Specifically, people appear to become less motivated to exert control and more motivated to act impulsively, while at the same time becoming less attentive to cues which support control and more attentive to cues associated with immediate reward (Inzlicht & Schmeichel, 2012). For example, a man may intend to go to the gym at 5 PM, but after a long day of exerting self-control at work, his
motivation to control his behavior is reduced, and he may be more attentive to reward cues, like the memory of how comfortable his couch is. When the idea to skip the gym enters his mind, he fails to stick to his original intention due to these shifts in motivation and attention. One method to overcome this issue is to build more automaticity or habit into self-regulation, as habits require far less effortful self-control (Webb & Sheeran, 2003). Unfortunately, many people who should increase their physical activity do not have the right kind of habits; their habits perpetuate unhealthy behaviors, like long bouts of sedentary activity. These poor health habits need to be replaced with new goal-congruent habits. How can new behaviors become habitual, or at least be made more automatic and less effortful? A specific type of plan called implementation intentions (IIs) offers a time- and cost-efficient way to theoretically hasten the formation of new goal-congruent habits (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006).

**Implementation Intentions**

Implementation intentions are specific plans for behavior which specify both a cue for action and a goal-directed response (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). These are distinct from more general goal intentions, which are simply statements of desired goal states (e.g., “I want to run a 10k by next March”). Implementation intentions specify detailed plans for pursuing a goal intention; for physical activity, this would typically include when, where and how a person plans to be active (Gollwitzer, 1999). By specifying the details for carrying out the behaviors that will lead to goal progress, IIs allow individuals to prospectively envision good opportunities for action and then recognize those opportunities as they appear in daily life (Achtziger, Bayer, & Gollwitzer, 2012). Additionally, IIs can be formed to help individuals overcome anticipated barriers (Gollwitzer, Wieber, Myers, & McCrea, 2010; Sniehotta, Scholz, & Schwarzer, 2006), by forming a specific plan for what to do if a barrier arises (e.g., “If I do not
have the time to go to the gym, then I will do a short home exercise video”). This may be particularly important for complex health behaviors like physical activity, in which plans can be derailed by any number of perceived barriers.

Implementation intentions have been found to be useful in improving goal progress across a wide range of domains, including health behaviors like physical activity (Bélanger-Gravel, Godin, & Amireault, 2013), healthy eating (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011), and cancer screening (Sheeran & Orbell, 2000), among others (Gollwitzer & Sheeran, 2006). In a meta-analysis of 94 independent tests of implementation intentions across many domains (e.g., health, personal, academic), IIIs had a positive and medium-to-large effect ($d = .65$) on people’s goal progress (Gollwitzer & Sheeran, 2006). Since the publication of Gollwitzer and Sheeran’s (2006) meta-analysis, hundreds of studies on the effects of IIIs have been conducted. Two recent meta-analyses examined the effectiveness of IIIs within specific health domains: dietary behavior (Adriaanse et al., 2011) and physical activity (Bélanger-Gravel, Godin, & Amireault, 2013). While both of these meta-analyses indicate the overall effect of IIIs is positive, the results come with a few caveats. In the meta-analysis of dietary behavior (Adriaanse et al., 2011), it was found that IIIs were more effective at promoting healthy dietary behaviors (e.g., increase fruit and vegetable intake), but less effective at preventing unhealthy dietary behaviors (e.g., reducing consumption of fatty foods). These disparate findings point to the sensitivity of IIIs to context—IIIs may be more effective for some behavioral contexts than others. While it has not been tested empirically, if this pattern held true for physical activity, it would suggest that IIIs to increase bouts of physical activity should be more effective than trying to decrease sedentary time. Overall, the meta-analysis of physical activity (Bélanger-Gravel, Godin, & Amireault, 2013) indicated lower overall effectiveness of IIIs than was found in Gollwitzer and
Sheeran’s meta-analysis (2006); Bélanger-Gravel and colleagues found the average size of the effect to be small-to-medium (d = .31 post-intervention, d = .24 follow-up; Bélanger-Gravel, Godin, & Amireault, 2013) rather than the medium-to-large effect found by Gollwitzer and Sheeran (d = .65; 2006). Thus, it appears that IIs may not be equally effective for all people or all behaviors.

**Moderators of Implementation Intentions**

Why do these disparities exist? In addition to differences caused by study characteristics and the possibility that IIs work better for some behaviors than others, another possible factor is that IIs are more effective for some people than for others. Indeed, many researchers have found that the effects of IIs are at least partially dependent on individual difference factors (for review, see Prestwich & Kellar, 2014). Given the breadth of moderators that have been studied, it is useful to create a framework for understanding these effects. Broadly, the individual difference factors that have been studied can fit within three categories: motivational differences, cognitive/executive functioning differences, and personality-based differences.

Within the realm of motivational moderators of IIs, the most widely studied variable has been that of goal intention strength (Prestwich & Kellar, 2014). Goal intention strength reflects an individual’s commitment to the target goal, and a large number of studies have found that intention strength moderates the effect of IIs on behavior. Specifically, these studies indicate that IIs are particularly beneficial or exclusively beneficial for those with strong goal intentions (Elliott & Armitage, 2006; Hall, Zehr, Ng, & Zanna, 2012; Sheeran, Webb, & Gollwitzer, 2005; van Osch, Reubsaet, Lechner, & de Vries, 2008). However, just as many studies have failed to find interactive effects of intention strength and IIs—rather, they show that IIs work equally well for those with high and low intention (Adriaanse et al., 2010; Bélanger-Gravel, Godin, Bilodeau,
& Poirier, 2013; de Nooijer, de Vet, Brug, & de Vries, 2006; Skår, Sniehotta, Molloy, Prestwich, & Araújo-Soares, 2011; Verplanken & Faes, 1999). A number of factors could be responsible for the discrepancy in findings around this moderator. First, different samples may yield floor or ceiling effects for goal intention strength; a self-selected intervention sample may exhibit very high goal intentions, whereas participants given a goal to adopt by the researcher may demonstrate weak goal intentions. Neither scenario is conducive to detecting interaction effects, given that the range of intentions is limited. Second, the relative effect of intentions on IIs could be itself dependent on the target behavior. As discussed above, the effects of IIs for improving diet were consistently stronger effects for healthy behaviors (e.g., fruit and vegetable intake) than for unhealthy behaviors (e.g., high-fat high-sugar snacks; Adriaanse et al., 2011). While not explicitly reviewed in the study, studies that measure both types of eating behaviors show that people report significantly stronger goal intentions for increasing fruit and vegetable intake than for decreasing snack food intake (e.g., van Osch et al., 2009), suggesting that stronger goal intentions may be important for II effectiveness, but may not be captured in a single study examining a single behavior.

Other motivational moderators of II effectiveness include self-efficacy, spontaneous action and coping planning, and self-concordance of the target goal. Self-efficacy, or confidence in one’s ability to perform a behavior, has received similarly mixed support, with some research indicating that planning interventions like IIs increase behavior only in those with higher levels of self-efficacy (Luszczynska et al., 2010; Luszczynska, Schwarzer, Lippke, & Mazurkiewicz, 2011), but other research finding no such moderating effect (Bélanger-Gravel, Godin, Bilodeau, et al., 2013). Action planning and coping planning reflect the degree to which an individual has spontaneously made plans to engage in a behavior and deal with potential barriers to the
behavior, respectively (Schwarzer, 2008). One study examined the role of these baseline indicators and found that IIs worked exclusively for those with low initial action or coping plans; essentially, those with high initial action and coping plans had little need for additional IIs (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012). Finally, the degree to which a goal is self-concordant, or motivated by personal values and interests rather than external or internal pressures (Mullan, Markland, & Inglede, 1997; Sheldon & Elliot, 1998), may play a role in the effect of IIs. Current research offers contradictory findings in this domain; some studies have found that IIs are more effective for non-concordant goals (Chatzisarantis, Hagger, & Thøgersen-Ntoumani, 2008), while others have found that they are more effective for concordant goals (Koestner, Lekes, Powers, & Chicoine, 2002). In summary, research on motivational moderators is largely inconclusive and suggests that additional study across varied domains of behavior would be beneficial for improving our understanding of the interplay of these factors with IIs.

Another category of moderator that has been examined in the context of IIs is the role of cognitive/executive functioning. Initial research on the role of executive and cognitive functioning came from comparison of the effects of IIs in healthy controls compared to individuals with known deficits in executive functioning, such as among those with frontal brain lesions (Lengfelder & Gollwitzer, 2001). A number of studies since then have examined the role of individual differences in executive functioning among healthy adults on II effectiveness (Allan, Sniehotta, & Johnston, 2013; Brom et al., 2013; Hall et al., 2012; Hall, Zehr, Paulitzki, & Rhodes, 2014). For the most part, these studies tend to indicate that IIs work particularly well for people with deficits in some aspect of executive or cognitive functioning, like inhibitory control (Hall et al., 2012), planning ability (Allan et al., 2013; Lengfelder & Gollwitzer, 2001), or fluid intelligence (Brom et al., 2013). In contrast, to the author’s knowledge, only one study has found
that IIs work exclusively for those with high executive functioning (Hall et al., 2014). Thus, it appears that the weight of evidence supports the value of IIs for supporting goal progress among those with low executive or cognitive functioning—arguably, those who need it the most.

The last category of moderators corresponds to individual differences in personality which influence the effectiveness of IIs. The two personality factors that have been examined most frequently in relation to IIs are impulsivity and conscientiousness. The evidence for the role of these personality factors is mixed. While some studies have shown that IIs improve performance only for those with low levels of urgency (a sub-scale of impulsivity; Churchill & Jessop, 2010, 2011), another indicates that performance is improved by IIs only for those with high urgency after negative affect is evoked (Burkard, Rochat, & Van der Linden, 2013).

Regarding conscientiousness, some have found that IIs improve goal progress only for those with low levels of conscientiousness (Webb, Christian, & Armitage, 2007), while other studies have failed to find any moderating effects of conscientiousness (Ajzen, Czasch, & Flood, 2009; Walsh, da Fonseca, & Banta, 2005).

Given the mixed results of all three categories of individual difference moderators, additional tests of these moderators within specific domains of behavior is warranted. However, what simple tests of moderators cannot reveal are the reasons why these individual differences bear upon the outcome of II interventions. If light can be shed on the underlying processes that contribute to IIs having different effects for different people, solutions can be created to make IIs more widely effective.

**Plan Quality and Implementation Intention Effectiveness**

Plan quality may be a particularly important factor in the differential effects of IIs. Plan quality reflects the degree to which a plan is both instrumental (i.e., will lead to goal progress) as
well as specific (i.e., detailing when, where, and how behavior will be performed). Studies indicate that plan specificity is variable; a study of IIs for condom use found that less than 18% of participants formed fully specified plans (i.e., including what to do, where to do it, and when to do it) when the behavioral prompt was broad and encompassed using condoms in general (de Vet, Gebhardt, et al., 2011). When the target behavior was narrower (i.e., preparatory behaviors like carrying condoms, talking to partner about condoms), the percentage of plans that were fully specified was greater (27 - 75%; de Vet, Gebhardt, et al., 2011). Similarly, in a study evaluating the role of plan specificity for physical activity, 30% of participants failed to fully specify any of their plans (de Vet, Oenema, & Brug, 2011).

In addition to simply being variable across individuals, there is evidence to suggest that plan quality plays a role in how effectively IIs promote goal progress. Highly specific plans are associated with higher levels of goal progress in the behaviors of physical activity (de Vet, Oenema, et al., 2011; Evers, Klusmann, Ziegelmann, Schwarzer, & Heuser, 2012; Ziegelmann, Lippke, & Schwarzer, 2006), smoking cessation (Elfeddali, Bolman, & de Vries, 2013; van Osch, Lechner, Reubsaet, & De Vries, 2010), sexual health (Vet, de Wit, & Das, 2013), and doctor-patient communication (Verbiest et al., 2014). For example, in the domain of physical activity, forming a higher quantity of fully specified IIs (i.e., including activity, day, moment, location, duration) predicted greater activity at follow-up; that is, forming additional IIs was only beneficial if they were fully specified (de Vet, Oenema, et al., 2011). Thus, plan quality appears to play an important role in the relative effectiveness of IIs, and as such, might help explain why some individuals are more successful than others following II interventions.

Plan quality is likely affected by many of the individual difference factors discussed above. Motivational differences may affect individuals’ engagement with the planning activity;
for example, individuals with weak intentions to change behavior will likely form lower quality plans than those with strong goal intentions. Indeed, in a study of IIs for promoting hepatitis B vaccination, men with stronger goal intentions tended to form more complete IIs than men with weaker intentions (Vet et al., 2013). Similar effects for self-efficacy and self-concordance could be expected, given that low levels of these may lead to non-instrumental or non-specific plans, findings which would be in line with models like the Health Action Process Approach, which propose task self-efficacy and other motivational factors as antecedents of intentions and plans (Schwarzer, 2008). Plan quality and its effect on subsequent physical activity likely is also affected by executive functions; working memory and inhibitory control offer the most intuitive theoretical effects. Working memory may affect plan quality through the allocation of attention to the task of planning and to relevant information for generating high quality plans (Hofmann, Friese, Schmeichel, & Baddeley, 2011; Hofmann, Schmeichel, & Baddeley, 2012), such as appropriate cues for action, effective responses, and relevant barriers to anticipate. Inhibitory control refers to the ability to override a dominant or habitual response (Miyake et al., 2000), and thus would likely affect ones’ put a plan for activity into action when the opportunity arose.

Can plan quality be improved? Research suggests that this is the case, as those who form IIs with the assistance of an experimenter form higher quality plans than those who form them alone (Evers et al., 2012; Ziegelmann et al., 2006). However, the resources associated with experimenter-assisted plan formation are costly, so devising ways to help individuals improve their IIs without assistance is vital to the widespread use of II interventions. A short online training module would be a time- and cost-effective way of improving IIs, but no such intervention exists.
Ostensibly, the primary benefit of forming plans in the presence of a researcher is that the researcher can provide feedback on the participant’s plans; thus, an online training module should seek to include a similar feature. However, for an online module to be able to provide feedback on open-ended IIs, it would have to be enormously complex. A simple workaround is to train the skills of critiquing and enhancing plan quality (i.e., instrumentality and specificity) in a different domain, providing feedback, and then providing the chance for individuals to revisit and revise their initial plans. Prior to revisiting one’s own plans, a practice test embedded in the training module would allow individuals to practice applying the planning skills they learned in one behavioral domain to a new domain and to receive feedback on their practice test choices. Practice testing has been shown to be a powerful learning tool across various learning materials and test formats (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Thus, a short online training module could prepare individuals to critique and improve upon their own plans by learning to do so with others’ plans in different behavioral domains.

**The Present Study**

The current study had three primary aims. First, it assessed whether adding a short online training module (II+T) to a traditional II activity produces greater increases in physical activity than an II intervention alone or an information-only control. Second, it tested whether the effects of II and II+T interventions are moderated by motivational, personality-based, and cognitive/executive moderators. Third, it investigated whether the benefit of II+T over and above the traditional II intervention is explained by differences in plan quality.

The following hypotheses were investigated:
Aim 1: Assessing main effect of the intervention

A. Controlling for baseline physical activity, I hypothesized that those who completed the II+T or II activities would have higher levels of physical activity at follow-up than those who received the information-only control activity.

B. Controlling for baseline physical activity, I hypothesized that those who completed the II+T activity would have higher levels of physical activity at follow-up than those who received the traditional II activity.

C. I hypothesized that the effect of the interventions would pertain only to increased moderate and vigorous activity, and not to decreased sedentary time, given that the II activities were intended to promote bouts of intentional moderate and vigorous activity.

Aim 2: Assessing moderation: are the effects of the interventions dependent on individual difference factors?

A. Based on previous research and theory, I hypothesized that II+T would be more effective than II for those with strong goal intentions but not for those with weak goal intentions. Despite somewhat mixed results regarding intentions as moderators in single studies, studies that are able to detect interactive effects find that IIs are more effective for those with strong intentions (e.g., Elliott & Armitage, 2006; van Osch et al., 2008). Promoting increased plan specificity among those who are highly motivated to increase their physical activity should produce the strongest effects. In contrast, no such difference is expected among those with weak goal intentions; adding specificity to plans that are weakly motivated likely won’t produce greater physical activity.
B. Based on previous research and theory, I predicted that II+T would be more effective than II among those with low levels of baseline spontaneous action and coping planning for physical activity. Spontaneous action and coping planning reflect the degree to which an individual is already making specific plans about how, when, and where to be active and how to overcome barriers to being active. Thus, those whose levels of planning are low likely have less experience forming plans for activity and would benefit most from training. In contrast, those whose planning levels are already high likely will not benefit greatly from either the II or II+T interventions (Guillaumie et al., 2012).

C. I hypothesized that executive/cognitive functions would moderate the effects of both traditional II and II+T interventions, with II+T having the largest effect for those with low executive/cognitive functioning (i.e., inhibitory control, working memory, task-switching ability), based on previous research that suggests those with low cognitive/executive abilities have the most to gain from II interventions (e.g., Allan et al., 2013; Brom et al., 2013; Hall et al., 2012), and that training in creating high quality plans should increase the effect of the intervention. In contrast, no difference is predicted between the II and II+T groups for those with high executive functions, as research suggests high functioning individuals are more likely to self-regulate naturally, leaving little room for improvement via training interventions (Allan et al., 2013; Brom et al., 2013).

D. Because studies of other motivational (i.e., intention, self-efficacy, and self-concordance) and personality moderators (i.e., urgency and conscientiousness) have
yielded such inconclusive results, moderation analyses for these variables were exploratory.

**Aim 3: Assessing mediation: does plan quality account for the differences in effectiveness between II and II+T interventions?**

A. I predicted that those in the II+T intervention would form higher quality IIs compared to those who receive the II intervention.

B. I predicted that the differences in physical activity at follow-up between the II and II+T groups (Hypothesis 1) would be mediated by plan quality.
CHAPTER II

METHOD

Participants

Two hundred seven undergraduate students were screened for eligibility in the study (see Figure 1 for CONSORT diagram). Eligibility for the study included interest in increasing their physical activity levels (i.e., respond “yes” to the question, “Do you want to increase your physical activity?”) and non-student-athlete status. One participant was excluded from the study for not meeting eligibility criteria. The analyzed sample included 197 participants. Participant demographics across conditions are presented in Table 1.

Of the 206 eligible participants, 63 comprised a sub-sample that wore an activity monitor to provide objective physical activity data (see Figure 2 for CONSORT diagram). The analyzed self-report sample consisted of 23 participants. The sub-sample was intended to test corroboration of the primary self-report analyses with an objective measure of physical activity; a subsample was used because the cost of activity monitors prohibited their use in the full sample. The procedure for the activity monitor sample is described separately, as the use of activity monitors necessitated multiple visits to the laboratory.
Table 1

Participant Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (N = 197)</th>
<th>Information-Only (n = 56)</th>
<th>Traditional II (n = 68)</th>
<th>II + Training (n = 73)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Range</td>
<td>M</td>
</tr>
<tr>
<td>Baseline MVPA</td>
<td>51.84</td>
<td>55.18</td>
<td>0 - 266</td>
<td>46.39</td>
</tr>
<tr>
<td>Age</td>
<td>19.89</td>
<td>2.44</td>
<td>15 – 34</td>
<td>20.02</td>
</tr>
<tr>
<td>BMI</td>
<td>24.43</td>
<td>4.57</td>
<td>16 - 50</td>
<td>25.50</td>
</tr>
<tr>
<td>Historical PA</td>
<td>8.48</td>
<td>10.67</td>
<td>0 – 75</td>
<td>9.82</td>
</tr>
<tr>
<td>Resting HR</td>
<td>81.22</td>
<td>11.22</td>
<td>52 – 113</td>
<td>81.34</td>
</tr>
<tr>
<td>GPA</td>
<td>3.23</td>
<td>.76</td>
<td>0 – 4.3</td>
<td>3.14</td>
</tr>
<tr>
<td>ACT Score(^a)</td>
<td>23.53</td>
<td>3.61</td>
<td>16 – 35</td>
<td>22.73</td>
</tr>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Gender - Female</td>
<td>141</td>
<td>71.6</td>
<td>38</td>
<td>67.9</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
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<td></td>
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<td>6</td>
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\(^a\) ACT scores were used rather than SAT, given the small percentage of participants who reported SAT scores
Figure 1. CONSORT diagram for Self-Report Sample
Figure 2. CONSORT diagram for Activity Monitor Sub-Sample
Procedure

Self-Report Only Sample

Participants signed up for the study through Kent State’s Psychology Sona System. The study took place in three parts: an initial lab session and two online follow-ups which were emailed to participants one and two weeks after the lab session. During the lab session, participants used an online survey to provide informed consent and complete measures on their physical activity, motivational and attitudinal measures, personality questionnaires, and demographics. Participants were fitted with a blood pressure cuff prior to starting the questionnaires, and as they completed the questionnaires, blood pressure and heart rate were assessed every 2.5 minutes until 5 readings had been completed. Upon completing the questionnaires, participants were guided through the computer-based executive/cognitive functioning tasks through a combination of experimenter instruction and on-screen directions. After completing these tasks, participants were randomly assigned by the online survey to one of the three experimental conditions and received the corresponding manipulation (II, II+T, or information-only control) via the online survey. Following the manipulation, all participants were reminded that they would receive emails in one and two weeks with links to the follow-up surveys, and the lab session was concluded.

One and two weeks after the lab session, participants received a link to an online follow-up survey via email which they were able to complete from any computer with an internet connection. The first of the two follow-up surveys re-assessed physical activity, intentions, and plans for activity. The final survey re-assessed physical activity and motivational factors, included exploratory measures, and debriefed participants on the purpose of the study. While two weeks is a relatively short time span for a physical activity follow-up, it is not without precedent.
Other studies on the effects of IIs on physical activity have used two weeks as a follow-up period (e.g., Conner, Sandberg, & Norman, 2010; de Vet, Oenema, et al., 2011; Milne, Orbell, & Sheeran, 2002)(e.g., Conner, Sandberg, & Norman, 2010; de Vet, Oenema, et al., 2011; Milne, Orbell, & Sheeran, 2002) and research demonstrates that long-term effects of II interventions are detectable even at a one-week follow-up (Stadler, Oettingen, & Gollwitzer, 2009) and persist without substantial loss to effect size for much longer periods (i.e., 3 - 11 months; Bélanger-Gravel, Godin, & Amireault, 2013).

**Self-Report Plus Activity Monitor Sample**

Participants in the self-report plus activity monitor sub-sample followed a slightly different procedure, as they needed to visit the lab three times: an initial session to receive instruction on how to use the activity monitor and begin baseline physical activity data collection, the lab session (which followed the same procedure indicated above), one online follow-up identical to the first follow-up survey for the Self-Report Only sample, and a final follow-up lab session two weeks later to return the device and complete the online follow-up survey. Activity monitor participants signed up for the study through Kent State’s Psychology Sona System, and scheduled 3 lab sessions one and two weeks apart, respectively. At the first lab session (Time 0), participants received an activity monitor and were instructed on how to use it (i.e., placement on body, when they should put it on and take it off, etc.), and were given a log to track the days and times that they wore the device to corroborate wear time generated algorithmically by the devices. I randomly assigned participant ID numbers to the three conditions in an Excel file using block randomization for each cohort of 15 participants so as to achieve a final condition distribution of 25 participants in each II condition and 10 in the information-only control. At the second lab session (Time 1), participants turned in their log and
received a new one, and followed the same lab procedure as the Self-Report Only sample. One week after the lab session, participants received a link to an online follow-up survey via email, identical to the Self-Report Only sample. Two weeks later, at the third lab session, participants returned the activity monitors and logs, and completed the same online questionnaire sent to the Self-Report Only sample.

Measures

Baseline Lab Session (Time 1) Measures (See Appendix A)

Self-reported physical activity. The International Physical Activity Questionnaire (IPAQ) Short Last 7 Days Self-Administered Format is a 4-question measure that assesses vigorous activity, moderate activity, walking, and sitting over the last 7 days (Craig et al., 2003). Participants reported the number of days per week and the average minutes per day that they did each type of activity. For moderate and vigorous physical activity, days and minutes were multiplied to estimate total minutes per week of each activity type, and minutes of each were added together to generate total minutes per week spent in MVPA. That number was then divided by 7 to reflect average minutes per day, which could be more readily compared to the objective MVPA score described below. The test-retest reliability is satisfactory (Spearman’s $\rho = .71 - .89$) and criterion validity against activity monitors is comparable to other self-report measures (Dinger, Behrens, & Han, 2006). Physical activity was also self-reported at both follow-ups (Time 2 and 3).

Objective physical activity. Daily light, moderate, and vigorous physical activity as well as sedentary time were measured objectively with the tri-axial ActiGraph wGT3x-BT activity monitor (ActiGraph, Pensacola, Florida, USA). Sixty-three participants wore an ActiGraph monitor in addition to reporting physical activity with the IPAQ. Participants received activity
monitors at an initial baseline session one week prior to the first lab session were asked to wear the ActiGraph during all their waking hours, except during water-based activities, for 21 consecutive days until the end of the study. Participants received credit for wearing the device each week if they wore the device for at least 3 weekdays and 1 weekend day, for at least 10 hours per day. Additionally, participants received one raffle entry for every day that they wore the device, with the possibility of earning up to 21 raffle entries. At the end of each semester, a raffle entry was randomly selected from all entries throughout the semester, and the winning participant received a $100 Visa gift card.

Participants wore the monitor around the waist above the right hip with an elastic belt. The raw data was collected at 30Hz (30 samples per second), and the data were aggregated into 10-second epochs to be scored by the ActiGraph algorithms. Wear time validation was assessed using ActiLife’s Choi (2011) wear time algorithm (Choi, Liu, Matthews, & Buchowski, 2011). The algorithm classifies non-wear times using counts on the vertical axis, with a minimum length for non-wear time of 90 minutes, a small window length of 30 minutes, and a spike tolerance of 2 minutes to account for artifactual movement. In addition to this algorithm, minimum wear time (600 minutes per day) and wear day (3 weekdays and 1 weekend day) requirements were set to limit the data to those who had worn the device for the minimum number of valid days each week. For participants with more than 3 weekdays and 1 weekend day of valid wear time at any given time point, 3 weekdays and 1 weekend day were selected at random to serve as the representative wear days for that participant, thus equalizing wear time across participants.

Three metrics were calculated for each participant at each time point with valid wear time. The first metric, time in MVPA, was generated using the Freedson Adult VM3 cut points.
for moderate and vigorous activity (Sasaki, John, & Freedson, 2011). This was then divided by 4 (the total number of days analyzed per time point per person) to reflect average MVPA per day. This was done to make comparisons between subjective and objective PA more clear. Second, amount of time spent in bouts of MVPA lasting 10 minutes or more was calculated using the Freedson (1998) algorithm (Freedson, Melanson, & Sirard, 1998). This was calculated to examine correspondence with self-report if the correlations between subjective and objective MVPA per day were low. Finally, total length of sedentary bouts per person per time period was calculated using ActiLife’s Sedentary Analysis. This was calculated so as to provide a discriminant measure of the effects of plans on physical activity; that is, plans were hypothesized to increase MVPA, but not hypothesized to decrease sedentary time.

**Intentions.** Intentions were measured in two ways. First, a five-item scale assessed the strength of participants’ intentions for being physically active (e.g., “I intend to increase my leisure time activity”), adapted from a questionnaire developed by Sniehotta, Schwarzer, Scholz, and Schuz (2005). Each item used a seven-point Likert scale from “strongly disagree” to “strongly agree.” Internal consistency with all 5 items (α = .64) did not meet the threshold of .70, and thus interitem covariances were assessed for inconsistent items. The item “Over the next two weeks, I intend to increase my leisure time activity” demonstrated poor covariance with the other items (r’s: 0.03 - .04), and thus was removed from the scale. The reliability among the remaining four items comprising the scale was good (α = .80).

Second, intended amount of activity was measured using the same language as the IPAQ for moderate and vigorous activity with the exception of the frame of reference, which was changed to refer to the “next 7 days” rather than the “past 7 days.” This framework has been used and validated in past studies examining intention–behavior moderators for physical activity
(Hall, Fong, Epp, & Elias, 2008; Hall et al., 2012). Importantly, it allows for direct comparison of intentions and actual behavior, and the ability to quantify the intention-behavior gap. Intention items were also measured at both follow-ups (Time 2 and 3).

**Resting heart rate.** In order to assess objective baseline fitness, we used a blood pressure/heart rate monitor cuff to assess resting heart rate. Blood pressure and heart rate were assessed every 2.5 minutes using an Accutor Plus Oscillometric blood pressure device (Datascope Corp, Mahwah, NH). The experimenter placed the cuff around the upper arm of the participant, and the machine automatically took measurements as the participant filled out questionnaires (this was to provide an opportunity for levels to stabilize and to reduce the influence of reactivity to the cuff). The experimenter notated the data for systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate each cycle until 5 measurements were collected. Participants were not shown their data, and no interpretation of the numbers was made by the experimenter to the participant. The data for the first two readings was dropped and the average of the last 3 measurements was used as a measure of baseline objective fitness.

**Historical Physical Activity.** Historical physical activity was assessed in three ways: first, participants were asked to report the number of sports teams that they played on during high school (0 teams, 1 team, 2 teams, or 3+ teams). Second, participants reported on their past year physical activity as well as their physical activity during their last two years of high school using modified versions of a Lifetime Physical Activity Questionnaire (Chasan-Taber et al., 2002; Kriska et al., 1990). In the Past Year Physical Activity measure, participants saw a list of 26 physical activities (plus the option of “other” activity) and for each, estimated the number of months in the past year they had engaged in the activity, and the average number of hours per
week they had engaged in the activity during months in which the activity occurred. To get an overall Past Year score, for each activity, months were multiplied by hours times 4 (4 weeks per month), and then divided by 52 to obtain an estimate of hours per week, and then hours per week of each activity was summed. In the High School Physical Activity measure, participants saw the same list of activities, but were asked to estimate their activity during the last two years of high school (i.e., Junior and Senior years). Thus, for each activity, participants first reported the number of years (0-2) that they engaged in each activity, and then the number of months and average hours per week, as in the Past Year Physical Activity Measure. To get an overall High School Physical Activity score, for each activity, years were multiplied by months times hours times 4 (4 weeks per month), and then divided by 52 to obtain an estimate of hours per week, and then hours per week of each activity was summed. Following protocol of prior studies, for both Past Year and High School Activity, these summary scores were calculated without walking, due to the fact that walking estimates have been found to be unreliable (Kriska et al., 1990).

**Self-efficacy.** Self-efficacy was measured with two scales for assessing task/action self-efficacy and maintenance self-efficacy. Task/action self-efficacy was measured with a 4-item scale based on the Health Action Process Approach (Schwarzer, 2008) which assesses individuals’ confidence in becoming physically active (e.g., “I can be physically active at least 3 times a week for 30 minutes;” Sniehotta, Scholz, & Schwarzer, 2005). One item was added to the original scale to assess confidence in being able to meet national physical activity guidelines. Maintenance Self-Efficacy was similarly measured with a scale informed by the Health Action Process Approach (Sniehotta, Scholz, et al., 2005). This is an 11-item scale which assesses how much confidence a person has in her ability to maintain physical activity despite barriers (e.g., “I
am sure I can be physically active on a regular basis even if I don’t see success at once”). Items on both measures were modified to be measured on a 7-point Likert scale, ranging from “not at all confident” to “completely confident.” Both task self-efficacy ($\alpha = .82$) and maintenance self-efficacy ($\alpha = .91$) demonstrated good internal consistency. Self-efficacy was also measured at both follow-ups (Time 2 and 3).

**Spontaneous action and coping planning.** Action planning and coping planning were assessed using a developed measure (Sniehotta, Schwarzer, et al., 2005) to determine individuals’ plans for both initiating physical activity (action planning) and maintaining physical activity despite setbacks (coping planning). The scale contains 9 items, 4 which measure action planning (e.g., “I have made a detailed plan regarding when to exercise”) and 6 which measure coping planning (e.g., “I have made a detailed plan regarding what to do if something interferes with my plans”). All items are rated on a 7-point Likert scale, from “completely disagree” to “totally agree.” Prior research indicates these scales demonstrate excellent internal consistency ($\alpha = .92 - .95$ for action planning, $\alpha = .90 - .91$ for coping planning), and the current data similarly yielded good reliability ($\alpha = .81$ for action planning, $\alpha = .90$ for coping planning). Spontaneous action and coping planning were also measured at both follow-ups (Time 2 and 3).

**Self-concordance of physical activity goals.** The Behavioural Regulation in Exercise Questionnaire (BREQ) was used to assess self-concordance or autonomy of individuals’ exercise goals (Mullan et al., 1997). The BREQ contains 15 items measuring 4 factors of motivation: external regulation (e.g., “I exercise because other people say I should”), introjected regulation (e.g., “I feel guilty when I don’t exercise”), identified regulation (e.g., “I value the benefits of exercise”), and intrinsic regulation (e.g., “I exercise because it’s fun”). Each
subscale has been found to have adequate reliability in prior research ($\alpha$’s = .76 - .90), and the present data yielded very similar internal consistency among subscale items ($\alpha$’s = .74 - .88).

Impulsivity. The 45-item UPPS Impulsive Behavior Scale (Whiteside & Lynam, 2001) was used to assess 4 factors of impulsivity: urgency (e.g., “When I am upset I often act without thinking”), (lack of) premeditation (e.g., “My thinking is usually careful and purposeful”), (lack of) perseverance (e.g., “I generally like to see things through to the end”), and sensation seeking (e.g., “I generally seek new and exciting experiences and sensations”). Prior research has demonstrated internal consistency in each subscale is good ($\alpha$’s = .82 - .91), and the present data yielded very similar reliabilities in each subscale ($\alpha$’s = .81 - .88). As a single factor, the scale had strong internal consistency ($\alpha = .89$). The subscale of urgency was tested as a moderator apart from the rest of the UPPS, as previous research has shown urgency to uniquely moderate the effects of IIs (Churchill & Jessop, 2010, 2011).

Conscientiousness. Conscientiousness was measured with the sub-scale of 20 conscientiousness items from Goldberg’s (1992) 100-item Unipolar Big Five Markers. Participants were asked to respond to how accurately each word (e.g., “organized,” “inconsistent” [reverse-scored]) describes them, on a 9-point Likert Scale from extremely inaccurate to extremely accurate. The conscientiousness subscale has been found to have adequate internal consistency in past research ($\alpha$’s = .88 - .94), and present data demonstrated similarly sufficient reliability ($\alpha = .88$).

Intelligence Proxy Measures. Students were asked to report current GPA, and SAT and/or ACT scores.

Demographics. Sociocultural Variables included age, gender, height, weight, education, and race/ethnicity. Body mass index was calculated based on self-reported height and weight.
Inhibitory control. Two computerized tasks, Go/NoGo and Stroop were used to assess inhibitory control. In the Go/NoGo task, participants were shown a series of uppercase letters, one at a time, with a fixation cross appearing between letters. Participants were instructed to press the spacebar when they saw any letter besides “X,” but that if they saw an “X,” they should try not to press the spacebar. Seventy-five percent of the trials were “Go” trials, requiring a key press, and 25% were “NoGo” trials, requiring inhibition, or override of the dominant key press response. Reaction time on correct “Go” trials was calculated as the dependent variable, then standardized and reverse coded so that higher scores reflect better inhibition.

I used a computerized version of the original Stroop color task (Stroop, 1935; Was, 2007). Four keys on a computer keyboard were marked with colored stickers: red, blue, yellow, and green. Participants were instructed with on-screen directions to respond to the color name presented on the screen (i.e., “red,” “blue,” “yellow,” “green”). Initial practice trials displayed color words in their congruent colors (i.e., “red” in the color red), then mixed incongruent trials (i.e., “green” in the color blue) with congruent trials. Test trials were comprised of 75% congruent trials and 25% incongruent trials, such that 25% of the trials required inhibition. Given that performance on the Stroop task depends on both accuracy and response time, an adjusted speed measure as calculated for congruent and incongruent trials by taking the proportion of accurate responses and dividing by the average responses. A difference score was then calculated by subtracting incongruent adjusted speed from congruent adjusted speed. The difference score was standardized for clarity of interpretation.

Working memory. Working memory was assessed with two computerized tasks: a shortened operation span task (Ospan) and a shortened reading span task (Rspan; Oswald, McAbee, Redick, & Hambrick, 2015; Unsworth, Heitz, Schrock, & Engle, 2005). In the
operation span task, participants were shown a mathematical operation (e.g., “(3 x 2) + 5”) and asked on the following screen to judge whether or not an answer was correct. After each operation, participants were shown a letter (e.g., L) that they had to remember in correct sequence. Each set contained a specific number of operations (and therefore letters), ranging from 2 (easiest) to 6 (hardest), with a maximum score of 30. In the reading span task, participants were shown a sentence of 10 to 15 words and asked on the following screen to judge whether or not the sentence was sensible. After each sentence, participants were shown a letter (e.g., L) that they had to remember in correct sequence. Each set contained a specific number of operations (and therefore letters), ranging from 2 (easiest) to 6 (hardest), with a maximum score of 30. There was a strong positive correlation between the operation span and reading span tasks ($r = .60$), similar to the correlation found in prior studies (Oswald et al., 2015).

**Task-switching.** A cued letter-number task-switching assessment used in prior studies (Friedman et al., 2008; adapted from Rogers & Monsell, 1995) was used to quantify the switch-cost for each individual, or the amount of extra time it takes to respond to a trial when it is preceded by a different subtask versus the same subtask. Participants saw letter-number or number-letter combinations (e.g., 4G, E6), which appeared in a square box either above a screen midline or below. Participants were trained to respond to the letter (i.e., vowel vs. consonant) when the box appeared above the line (subtask 1), and to respond to the number (i.e., even vs. odd) when the box appeared below the line (subtask 2). The test block consisted of two test blocks of 48 trials, each of which contained 24 no-switch and 24 switch trials. Per previous studies, incorrect responses (which comprised 10% of total responses) and responses following incorrect responses were not used (Friedman et al., 2008). The dependent measure was the average switch cost: the difference between average reaction time on correct trials where a
switch was required and average reaction time on correct trials where a switch was not required. Switch costs were standardized and reverse-coded so that higher scores reflect better task-switching ability.

**Experimental Manipulation**

The experimental manipulation took place during the lab session after all baseline measures were assessed. The experimental manipulation was delivered on the same survey that participants used to complete self-report physical activity and intention measures. In the self-report only sample, the survey randomly assigned participants to condition. In the activity-monitor sub-sample, block random assignment was used so that each cohort of participants would support a final ratio of 25:25:10 across the two intervention conditions and the control condition. Please see Appendix B for all experimental manipulation materials.

**Information-Only Control (See Appendix B for procedure).** Participants in the control condition received information about national recommendations for physical activity and completed a short quiz to increase engagement with the material.

**Implementation Intention (II) Condition (see Appendix B for full procedure).** Participants that were assigned to the II condition began by receiving the information-only control materials, then followed a computer-guided process for creating up to three IIs. The screen explained the usefulness of “if-then” plans and provided an example of two IIs from a different behavioral domain (i.e., healthy eating). Then the screen prompted the participant to form three IIs about where, when, and how he/she will be active in the coming week. After this, the screen prompted the participant to list his/her most significant barriers to physical activity, and asked them to rank order them in significance. Participants were then asked to form three IIs to cope with their largest barrier.
Implementation Intention Plus Training (II+T; see Appendix B for full procedure).

Participants in the II+T condition began by receiving the information-only control materials and completing the traditional II activity on the online survey, following the same procedure as outlined above. Immediately after, they began the training activity. The training activity provided information about the importance of plan quality and defined plan quality in terms of instrumentality and specificity. Then, the training module introduces participants to the practice of critiquing plans and improving upon their plan quality. Participants read examples of plans from a different behavioral domain (i.e., practicing piano), and learned how to apply the concepts of specificity and instrumentality. After the lesson phase, participants were asked to complete a practice test in which they evaluated and modified plans in a new behavioral domain (i.e., study habits). The practice test asked participants to critique plans on their instrumentality and specificity, and to select modifications to improve instrumentality and specificity—the same skills that participants later used to improve their own plans. The practice test was delivered in a multiple-choice format so that feedback could be provided. Once participants completed the practice test, they were presented with their original three IIs about where, when, and how they will be active, and asked to determine whether each plan was instrumental or not. For any plans marked as non-instrumental, participants were given the opportunity to revise the plan to improve its instrumentality. After revising for instrumentality, participants were shown their three plans (revised if applicable), and asked whether or not the IIs were fully specified. For any plans marked as not fully specified, participants were given the opportunity to revise the plan to improve its specificity. Participants then completed the same process for their IIs to cope with their largest barrier (assessing and revising instrumentality, then assessing and revising
specificity). At the end of the exercise, participants were shown all six of their final IIs (revised if applicable).

**Plan Quality.** Instrumentality and specificity of each plan was coded by two independent coders, and all discrepancies between raters were resolved by the author. Quality coding protocol was based on previous studies of plan quality (Mistry, Sweet, Rhodes, & Latimer-Cheung, 2015; van Osch et al., 2010). First, IIs were assessed for instrumentality (1: instrumental; 0: non-instrumental; van Osch et al., 2010). Plans were considered instrumental if they would facilitate physical activity and were viable responses in the specified situation. Plans were only be coded as non-instrumental if they clearly would not facilitate physical activity (e.g., “If I am too tired to go to the gym, then I will watch TV”) or clearly could not be performed in the situation (van Osch et al., 2010). Plans that were not instrumental will not be scored for specificity. Interrater reliability of instrumentality was high, Kappa = .87, AC1 = .91.

Second, four components of each II (activity, place, moment, duration) were scored for specificity, on a scale from 0 to 2 (Mistry et al., 2015). Components that were not specified were given a score of 0. Components that were vague were given a score of 1. Components that were specified in detail were given a score of 2. Thus, the total specificity score for each plan could range from 0 to 8. For example, the plan “If I have completed my homework and it is before 9 p.m. on a weekday, then I will go for a run through the neighborhood for 30 minutes” was given a score of 8: specific activity (2), moment (2), place (2), and duration (2). The plan “If I am too tired to go to the gym, then I will do some moderate exercise at home” was given a score of 4: vague activity (1) and moment (1), specific place (2), and lacking duration (0). The plan, “If I am bored, then I will be active rather than unproductive” was given a score of 2: vague activity
(1) and moment (1), lacking duration (0) and place (0). Interrater reliability of plan specificity was high, ICC = .93.

Participants made 6 plans (3 plans for action, 3 plans for coping with a barrier). The following summary scores were computed: number of instrumental IIs, average specificity of instrumental IIs, and an overall plan quality score (de Vet, Oenema, et al., 2011). Number of IIs corresponded to the number of instrumental IIs that a person formed, independent of specificity. Average specificity was calculated as the sum of the specificity scores for all instrumental IIs, divided by the number of instrumental IIs formed. The overall plan quality score was equal to the number of instrumental IIs multiplied by the average specificity, for a score out of 48.

Follow-Up (Time 2) Measures

Reassessment. Physical activity, intentions, self-efficacy, and spontaneous action and coping planning were reassessed at follow-up.

Implementation intention memory (exploratory). Participants were asked to recall their IIs from the previous week. “Think back to the plans you formed last week in regard to your physical activity. Please recall those plans as accurately as possible in the spaces below. Try to remember the exact plans you set, whether or not you completed them this week.” There were six spaces for participants to recall up to 3 IIs for action and 3 IIs to deal with their barrier. Participants were also asked to rate how confident they are in their memory of their IIs, on a 5-point Likert scale from “not at all confident” to “completely confident.” This was an exploratory measure to examine as a possible mediator of plan quality.

Implementation intention execution (exploratory). For each plan a participant recalled, they were asked to indicate whether they a) did not carry out the plan at all, b) carried out the plan with some modifications, or c) carried out the plan exactly.
If participants reported not carrying out the plan at all, they were asked to indicate the type of barrier they experienced, “What prevented you from carrying out this plan?” with options reflecting the 5 factors of barriers from the Physical Activity Barriers Scale discussed above, as well as “I forgot about it” and the option to write in another barrier.

If a participant reported that they carried out the plan with some modifications, they were asked to specify what modifications they made, “Please check the box next to any modifications you made to this plan during the week, and describe the change in the space provided.” The options will include “changed day,” “changed time,” “changed activity,” “changed location,” and “changed duration.” These are exploratory measures designed to be able to shed light on the effects of plan quality on the execution of IIs.

**Data Analytical Plan**

Prior to testing the main hypotheses, frequency distributions on all continuous variables were examined. All scales were assessed for internal consistency using Cronbach’s alpha. Scales with alphas greater than .70 were retained; for scales with alphas less than .70, inconsistent items were removed. A pairwise correlation matrix was generated to assess simple relationships between the variables. Success of random assignment was checked with linear regressions of baseline physical activity, age, and BMI on condition, and chi-squared tests of independence for gender and condition and ethnicity (i.e., white vs. non-white) and condition.

**Aim 1: Assessing main effect of the intervention**

Self-report and objective physical activity were assessed at baseline, one week post-baseline, and two weeks post-baseline, yielding nested data: weeks (level 1) nested within people (level 2). Due to the nested nature of the data, a multilevel approach to data analysis was used. Generalized estimating equations (GEE) are a type of multilevel model that allow for the
prediction of a variable over time while accounting for the correlation between a single participant’s scores. Failing to control for the clustering of observations within participants would underestimate the standard errors of the effects, and thus the GEE improves on traditional regression models in these circumstances (Zeger, Liang, & Albert, 1988). Given that physical activity data typically demonstrates significant positive skew (i.e., many people have low physical activity levels, fewer people report very high levels), a bootstrapping procedure was used to calculate standard errors. Bootstrapping is a resampling process in which the sampling distribution is obtained by repeatedly sampling the dataset with replacement, rather than making a parametric assumption (e.g., normality) about the distribution. Two thousand repetitions were used to form the bootstrapped distributions for each analysis.

To assess the overall effect of the intervention on MVPA one- and two-weeks post baseline, a GEE was conducted predicting MVPA from intervention condition, controlling for baseline MVPA, intentions for physical activity, time, and any demographic variables found to have significant ($p < .05$) bivariate correlations or point-biserial correlations with MVPA at Time 2 or Time 3. To determine whether any of the conditions differed significantly, an omnibus contrast of the marginal linear predictions was conducted. If the contrast revealed a significant difference (i.e., $p < .05$), the coefficients associated with each intervention group would be assessed for significant differences relative to the information-only control condition. Each unstandardized coefficient can be interpreted as the increase in MVPA attributable to the intervention. The corresponding p-value for each coefficient indicates whether the increase in physical activity over and above the control for each intervention group is statistically significant. Next, a second GEE would be conducted with the II condition as the reference group to determine whether any significant differences existed between the two intervention groups.
The unstandardized coefficient of the II+T comparison would be interpreted as the increase in physical activity (in estimated METs) attributable to the II+T over and above the traditional II intervention, and the corresponding p-value indicates whether the increase is statistically significant.

These analyses were conducted in the same manner for objective (accelerometer) physical activity data for the Activity Monitor Sub-Sample, to attempt to corroborate the self-report findings with an objectively measured outcome.

*Aim 2: Assessing moderation: effects of the interventions will be dependent on individual difference factors*

To determine whether the effectiveness of the interventions was dependent on individual difference variables, a series of moderation analyses were conducted within the GEE framework.

For each proposed moderator (e.g., intention) of a given category (e.g., motivational), a GEE was conducted predicting MVPA from intervention condition, the moderator of interest, and the product of condition and the moderator of interest, controlling for baseline MVPA, intentions for physical activity, time, demographic controls, and the main effects of the other proposed moderators of the same category (e.g., motivational). To assess significance of the interaction, a Wald chi-squared test was conducted to determine if either of the interaction terms significantly differed from zero, serving as an omnibus test of the interaction. For each moderation analysis that yielded a significant Wald test, the simple slopes were analyzed at the mean and one standard deviation above and below the mean.

*Aim 3: Assessing mediation: plan quality will account for the differences in effectiveness between II and II+T interventions*
To assess whether the II+T intervention produced higher plan quality than the traditional II intervention, regressions were conducted with each of the plan quality variables (number of instrumental plans, average specificity of plans, and total plan quality score) regressed on intervention condition. Note that plan quality is not applicable to participants in the information-only control condition, so this only compared plan quality between the II and II+T interventions.

In addition to assessing plan quality differences between the two intervention groups, intra-individual differences in plan quality from pre- to post-training were evaluated using within-subject t-tests. Significant t-tests would indicate that plan quality increased significantly after training.

To assess whether there was an indirect effect of intervention condition on physical activity via plan specificity, the sembuilder package in Stata was used to create a multilevel mediation model (controlling for baseline physical activity, intentions for physical activity, time, and demographic controls). After generating the model with SEM, the indirect effect was tested directly with a product of coefficients test using the nlcom (nonlinear combination of estimators) command, which assesses the magnitude of the indirect effect in relation to the standard error of the indirect (Hayes, 2009). A product-of-coefficients test compares the size of the indirect effect (the ‘a’ path multiplied by the ‘b’ path) to the standard error of the indirect effect; if the indirect effect is significant, mediation has occurred. Bootstrapping was used because the product of the ‘a’ and ‘b’ paths rarely produces a normal distribution, and tests of mediation based on the normal distribution have low power to detect real mediation effects (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002); bootstrapped methods yield substantially greater power to detect the indirect effect (Fritz & MacKinnon, 2007).
CHAPTER III
RESULTS

Preliminary Analyses

Random Assignment Check

To assess the effectiveness of random assignment, I conducted analyses to determine whether characteristics of participants were significantly different across conditions. Linear regressions were used to assess continuous characteristics, including age, BMI, resting heart rate, historical physical activity, GPA, ACT scores, and baseline self-report MVPA; none of these variables differed significantly across conditions within the full sample ($p$’s = .14 - .82). Pearson’s chi-squared tests of independence were used to assess categorical variables, including gender and ethnicity (white vs. non-white); neither of these variables differed significantly across conditions within the full sample ($p$’s = .25). These analyses were repeated with the Activity Monitor sub-sample, using objective MVPA rather than self-reported MVPA, and similarly, none of these baseline characteristics differed across conditions ($p$’s .19 - .86).

Manipulation Check

To test whether the II+T training significantly improved plan quality scores, I assessed between-subjects and within-subjects differences in plan quality. Simple regression analyses revealed that the II+T group had significantly higher overall planning scores ($b = 5.27$, $SE = 1.57$, $p = .001$) and higher average plan specificity scores ($b = .88$, $SE = .22$, $p < .001$), but did not form a significantly greater number of instrumental IIs ($b = .24$, $SE = .26$, $p = .351$) than the Traditional II group. Means and standard deviations are shown in Table 2. Paired $t$-tests revealed
that participants in the II+T condition had significantly higher overall planning scores, \( t(145) = 9.56, p < .001 \), and average plan specificity scores, \( t(145) = 11.13, p < .001 \), as well as a significantly greater number of instrumental IIs, \( t(145) = 3.77, p < .001 \), at post-training compared to pre-training. Thus, the intervention significantly improved the quality of participants’ plans for physical activity.

Table 2

Plan Quality Between and Within II Intervention Conditions

<table>
<thead>
<tr>
<th></th>
<th>Number of Instrumental IIs</th>
<th>Average Specificity</th>
<th>Overall Plan Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td><strong>Final Plan Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional II</td>
<td>4.26 (1.50)</td>
<td>2.28 (.97)</td>
<td>10.95 (6.63)</td>
</tr>
<tr>
<td>II+T</td>
<td>4.51 (1.56)</td>
<td>3.17 (1.55)</td>
<td>16.22 (11.28)</td>
</tr>
<tr>
<td><strong>Pre-Training Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II+T</td>
<td>4.32 (1.61)</td>
<td>2.37 (1.12)</td>
<td>11.79 (8.26)</td>
</tr>
</tbody>
</table>

**Activity Monitor Compliance**

ActiLife’s wear time validation algorithm revealed that compliance to the wear time requirements was poor, with only 14 (23.3%) participants meeting the full wear time requirements (3 weekdays plus 1 weekend day for at least 10 hours per day) across all three weeks. At baseline, 31 (51.7%) participants met the wear time requirements; one week after baseline, 30 (50.0%) met requirements, and two weeks after baseline, 27 (45.0%) met requirements. Compliance was significantly lower than expected from prior ActiGraph studies using college student samples (e.g., 80% compliance in Dinger et al., 2006; 87% compliance in Raynor & Jankowiak, 2010), although these data come from studies requiring wear time across only one week rather than three. Given that the GEE analysis is able utilize participants’ data as
long as they have sufficient wear time at baseline as well as one of the two subsequent weeks, the analyzed activity monitor sub-sample included 23 (38.3%) participants. Activity monitor participants excluded from analyses due to insufficient wear time did not differ from those included in terms of baseline self-reported MVPA, intentions for MVPA, gender, age, BMI, or ethnicity. Due to the resulting small sample size, I only conducted analyses from Aim 1 (main effect of intervention) with the activity monitor sub-sample; there were too few observations to conduct analyses of moderation or mediation.

**Descriptive Statistics**

Participants self-reported high levels of MVPA at baseline, with an average daily MVPA of over 50 minutes (M = 51.85, SD = 55.18), although the accelerometers indicated lower objective levels (M = 15.51, SD = 3.92). Correlations between self-reported MVPA and accelerometer MVPA at all time points are displayed in Table 3. Correlations between self-reported MVPA at each time point were moderate (r’s .36 - .57), with stronger correlations between time points which occurred closer together. There was a strong correlation between accelerometer MVPA at T1 and T2 (r = .71), but the correlations between accelerometer MVPA at other time points were weak (r’s = .12, .14). Associations between self-reported MVPA and accelerometer MVPA varied, with a weak negative correlation between T1 MVPAs (r = -.16), a weak positive correlation between T2 MVPAs (r = .20), and a strong positive correlation between T3 MVPAs (r = .60). The increasing strength in relationship between the two measurements may reflect increased awareness of physical activity brought on by the study. Descriptives for bouts of MVPA and sedentary time across the study are displayed in Table 4, along with correlations with subjective and objective MVPA across the study. Because bouts of
MVPA were not significantly related to Self-Report MVPA at any time point, no other analyses were conducted with bouts of MVPA.

Correlations (point-biserial correlations for dichotomous variables) between demographic characteristics and self-report MVPA across the study are listed in Table 5. Historical PA was positively associated with MVPA at all time points ($r$’s = .21 - .26), and age was negatively associated with MVPA at T2 ($r = -.16$). Thus, per the analytical plan, both historical PA and age were retained as covariates in all subsequent analyses. No other demographic variables were retained as covariates.

Table 3

Self-Report and Accelerometer MVPA: Descriptives and Bivariate Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptives</th>
<th>Self-Report MVPA</th>
<th>Accelerometer MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>T1</td>
</tr>
<tr>
<td>Self-Report MVPA T1</td>
<td>51.85</td>
<td>55.18</td>
<td>1</td>
</tr>
<tr>
<td>Self-Report MVPA T2</td>
<td>60.91</td>
<td>58.46</td>
<td>.57**</td>
</tr>
<tr>
<td>Self-Report MVPA T3</td>
<td>74.20</td>
<td>67.27</td>
<td>.36**</td>
</tr>
<tr>
<td>Accelerom. MVPA T1</td>
<td>15.51</td>
<td>3.92</td>
<td>-.16</td>
</tr>
<tr>
<td>Accelerom. MVPA T2</td>
<td>16.37</td>
<td>4.72</td>
<td>-.09</td>
</tr>
<tr>
<td>Accelerom. MVPA T3</td>
<td>17.26</td>
<td>3.97</td>
<td>.31</td>
</tr>
</tbody>
</table>

† $p < .10$
* $p < .05$
** $p < .01$
Table 4

Additional Accelerometer Metrics: Descriptives and Correlations with MVPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptives</th>
<th>Self-Report MVPA</th>
<th>Accelerometer MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>T1</td>
</tr>
<tr>
<td>Bout MVPA T1</td>
<td>7.53</td>
<td>7.77</td>
<td>0.08</td>
</tr>
<tr>
<td>Bout MVPA T2</td>
<td>14.10</td>
<td>10.87</td>
<td>-0.28</td>
</tr>
<tr>
<td>Bout MVPA T3</td>
<td>15.09</td>
<td>11.37</td>
<td>0.05</td>
</tr>
<tr>
<td>Sedentary Time T1</td>
<td>234.81</td>
<td>85.29</td>
<td>-0.23</td>
</tr>
<tr>
<td>Sedentary Time T2</td>
<td>275.80</td>
<td>136.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Sedentary Time T3</td>
<td>298.50</td>
<td>150.62</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

† p < .10
* p < .05
** p < .01

Table 5

Bivariate Correlations between Participant Demographics and MVPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bivariate Correlations with Self-Report MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MVPA T1</td>
</tr>
<tr>
<td>Age</td>
<td>-.01</td>
</tr>
<tr>
<td>BMI</td>
<td>-.19</td>
</tr>
<tr>
<td>Historical PA</td>
<td>.21**</td>
</tr>
<tr>
<td>Resting HR</td>
<td>-0.10</td>
</tr>
<tr>
<td>Gender - Female</td>
<td>-.12†</td>
</tr>
<tr>
<td>Race - White</td>
<td>.15*</td>
</tr>
<tr>
<td>GPA</td>
<td>.16*</td>
</tr>
<tr>
<td>ACT Score</td>
<td>.03</td>
</tr>
</tbody>
</table>

a Included as demographic covariate due to significant correlation with MVPA T2 and/or T3
b ACT scores were used rather than SAT, given the small percentage of participants who reported SAT scores
† p < .10
* p < .05
** p < .01

Descriptive statistics of motivational factors and their bivariate correlations with self-reported MVPA across the study are shown in Table 6. Bivariate correlations between motivational variables are shown in Table 7. To standardize intended MVPA to the same scale as
self-reported MVPA, total intended MVPA was divided by 7 to generate a variable reflecting average intended MVPA per day. This allows for clearer comparison between intended MVPA and self-report and accelerometer MVPA. Participants self-reported high levels of intended MVPA (M = 78.76, SD = 95.89), although 6 participants (3.1%) reported no intentions for MVPA and 15 participants (7.6%) reported intentions of less than 10 minutes per day. While participants were excluded for having no intentions for physical activity, all 6 of the participants who reported no intentions for MVPA reported intending to walk on 2 or more days, thus they met the criteria for inclusion as originally stated\(^1\). Participants also reported high levels of intention strength (M = 4.23, SD = .63), though the relationship between the two measures of intention was weak-to-moderate (\(r = .27\)), suggesting that they represent distinct constructs. Intended MVPA was significantly and positively correlated with self-reported MVPA at all time points, with a particularly strong correlation between intended MVPA and MVPA at T2 (\(r = .63\)); intention strength demonstrated positive associations with MVPA across the study, but with weaker correlations than Intended MVPA at all time points. Participants reported moderate to high levels of baseline action planning (M = 5.55, SD = 1.16) and moderate levels coping planning (M = 4.21, SD = 1.50); both of these factors were significantly and positively associated with MVPA across the study per bivariate correlations (\(r’s = .21 – .34\)). Participants reported moderate to high task self-efficacy (M = 5.32, SD = 1.06) and maintenance self-efficacy (M = 5.32, SD = 1.09); both variables were significantly and positively associated with MVPA (\(r’s = .28 – .35\)). Average external motivation was low (M = 1.75, SD = .82) and was not associated with MVPA at any time point in the study (\(r’s = .04 – -.03\)). Average intrinsic motivation was moderate (M = 3.16, SD = 1.01) and was significantly and positively associated

---

\(^1\) Aim 1 analyses and all significant interaction effects were re-analyzed excluding the 6 participants with zero intended minutes of MVPA. No results differed from the results obtained using the full sample.
with MVPA across the study ($r$'s = .24 – .29). With the exception of external motivations, which was negatively associated with maintenance self-efficacy ($r$'s = -.13 – -.18), all motivational factors were positively associated with each other (see Table 4).

Table 6

Motivational Factors: Descriptives and Correlations with Self-Reported MVPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptives</th>
<th>Bivariate Correlations with Self-Reported MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Intended MVPA</td>
<td>78.76</td>
<td>95.89</td>
</tr>
<tr>
<td>Intention Strength</td>
<td>4.23</td>
<td>.63</td>
</tr>
<tr>
<td>Action Planning</td>
<td>5.55</td>
<td>1.16</td>
</tr>
<tr>
<td>Coping Planning</td>
<td>4.21</td>
<td>1.50</td>
</tr>
<tr>
<td>Task Self-Efficacy</td>
<td>5.86</td>
<td>1.06</td>
</tr>
<tr>
<td>Maint. Self-Efficacy</td>
<td>5.32</td>
<td>1.09</td>
</tr>
<tr>
<td>External Motivation</td>
<td>1.75</td>
<td>.82</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>3.16</td>
<td>1.01</td>
</tr>
</tbody>
</table>

† $p < .10$  
* $p < .05$  
** $p < .01$

Table 7

Motivational Factors: Bivariate Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intention</th>
<th>Planning</th>
<th>Self-Efficacy</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1. Intended MVPA</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Intention Strength</td>
<td>.27**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Action Planning</td>
<td>.19*</td>
<td>.53**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. Coping Planning</td>
<td>.20*</td>
<td>.40**</td>
<td>.53**</td>
<td>1</td>
</tr>
<tr>
<td>5. Task Self-Efficacy</td>
<td>.28**</td>
<td>.60**</td>
<td>.44**</td>
<td>.38**</td>
</tr>
<tr>
<td>6. Maint. Self-Efficacy</td>
<td>.30**</td>
<td>.44**</td>
<td>.42**</td>
<td>.48**</td>
</tr>
<tr>
<td>7. External Motivation</td>
<td>.09</td>
<td>.03</td>
<td>-.02</td>
<td>.02</td>
</tr>
<tr>
<td>8. Intrinsic Motivation</td>
<td>.25**</td>
<td>.37**</td>
<td>.41**</td>
<td>.40**</td>
</tr>
</tbody>
</table>

† $p < .10$  
* $p < .05$  
** $p < .01$
Descriptive statistics of executive functioning factors and their bivariate correlations with self-reported MVPA across the study are shown in Table 8. Bivariate correlations between executive functioning variables are shown in Table 9. None of the measures of executive functioning were significantly and positively associated with MVPA at any time point, but there was a trend that greater inhibitory control, as measured by the Go/NoGo task, was associated with lower MVPA at T3 ($r = -.16$). The two measures of working memory (i.e., Ospan and Rspan) were significantly and positively associated ($r = .59$) and demonstrated similar bivariate associations with MVPA across the study, and thus were combined for main analyses. The two measures of inhibitory control (i.e., Stroop and Go/NoGo) were not related ($r = .03$), and thus were analyzed separately in the main analyses.

Table 8

| Executive Functioning: Descriptives and Correlations with Self-Reported MVPA |
|---------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|
| Variable                        | Descriptives | Bivariate Correlations with Self-Reported MVPA | | |
|                                | M         | SD    | MVPA T1 | MVPA T2 | MVPA T3 |
| Inhibitory Control             |           |       |         |         |         |
| Stroop                          | 22.10     | 16.04  | -0.02   | -0.00   | 0.04    |
| Go/No-Go                        | 355.78    | 58.28  | 0.01    | -0.04   | -0.16†  |
| Working Memory                  |           |       |         |         |         |
| Ospan                           | 20.83     | 6.15   | 0.05    | -0.03   | -0.04   |
| Rspan                           | 21.09     | 6.05   | 0.00    | -0.11   | -0.07   |
| Task-Switching                  |           |       |         |         |         |
| Letter-Number                   | 229.41    | 171.13 | 0.05    | -0.04   | 0.09    |

*Note.* Scores on Stroop are an adjusted speed measure accounting for incorrect responses and reaction time (RT). Scores on Go/No-Go reflect RT, reported in ms. Ospan and Rspan reflect partial scores referring to the number of items recalled in correct order. Letter-Number scores reflect the difference in RT, in ms, between switch- and non-switch trials, with higher scores reflecting a greater switch cost (i.e., poorer task-switching).

† $p < .10$

* $p < .05$

** $p < .01$
Table 9

Executive Functioning: Bivariate Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Inhibitory Control</th>
<th>Working Memory</th>
<th>Task-Switching</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1. Stroop</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Go/No-Go</td>
<td>.03</td>
<td>.14†</td>
<td></td>
</tr>
<tr>
<td>3. Ospan</td>
<td>.00</td>
<td>.12</td>
<td>.17*</td>
</tr>
<tr>
<td>4. Rspan</td>
<td>.03</td>
<td>.21**</td>
<td>.59**</td>
</tr>
<tr>
<td>5. Letter-Number</td>
<td>.14†</td>
<td>.12</td>
<td>.17*</td>
</tr>
</tbody>
</table>

† *p < .10
* *p < .05
** *p < .01

Descriptive statistics of personality factors and their bivariate correlations with self-reported MVPA across the study are shown in Table 10. Bivariate correlations between personality variables are shown in Table 11. The overall measure of impulsivity and the subscale of urgency were both negatively correlated with MVPA at T1 (r’s = -.18 – -.13) but not significantly associated with MVPA at T2 or T3 (r’s = -.11 – -.05); unsurprisingly, the two measures were strongly correlated (r = .75), given that the urgency measure is a subscale of the full impulsivity scale. Both measures of impulsivity were negatively associated with conscientiousness (r’s = -.54 – -.49), and conscientiousness was significantly and positively associated with MVPA across the study (r’s = .18 - .22).
Table 10

Personality Factors: Descriptives and Correlations with Self-Reported MVPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptives</th>
<th>Bivariate Correlations with Self-Reported MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Impulsivity – All</td>
<td>.10</td>
<td>.31</td>
</tr>
<tr>
<td>Impulsivity – Urgency</td>
<td>1.92</td>
<td>.513</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>1.44</td>
<td>.98</td>
</tr>
</tbody>
</table>

† p < .10
* p < .05
** p < .01

Table 11

Personality Factors: Bivariate Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Impulsivity</th>
<th>Conscientiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1. Impulsivity - All</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2. Impulsivity - Urgency</td>
<td>75**</td>
<td>1</td>
</tr>
<tr>
<td>3. Conscientiousness</td>
<td>-.54**</td>
<td>-.49**</td>
</tr>
</tbody>
</table>

† p < .10
* p < .05
** p < .01

Main Analyses

Aim 1: Assessing the Main Effect of the Intervention

A Generalized Estimating Equation (GEE) was used to evaluate the effect of the intervention on self-reported MVPA at the two- and three-week follow-ups. Controlling for baseline MVPA, intentions for MVPA, demographic controls (age and sport history), and time, there was no significant effect of the interventions on MVPA, $\chi^2 = 0.02, p = .990$ (see Table 12). Thus, contrary to my hypotheses, neither intervention (II or II+T) produced greater self-reported MVPA than the information-only control. The same analysis was conducted using accelerometer-generated MVPA (baseline, T2, T3) in place of self-reported MVPA, and again,
no differences were found between any of the conditions, $\chi^2 = 1.30$, $p = .543$, suggesting that neither intervention significantly affected MVPA.

It was hypothesized that the intervention would impact MVPA but not sedentary time, given that plans were made for bouts of intentional physical activity. A GEE was conducted to determine whether the intervention significantly affected time spent in a sedentary state, as measured by the accelerometers. Controlling for baseline sedentary time, intentions for MVPA, demographic controls (age and sport history), and time, there was no significant effect of the interventions on sedentary time, $\chi^2 = 0.60$, $p = .740$. Thus, neither intervention affected the time participants spent being sedentary.

**Aim 1 Supplementary Analyses.** Given that MVPA appeared to increase across the course of the study, I conducted a follow-up analysis for Aim 1 to test whether the effect of intervention condition on subsequent MVPA was dependent on time. Essentially, this analysis allowed me to test whether one or more intervention conditions produced a different pattern of MVPA over time, compared to the other conditions. For example, it could be that one condition led to increased MVPA at T2, but steady or decreased MVPA at T3. A GEE was conducted predicting MVPA from intervention condition, time, and the product of condition and time, controlling for baseline MVPA, and demographic controls (age and historical PA). The interaction between condition and time was not significant, $\chi^2 = 1.00$, $p = .608$, indicating that the effect of condition on self-reported MVPA did not vary across time.
Table 12

GEE Models Examining Main Effects of II Interventions

<table>
<thead>
<tr>
<th></th>
<th>Estimate (SE)</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-Reported MVPA</strong> a (N = 197, Obs = 354)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVPA T1 (baseline)</td>
<td>.29 (.09)</td>
<td>.001</td>
<td>.12 – .47</td>
</tr>
<tr>
<td>Intended MVPA</td>
<td>.22 (.06)</td>
<td>&lt; .001</td>
<td>.10 – .35</td>
</tr>
<tr>
<td>Historical PA</td>
<td>.90 (.45)</td>
<td>.043</td>
<td>.03 – 1.77</td>
</tr>
<tr>
<td>Age</td>
<td>-1.19 (1.04)</td>
<td>.255</td>
<td>-3.22 – .85</td>
</tr>
<tr>
<td>Time</td>
<td>7.94 (4.97)</td>
<td>.110</td>
<td>-1.80 – 17.67</td>
</tr>
<tr>
<td>Traditional II (vs. Info-Only Control)</td>
<td>-.30 (7.71)</td>
<td>.969</td>
<td>-15.42 – 14.82</td>
</tr>
<tr>
<td>II+T (vs. Info-Only Control)</td>
<td>-1.01 (7.36)</td>
<td>.891</td>
<td>-15.43 – 13.41</td>
</tr>
<tr>
<td><strong>Accelerometer MVPA</strong> b (N = 23, Obs = 37)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVPA T1 (baseline)</td>
<td>.47 (.26)</td>
<td>.076</td>
<td>-.05 – .98</td>
</tr>
<tr>
<td>Intended MVPA</td>
<td>.02 (.01)</td>
<td>.128</td>
<td>-.01 – .05</td>
</tr>
<tr>
<td>Historical PA</td>
<td>.07 (.14)</td>
<td>.626</td>
<td>-.20 – .34</td>
</tr>
<tr>
<td>Age</td>
<td>-.03 (.38)</td>
<td>.932</td>
<td>-.78 – .72</td>
</tr>
<tr>
<td>Time</td>
<td>1.20 (1.19)</td>
<td>.312</td>
<td>-1.13 – 3.54</td>
</tr>
<tr>
<td>Traditional II (vs. Info-Only Control)</td>
<td>-2.56 (2.27)</td>
<td>.260</td>
<td>-7.01 – 1.89</td>
</tr>
<tr>
<td>II+T (vs. Info-Only Control)</td>
<td>-1.49 (2.12)</td>
<td>.481</td>
<td>-5.64 – 2.66</td>
</tr>
<tr>
<td><strong>Accelerometer Sedentary Time</strong> c (N = 23, Obs = 37)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVPA T1 (baseline)</td>
<td>1.10 (.30)</td>
<td>&lt; .001</td>
<td>.51 – 1.69</td>
</tr>
<tr>
<td>Intended MVPA</td>
<td>.04 (.44)</td>
<td>.927</td>
<td>-.82 – .90</td>
</tr>
<tr>
<td>Historical PA</td>
<td>3.97 (2.71)</td>
<td>.144</td>
<td>-1.35 – 9.29</td>
</tr>
<tr>
<td>Age</td>
<td>-.66 (9.52)</td>
<td>.945</td>
<td>-19.31 – 17.99</td>
</tr>
<tr>
<td>Time</td>
<td>33.94 (32.52)</td>
<td>.297</td>
<td>-29.80 – 97.68</td>
</tr>
<tr>
<td>Traditional II (vs. Info-Only Control)</td>
<td>21.20 (48.91)</td>
<td>.665</td>
<td>-74.66 – 117.08</td>
</tr>
<tr>
<td>II+T (vs. Info-Only Control)</td>
<td>29.66 (40.81)</td>
<td>.467</td>
<td>-50.32 – 109.65</td>
</tr>
</tbody>
</table>

\[ a \chi^2 = .02, p = .990 \]
\[ b \chi^2 = 1.30, p = .523 \]
\[ c \chi^2 = .60, p = .740 \]
**Aim 2: Assessing Moderation: Are the Effects of the Interventions Dependent on Individual Difference Factors?**

**Motivational moderators.** The following motivational moderators of the intervention effect were tested: intended minutes of MVPA, intention strength, baseline action planning, coping planning, task self-efficacy, maintenance self-efficacy, external motivations for exercise, and intrinsic motivations for exercise. For each proposed moderator (e.g., intended minutes of MVPA), a GEE was conducted predicting MVPA from intervention condition, the moderator of interest, and the product of condition and moderator, controlling for baseline MVPA, time, demographic controls (age and historical PA), and the remaining motivational variables. Test statistics for the interaction terms are presented in Table 13.

The interaction between condition and intended minutes of MVPA was marginally significant, \( \chi^2 = 4.94, p = .085 \), indicating a trend that the effect of intervention condition on self-reported MVPA was dependent on intended activity (see Figure 3). To further understand this interaction trend, I examined the effect of each condition at mean levels of intentions and one standard deviation above and below the mean. Given that one standard deviation below the mean of intended minutes would yield a negative (and thus, impossible) intention score, I substituted an intention score of 0 to represent low intentions. Specifically, among people with no intentions for MVPA, participants in the II condition reported significantly lower MVPA than those in the information-only condition, \( b = -20.15, \text{SE} = 9.52, p = .034 \). There was a trend that among people with high intentions for MVPA, participants in the II condition reported higher MVPA than those in the information-only control condition, \( b = 23.53, \text{SE} = 14.94, p = .115 \). Among people with average intentions, there was no significant difference in MVPA between the II condition and the information-only control, \( p = .955 \). There were no significant differences
between the information-only condition and the II+T condition (p’s > .27) or between the II condition and the II+T condition (p’s > .35).

No other proposed motivational variables significantly moderated the effect of the interventions on self-reported MVPA (see Table 13). Specifically, the effect of the intervention on subsequent MVPA did not depend on baseline action plans or coping plans, task or maintenance self-efficacy, or external or intrinsic motivations.

### Table 13

**Interactions between Motivational Moderators and Condition**

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Estimate (SE)</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intended MVPA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intended MVPA</td>
<td>.18 (.07)</td>
<td>.013*</td>
<td>.02 – .35</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-1.21 (7.07)</td>
<td>.864</td>
<td>-15.06 – 12.65</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.33 (7.32)</td>
<td>.964</td>
<td>-14.68 – 14.01</td>
</tr>
<tr>
<td>II Traditional x Intended MVPA</td>
<td>.24 (.11)</td>
<td>.029*</td>
<td>.02 – .45</td>
</tr>
<tr>
<td>II + T x Intended MVPA</td>
<td>.14 (.12)</td>
<td>.273</td>
<td>-.11 – .38</td>
</tr>
<tr>
<td><strong>Intention Strength</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention Strength</td>
<td>5.86 (10.13)</td>
<td>.563</td>
<td>-14.00 – 25.71</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-1.41 (8.31)</td>
<td>.865</td>
<td>-17.70 – 14.88</td>
</tr>
<tr>
<td>II + T</td>
<td>-8.47 (8.02)</td>
<td>.291</td>
<td>-24.18 – 7.24</td>
</tr>
<tr>
<td>II Traditional x Intention Strength</td>
<td>5.43 (12.10)</td>
<td>.653</td>
<td>-18.27 – 29.14</td>
</tr>
<tr>
<td>II + T x Intention Strength</td>
<td>-14.54 (13.90)</td>
<td>.295</td>
<td>-41.79 – 12.70</td>
</tr>
<tr>
<td><strong>Baseline Action Planning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action Planning</td>
<td>4.37 (5.27)</td>
<td>.408</td>
<td>-5.97 – 14.70</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-0.01 (7.59)</td>
<td>.999</td>
<td>14.88 – 14.86</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.73 (7.34)</td>
<td>.922</td>
<td>15.09 – 13.66</td>
</tr>
<tr>
<td>II Traditional x Action Planning</td>
<td>1.28 (6.72)</td>
<td>.849</td>
<td>11.90 – 14.45</td>
</tr>
<tr>
<td>II + T x Action Planning</td>
<td>-6.13 (6.26)</td>
<td>.328</td>
<td>18.41 – 6.15</td>
</tr>
</tbody>
</table>

Note: Motivational variables were centered for moderation analyses.

| a $\chi^2 = 4.94, p = .085$ |
| b $\chi^2 = 3.19, p = .203$ |
| c $\chi^2 = 2.12, p = .347$ |
Interactions between Motivational Moderators and Condition, continued

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Estimate (SE)</th>
<th>( p )</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Coping Planning(^d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping Planning</td>
<td>5.12 (5.34)</td>
<td>.338</td>
<td>-5.35 – 15.59</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.06 (7.29)</td>
<td>.993</td>
<td>-14.23 – 14.35</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.09 (6.86)</td>
<td>.873</td>
<td>-14.53 – 12.35</td>
</tr>
<tr>
<td>II Traditional x Coping Planning</td>
<td>1.45 (6.03)</td>
<td>.810</td>
<td>-10.37 – 13.26</td>
</tr>
<tr>
<td>II + T x Coping Planning</td>
<td>-4.03 (5.59)</td>
<td>.471</td>
<td>-14.99 – 6.93</td>
</tr>
<tr>
<td>Task Self-Efficacy(^e)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Self-Efficacy</td>
<td>-6.98 (6.51)</td>
<td>.284</td>
<td>-19.74 – 5.79</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.49 (7.83)</td>
<td>.951</td>
<td>-14.86 – 15.83</td>
</tr>
<tr>
<td>II + T</td>
<td>-.84 (7.24)</td>
<td>.907</td>
<td>-15.03 – 13.35</td>
</tr>
<tr>
<td>II Traditional x Task Self-Efficacy</td>
<td>4.12 (7.83)</td>
<td>.599</td>
<td>-11.23 – 19.46</td>
</tr>
<tr>
<td>II + T x Task Self-Efficacy</td>
<td>-1.10 (8.73)</td>
<td>.899</td>
<td>-18.21 – 16.00</td>
</tr>
<tr>
<td>Maintenance Self-Efficacy(^f)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maint. Self-Efficacy</td>
<td>1.79 (5.80)</td>
<td>.758</td>
<td>-9.58 – 13.15</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.61 (7.52)</td>
<td>.935</td>
<td>-14.13 – 13.35</td>
</tr>
<tr>
<td>II + T</td>
<td>-.86 (7.00)</td>
<td>.903</td>
<td>-14.57 – 12.86</td>
</tr>
<tr>
<td>II Traditional x Maint. Self-Efficacy</td>
<td>6.75 (6.73)</td>
<td>.316</td>
<td>-6.45 – 19.95</td>
</tr>
<tr>
<td>II + T x Maint. Self-Efficacy</td>
<td>.84 (7.28)</td>
<td>.908</td>
<td>-13.44 – 15.11</td>
</tr>
<tr>
<td>External Motivations(^g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Motivations</td>
<td>-6.33 (6.72)</td>
<td>.346</td>
<td>-19.51 – 6.84</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-.42 (7.55)</td>
<td>.955</td>
<td>-15.22 – 14.38</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.33 (7.16)</td>
<td>.852</td>
<td>-15.37 – 12.70</td>
</tr>
<tr>
<td>II Traditional x External Motivations</td>
<td>11.58 (9.17)</td>
<td>.206</td>
<td>-6.39 – 29.55</td>
</tr>
<tr>
<td>II + T x External Motivations</td>
<td>9.73 (8.95)</td>
<td>.277</td>
<td>-7.81 – 27.26</td>
</tr>
<tr>
<td>Intrinsic Motivations(^h)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic Motivations</td>
<td>4.06 (6.04)</td>
<td>.501</td>
<td>-7.78 – 15.89</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.96 (7.73)</td>
<td>.901</td>
<td>-14.19 – 16.12</td>
</tr>
<tr>
<td>II + T</td>
<td>-7.9 (7.12)</td>
<td>.911</td>
<td>-14.75 – 13.16</td>
</tr>
<tr>
<td>II Traditional x Intrinsic Motivations</td>
<td>4.92 (8.57)</td>
<td>.566</td>
<td>-11.88 – 21.72</td>
</tr>
<tr>
<td>II + T x Intrinsic Motivations</td>
<td>-4.07 (7.66)</td>
<td>.596</td>
<td>-19.09 – 10.96</td>
</tr>
</tbody>
</table>

Note: Motivational variables were centered for moderation analyses.
\(^d\) \( \chi^2 = 1.68, p = .433 \)
\(^e\) \( \chi^2 = .50, p = .779 \)
\(^f\) \( \chi^2 = 1.21, p = .547 \)
\(^g\) \( \chi^2 = 1.83, p = .401 \)
\(^h\) \( \chi^2 = 1.29, p = .524 \)
Figure 3. Interactive effects of Intended MVPA and Condition on MVPA

Executive functioning moderators. Inhibitory control, measured with a Go/NoGo task and a Stroop task, working memory, and task-switching were assessed as moderators of the effect of condition on MVPA. The interaction between Go/NoGo and condition was significant, $\chi^2 = 7.18, p = .028$, indicating that the effect of intervention condition was dependent on inhibitory control as measured by the Go/NoGo task (see Figure 4). Specifically, an analysis of simple slopes indicated that at high levels of inhibitory control (i.e., one standard deviation above the mean), participants in the II condition reported marginally lower MVPA than participants in the information-only condition, $b = -18.73, SE = 10.79, p = .083$, and significantly lower MVPA than participants in the II+T condition, $b = -24.46 SE = 11.71, p = .037$. Additionally, there was a trend that at low levels of inhibitory control (i.e., one standard
deviation below the mean), participants in the II condition reported marginally higher MVPA than participants in the II+T condition, $b = 23.97$, $SE = 12.49$, $p = .055$.

No other proposed executive functioning variables significantly moderated the effect of the interventions on self-reported MVPA (see Table 14). That is, the effect of the II interventions on subsequent MVPA did not change based on individual levels of working memory, task-switching, or inhibitory control as measured by the Stroop task.

Figure 4. Interactive effects of Inhibitory Control and Condition on MVPA
Table 14

Interactions between Executive Functioning Moderators and Condition

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Estimate (SE)</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhibition: Go/NoGo</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Go/NoGo</td>
<td>2.14 (6.55)</td>
<td>.744</td>
<td>-10.70 – 14.97</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-.12 (8.43)</td>
<td>.989</td>
<td>-16.40 – 16.64</td>
</tr>
<tr>
<td>II + T</td>
<td>.77 (8.24)</td>
<td>.925</td>
<td>-15.37 – 16.91</td>
</tr>
<tr>
<td>II Traditional x Go/NoGo</td>
<td>-19.98 (9.96)</td>
<td>.045*</td>
<td>-39.51 – -0.46</td>
</tr>
<tr>
<td>II + T x Go/NoGo</td>
<td>5.26 (9.45)</td>
<td>.578</td>
<td>-13.27 – 23.78</td>
</tr>
<tr>
<td><strong>Inhibition: Stroop</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroop</td>
<td>-1.40 (4.88)</td>
<td>.774</td>
<td>-10.97 – 8.16</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.10 (5.69)</td>
<td>.990</td>
<td>-16.92 – 17.13</td>
</tr>
<tr>
<td>II + T</td>
<td>-.32 (8.46)</td>
<td>.970</td>
<td>-16.90 – 16.27</td>
</tr>
<tr>
<td>II Traditional x Stroop</td>
<td>5.97 (6.36)</td>
<td>.348</td>
<td>-6.49 – 18.42</td>
</tr>
<tr>
<td>II + T x Stroop</td>
<td>7.79 (7.99)</td>
<td>.329</td>
<td>-7.86 – 23.45</td>
</tr>
<tr>
<td><strong>Working Memory</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Memory</td>
<td>-9.44 (4.73)</td>
<td>.046</td>
<td>-18.70 – -.18</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.87 (8.58)</td>
<td>.919</td>
<td>-15.95 – 17.69</td>
</tr>
<tr>
<td>II + T</td>
<td>-.28 (8.26)</td>
<td>.973</td>
<td>-16.47 – 15.90</td>
</tr>
<tr>
<td>II Traditional x Working Memory</td>
<td>5.96 (8.01)</td>
<td>.457</td>
<td>-9.74 – 21.66</td>
</tr>
<tr>
<td>II + T x Working Memory</td>
<td>4.96 (7.63)</td>
<td>.516</td>
<td>-10.00 – 19.92</td>
</tr>
<tr>
<td><strong>Task-Switching</strong>&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task-Switching</td>
<td>-1.76 (5.11)</td>
<td>.731</td>
<td>-11.78 – 8.26</td>
</tr>
<tr>
<td>II Traditional</td>
<td>.92 (8.83)</td>
<td>.917</td>
<td>-16.38 – 18.22</td>
</tr>
<tr>
<td>II + T</td>
<td>-.43 (8.38)</td>
<td>.959</td>
<td>-16.85 – 16.00</td>
</tr>
<tr>
<td>II Traditional x Task-Switching</td>
<td>1.13 (7.10)</td>
<td>.873</td>
<td>-12.78 – 15.04</td>
</tr>
<tr>
<td>II + T x Task-Switching</td>
<td>8.38 (8.70)</td>
<td>.335</td>
<td>-8.66 – 25.43</td>
</tr>
</tbody>
</table>

Note: Executive function variables were standardized prior to moderation analyses.

<sup>a</sup> $\chi^2 = 7.18, p = .028^*$

<sup>b</sup> $\chi^2 = 1.32, p = .516$

<sup>c</sup> $\chi^2 = .72, p = .699$

<sup>d</sup> $\chi^2 = .98, p = .613$
**Personality moderators.** Three variables were tested as personality moderators of the effect of the intervention on subsequent self-reported MVPA: impulsivity (overall), urgency, and conscientiousness. Impulsivity was tested both as a single-factor item encompassing sub-scales of urgency, sensation-seeking, lack of premeditation, and lack of perseverance, and using only the sub-scale of urgency, which has been found in prior research to be the facet of impulsivity that contributes most to the effectiveness of II interventions (Churchill & Jessop, 2010, 2011). None of the proposed personality variables significantly moderated the effect of the interventions on self-reported MVPA (see Table 15), suggesting that the effect of the II interventions on MVPA were not dependent on these personality factors.
Table 15
Interactions between Personality Moderators and Condition

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Estimate (SE)</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulsivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulsivity</td>
<td>13.51 (32.86)</td>
<td>.681</td>
<td>-50.89 – 77.91</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-1.11 (7.83)</td>
<td>.887</td>
<td>-16.46 – 14.23</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.20 (7.30)</td>
<td>.870</td>
<td>-15.50 – 13.11</td>
</tr>
<tr>
<td>II Traditional x Impulsivity</td>
<td>-32.20 (35.20)</td>
<td>.360</td>
<td>-101.20 – 36.80</td>
</tr>
<tr>
<td>II + T x Impulsivity</td>
<td>-19.16 (36.57)</td>
<td>.600</td>
<td>-90.84 – 52.52</td>
</tr>
<tr>
<td>Urgency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urgency</td>
<td>7.70 (14.42)</td>
<td>.593</td>
<td>-20.57 – 35.97</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-1.11 (7.93)</td>
<td>.889</td>
<td>-16.66 – 14.45</td>
</tr>
<tr>
<td>II + T</td>
<td>-1.71 (7.24)</td>
<td>.813</td>
<td>-15.91 – 12.48</td>
</tr>
<tr>
<td>II Traditional x Urgency</td>
<td>-8.78 (16.43)</td>
<td>.593</td>
<td>-40.99 – 23.42</td>
</tr>
<tr>
<td>II + T x Urgency</td>
<td>-6.11 (17.39)</td>
<td>.725</td>
<td>-40.18 – 27.97</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>3.69 (7.95)</td>
<td>.642</td>
<td>-11.88 – 19.27</td>
</tr>
<tr>
<td>II Traditional</td>
<td>-7.74 (12.89)</td>
<td>.550</td>
<td>-32.98 – 17.55</td>
</tr>
<tr>
<td>II + T</td>
<td>2.66 (13.93)</td>
<td>.848</td>
<td>-24.65 – 29.97</td>
</tr>
<tr>
<td>II Traditional x Conscientiousness</td>
<td>3.89 (9.32)</td>
<td>.676</td>
<td>-14.38 – 22.17</td>
</tr>
<tr>
<td>II + T x Conscientiousness</td>
<td>-3.29 (9.48)</td>
<td>.728</td>
<td>-21.87 – 15.29</td>
</tr>
</tbody>
</table>

Note: Personality variables were centered for moderation analyses.

\[a \chi^2 = .95, p = .623\]

\[b \chi^2 = .29, p = .866\]

\[c \chi^2 = 1.12, p = .570\]

Aim 3: Assessing Mediation: Does Plan Quality Account for the Differences in Effectiveness Between II and II+T Interventions?

While there was no direct effect of the intervention on MVPA, it is still possible to test for an indirect effect via plan specificity, as indirect effects may be present even when direct effects are absent (Hayes, 2009). A multilevel mediation model using SEM revealed that, contrary to hypotheses, there was no significant indirect effect of condition on self-reported MVPA via overall plan quality, \(b = 1.40, \text{SE} = 1.94, p = .471\) (see Figure 5). To better
understand the lack of an indirect effect, the component ‘a’ and ‘b’ paths can be assessed. Specifically, the ‘a’ path, condition predicting plan specificity, was significant (b = 5.27, SE = 1.54, p = .001), reflecting that the II+T condition led to greater plan quality than the II condition. However, the ‘b’ path, specificity predicting MVPA while controlling for condition, was not significant (b = .27, SE = .36, p = .458), indicating that greater plan quality was not associated with changes in MVPA.

Figure 5. Mediation Model via Plan Quality

**Aim 3 Supplementary Analyses.** Given that the II+T manipulation produced higher quality plans but plan quality failed to lead to greater MVPA, I conducted a series of post-hoc exploratory analyses to better understand the association between plan specificity and MVPA.
First, I decoupled participants’ plans so that I could analyze IIs for action and IIs for coping with a barrier separately. To test whether number of instrumental action IIs and/or coping IIs affected MVPA, I conducted a GEE predicting MVPA from average specificity of action and coping IIs, controlling for baseline MVPA, intentions for MVPA, demographic controls (age and sport history), and time. I also conducted this analysis using average specificity of action and coping IIs and overall quality score of action and coping IIs. As shown in Table 16, forming a greater number of instrumental coping IIs was associated with greater MVPA; each additional instrumental coping II increases predicted MVPA by 10.69 minutes per day. However, forming a greater number of action IIs was not significantly associated with MVPA. Average specificity of coping IIs and overall quality of coping IIs were also associated with greater MVPA. Surprisingly, average specificity of action IIs predicted marginally lower MVPA, and overall quality of action IIs predicted significantly lower MVPA, with each unit increase in action IIs (on a scale from 0 – 24) predicting a decrease in MVPA of 1.57 minutes per day. Thus, plan quality for action and coping IIs appear to have opposing effects on MVPA.

To test whether the differential effects of action and coping plans explained the lack of direct effect between condition and MVPA, I ran a second mediation model using path analysis in the Structural Equation Modeling (SEM) framework. In this mediation model, action plan quality and coping plan quality were simultaneously modeled as mediators of the relationship between condition and MVPA (See Figure 6). After generating the model with SEM, the indirect effect was tested directly with a product of coefficients test using the nlcom (nonlinear combination of estimators) command, which assesses the magnitude of the indirect effect in relation to the standard error of the indirect effect (Hayes, 2009). Similar to prior analyses, the results indicated that there was no direct effect of condition on MVPA, \( b = 1.65, \ SE = 7.74, p = \)
.832. However, there was a significant indirect positive effect of condition on MVPA via coping plan quality, $b = 4.92$, $SE = 2.42$, $p = .042$. Additionally, there was an approaching-significant trend that indirect negative effect of condition on MVPA via action plan quality, $b = -3.41$, $SE = 2.35$, $p = .146$. Thus, it appears that one reason the II+T condition failed to improve MVPA is that only coping plan quality significantly improved MVPA, whereas action plan quality may have reduced MVPA.

Table 16

Effect of Action and Coping II Quality on MVPA

<table>
<thead>
<tr>
<th></th>
<th>Estimate (SE)</th>
<th>$p$</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specificity Conceptualization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Instrumental IIs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action Plans</td>
<td>-7.37 (5.11)</td>
<td>.150</td>
<td>-17.39 – 2.65</td>
</tr>
<tr>
<td>Coping Plans</td>
<td>10.69 (3.98)</td>
<td>.007**</td>
<td>2.89 – 18.49</td>
</tr>
<tr>
<td>Average Specificity of IIs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action Plans</td>
<td>-4.90 (2.66)</td>
<td>.066†</td>
<td>-10.12 – .33</td>
</tr>
<tr>
<td>Coping Plans</td>
<td>6.84 (2.81)</td>
<td>.015*</td>
<td>1.33 – 12.35</td>
</tr>
<tr>
<td>Overall Quality Score of IIs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action Plans</td>
<td>-1.57 (.78)</td>
<td>.045*</td>
<td>-3.10 – -.03</td>
</tr>
<tr>
<td>Coping Plans</td>
<td>2.21 (.87)</td>
<td>.011*</td>
<td>.51 – 3.91</td>
</tr>
</tbody>
</table>

† $p < .10$
* $p < .05$
** $p < .01$
Figure 6. Mediation Model via Action and Coping Plan Quality
CHAPTER IV
DISCUSSION

The present study tested whether plan quality and subsequent physical activity could be improved through a short online training. Results from the study suggest that while the short online training module did improve plan quality, contrary to hypotheses, neither planning intervention (i.e., Traditional II, II+T) led to greater moderate and vigorous activity (MVPA) compared to the information-only control condition.

Based on prior research, I had hypothesized that a number of motivational, executive function, and personality factors might moderate the effect of the Traditional II and II+T interventions on MVPA, such that even in the absence of a main effect of either intervention, it was possible that the interventions were effective for some people but not others. Of the moderators tested, only two were significant. Specifically, intended MVPA moderated the effect of the intervention, such that among people with high intended MVPA, there was a trend that those in the Traditional II condition were more active than those in the information-only control condition, and among those with no intention to be active, those in the Traditional II intervention were significantly less active than those in the information-only control condition. Surprisingly, there were no significant differences between the II+T condition and the information-only control nor the Traditional II condition, suggesting that any benefits the Traditional II intervention may have provided to high-intenders were not present in the II+T intervention. Additionally, inhibitory control, as measured by the Go/NoGo task, significantly moderated the effect of condition, such that among people with low levels of inhibitory control, there was a
trend that those in the Traditional II condition were more active than those in the II+T condition, and among those with high inhibitory control, those in the II+T condition and information-only control condition were more active than those in the traditional II condition. Implications of these findings are discussed in greater detail below.

The final aim of this study was to test whether the effect of the intervention indirectly affected MVPA via plan quality. This mediation model was not supported; examination of the component paths revealed that while the II+T condition produced higher quality plans than the Traditional II condition, overall plan quality was not associated with MVPA. This lack of effect prompted a series of post-hoc analyses to better understand the relationships between variables. Most notably, I found that when action plan quality (i.e., specifying what, were, when, how) and coping plan quality (i.e., plans for dealing with a barrier) were decoupled and run as separate predictors, they demonstrated opposing effects on MVPA. Specifically, while higher quality coping plans were associated with higher MVPA, higher quality action plans were actually associated with lower MVPA, a finding that will be discussed in greater detail below.

**Aim 1**

The lack of a main effect of either II intervention, while disappointing, is not wholly inconsistent with prior literature, which demonstrated mixed results regarding the role of IIs on physical activity (Bélanger-Gravel, Godin, & Amireault, 2013). Meta-analytic results show that the overall effect of IIs on physical activity appear to be weaker than the overall effect of IIs found across a broad range of health behaviors (Bélanger-Gravel, Godin, & Amireault, 2013; Gollwitzer & Sheeran, 2006). The present study’s findings are thus consistent with a number of prior studies that have failed to find a main effect of II interventions on subsequent physical
activity (e.g., de Vet, Oenema, Sheeran, & Brug, 2009; Godin et al., 2010; Prestwich, Perugini, & Hurling, 2009).

The present study extended past implementation intention research in that it included two II conditions: a Traditional II intervention as well as an II intervention enhanced with a short online training module (II+T). Researchers have implicated low plan quality as a potential reason why II interventions may fail or have small effect sizes (de Vet, Gebhardt, et al., 2011; de Vet, Oenema, et al., 2011). Thus, creating an II+T intervention allowed for a direct test of whether the overall effectiveness of an II intervention could be improved by training people to make higher quality plans. No main effects of either intervention condition were found, suggesting that increasing the effectiveness of IIs for physical activity may not be as simple as improving the quality of the plans people make.

Aim 2

A large body of research has sought to determine individual difference factors which may make II interventions more or less helpful. In the present study, I tested a number of potential moderators within the domains of motivation, executive functioning, and personality. Only intentions for exercise and inhibitory control surfaced as significant moderators of the effect of intervention condition on MVPA, and they reflect a complex relationship between implementation intentions and physical activity.

Intentions for MVPA marginally moderated the relationship between intervention condition and subsequent MVPA. However, upon inspection of the simple slopes, it was found that only the Traditional II condition differed significantly from the information-only control. There was a trend that among people with high intentions, the Traditional II condition led to greater physical activity than the information-only control, but that the opposite was true among
people with very low/nonexistent intentions—the Traditional II condition led to less activity than the control condition. The marginal benefit of IIs at high levels of intention is in line with prior studies which have found that IIs are particularly or exclusively beneficial for those with high intentions (Elliott & Armitage, 2006; Hall et al., 2012; Sheeran et al., 2005; van Osch et al., 2008). This finding can be interpreted through the theoretical lens of phase models of health behaviors, such as the Health Action Process Approach (HAPA; Schwarzer, 2008), which propose that planning is a post-intentional process, relying on intentions to have already been formed. HAPA specifies action and coping plans as mediators of the relationship between intentions and behavior (Schwarzer, 2008); thus, they would not be expected to positively affect physical activity if intentions are very low or nonexistent.

Inhibitory control, as measured by the Go/NoGo task, was also found to significantly moderate the relationship between the II interventions and subsequent physical activity. I had predicted that those with low levels of executive function would particularly benefit from the training intervention, given that a more highly specified plan should, in theory, make the resulting behavior more automatic (Gollwitzer, 1999). Contrary to my hypotheses, among those with low levels of inhibitory control, the Traditional II condition produced marginally higher activity levels than the II+T condition. Among those with high levels of inhibitory control, those in the II+T were significantly more active than those in the Traditional II condition, and those in the information-only control were marginally more active than those in the Traditional II condition. Thus, it appears that for those with low inhibitory control, it is better to make plans with no training or revision, but for those with high inhibitory control, it is better to either not make plans at all, or make plans with training and revision. These findings paint a complex picture of the role of IIs in physical activity. One potential explanation is that for those with low
inhibitory control, creating highly specific plans for physical activity with the help of a training module may set people up for failure. For example, if the training leads a person to create a very ambitious or rigid plan, but that person lacks the inhibitory control to override the old habit and enact the plan in the moment, he or she may experience a sense of failure and lose motivation to continue pursuing his or her physical activity goals. Alternately, for someone with high inhibitory control, a training designed to improve plan specificity might create scenarios in which that person can capitalize on his or her inhibitory control and succeed, contributing to greater motivation and physical activity. However, it is important to also note that among those with high inhibitory control, the II+T and information-only control conditions did not have different effects on physical activity, suggesting that people with high inhibitory control may already be successfully self-regulating their physical activity without the help of IIs.

**Aim 3**

Despite the lack of direct effect of either intervention condition on MVPA, I tested for an indirect effect via plan quality, as indirect effects may be present even in the absence of direct effects (Hayes, 2009). When plan quality was assessed as a single factor, there was no indirect effect of intervention condition on MVPA via plan quality. However, when action and coping plans were assessed as unique mediators, they were found to have opposing indirect effects, with coping plan quality facilitating the effect of the II+T intervention and action plan quality demonstrating a trend toward suppressing the effect of the II+T intervention.

While very few studies have attempted to improve coping plan quality, there is some evidence that improvements to coping plans may provide an indirect path through which II interventions can positively influence physical activity. For example, Evers and colleagues (2012) compared a traditional self-administered II intervention to an II intervention in which
participants were assisted by an experimenter via telephone when making their plans. The authors found that participants who were assisted by an experimenter made a greater number of coping plans than did those in the traditional II condition. While there was no significant direct effect of condition on adherence to physical activity, the authors did find a significant indirect effect, such that condition increased the number of coping plans formed, and the number of coping plans formed was associated with higher physical activity. The findings of the present study expand on the results of Evers and colleagues (2012), as the present study similarly demonstrated a positive relationship between number of instrumental coping plans and MVPA, but also found a significant and positive indirect effect of the intervention on MVPA via coping plan quality, along with a marginal negative indirect effect via action plan quality.

The negative relationship between action plan quality and MVPA is one of the more surprising results of this study, and there are a number of possible explanations for it. Prior research has demonstrated that greater action plan quality is associated with greater goal progress in physical activity (de Vet, Oenema, et al., 2011), but this research is limited to observational studies. Thus, when plan quality emerges organically, without intervention, it appears to promote subsequent health behaviors (de Vet, Oenema, et al., 2011; Vet et al., 2013). However, this may not hold true in the context of an intervention; rather, a person who naturally makes more specific plans may inherently have a better understanding of the specific scenarios in which their action could viably take place, while a person who is trained to make more specific plans may select less appropriate or viable situations in which to act.

A second possible reason for the opposite effects of action plan specificity and coping plan specificity on subsequent physical activity could be that creating highly specific action plans creates a rigid framework for self-regulation, whereas creating highly specific coping plans
creates a more flexible framework. A highly specific action plan specifies what, where, when, and for how long one will be active. This level of specificity may generate a sense of having no other option but to enact the plan as specified; thus, in the face of a barrier preventing that plan, a person may simply give up on the activity altogether. A highly specific coping plan, on the other hand, creates a clear alternative plan of action when an anticipated barrier is encountered, providing an opportunity for flexibly pursuing one’s goal. Recent research suggests that flexibility in the context of self-regulation may be important to consider alongside more rigid strategies (Bayuk, Janiszewski, & Leboeuf, 2010; Kelly & Updegraff, 2017). For example, research shows that when highly specific plans for action are made in the context of holding a rigid mindset, people are less likely to take advantage of unplanned opportunities for goal pursuit, that is, a highly specific plan may create blind spots for other ways to pursue a goal (Bayuk et al., 2010). Additionally, research shows that people with higher levels of cognitive flexibility are more likely to make substitutions in their activities when their original plans are not met, and these substitutions lead to greater physical activity (Kelly & Updegraff, 2017). Thus, in the present study, coping plans may have promoted physical activity by enhancing peoples’ flexibility with regards to goal pursuit, whereas action plans may have prevented physical activity by promoting a sense of rigidity. However, as the present study lacks the data to test these possibilities, future work should incorporate measures of flexibility and rigidity of goal pursuit to better understand the processes at work.

One final possibility for the differential effects of action plan specificity and coping plan specificity is that the structure of the “if…then” implementation intentions may have felt more natural in the context of coping plans compared to action plans, thus leading to better retention and enaction of the coping plans. While implementation intentions are intended for use in both
action and coping plans (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006), in the context of physical activity, the “if…then” format may sound odd to those unfamiliar with it (e.g., “If I get home from work Monday night, then I will go for a 30 minute run”), particularly compared to simply specifying the what, where, when, for how long, details of an action plan (e.g., “I will go for a 30 minute run when I get home from work on Monday night’’). On the other hand, the “if..then” format is well suited to coping with barriers (e.g., “If I feel too tired to go for a run on Monday, then I will go for a brisk walk instead’’). While some have argued for using the “if…then” format in all contexts (Gollwitzer et al., 2010), there is a small amount of research to indicate that the “if…then” format may be less effective in the context of physical activity compared to simply specifying the details (Bélanger-Gravel, Godin, & Amireault, 2013). Future research could manipulate both plan type and plan format to better understand the contextual factors most likely to improve physical activity.

Limitations

While this study makes a number of important contributions to the literature on implementation intentions and plan quality, there are a number of limitations to note. First, the study relies heavily on self-reported physical activity data, which can be prone to memory error or bias. While I supplemented the self-report data with a sub-sample of participants who also wore activity monitors, compliance with the devices was poor, yielding a small sample size with which to compare the self-report data. Additionally, correlations between self-report and accelerometer data at T1 and T2 were fairly weak; only T3 correlations yielded a strong positive association. Despite these limitations, the similar patterns found across self-report and accelerometer data for the main effect of the interventions speak in part to the validity of the self-report data.
The present study is also limited by a short follow-up period, only two weeks long. While this short time frame is not unprecedented (e.g., Conner et al., 2010; de Vet, Oenema, et al., 2011; Milne et al., 2002; Stadler et al., 2009), a meta-analysis of IIs for physical activity found an average length of approximately 11 weeks (Bélanger-Gravel, Godin, & Amireault, 2013), suggesting that the time frame of 2 weeks may not be directly comparable to other II studies which have used considerably longer follow-up periods.

A third limitation is related to the positioning of the manipulation. It was important that the manipulation occur at the end of the baseline session so that all baseline measures would be taken prior to the intervention the intervention would be the last thing participants did before leaving the lab. However, the length of the baseline session (approximately 1.5 hours – 2 hours, depending on condition) may have led to fatigue amongst participants by the time they reached the manipulation. While there is no data to test this hypothesis, research assistants conducting the lab sessions informally noted that many participants appeared fatigued by the time the manipulation occurred. This may have affected participants’ ability to make high-quality plans across both II conditions, reflected in low averages on specificity and quality scores.

Finally, the study is limited by characteristics of the sample. Participants were college students who received course credit for participating in the study. Given that the study was advertised as a study about physical activity, it is likely that people with an existing interest in physical activity self-selected into the study. The sample was predominantly female (72%) and white (67%), further limiting the generalizability of the study. Future research should examine the relationships between IIs, II quality, and physical activity among a more varied adult population. Additionally, given the nearly significant benefit for those with low inhibitory
control, future work might benefit from targeting populations known to be low in inhibitory control.

Conclusions

Physical activity is an important health behavior, conferring a number of health benefits to those who engage in it at recommended levels. However, given that many people fail to meet recommended levels of physical activity, identifying ways to improve adherence to physical activity is crucial. While making plans for exercise may be one way to help people improve physical activity levels, the results of the present study indicate that the effect of plans on physical activity is complex. While the present study found no main effect of either a traditional planning intervention or a planning intervention supplemented with a training module, it also demonstrated that planning may be a useful strategy for those with high intentions for physical activity. The present study extended prior research on exercise plans by testing whether plan quality and subsequent physical activity could be improved through completion of a short online training module. While the training succeeded in improving plan quality, it did not lead to greater physical activity. Results suggest that the improvements to action plans and coping plans had opposing effects on physical activity, with coping plan quality promoting physical activity, and action plan quality inhibiting it. Thus, future studies should isolate coping planning and action planning as singular targets for intervention, given that they may not confer consistent effects. Future research should also seek to examine the roles of action and coping II specificity in the context of other health domains.
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http://doi.org/10.1016/S0140-6736(04)17018-9


APPENDIX A

MEASURES
APPENDIX A

MEASURES

International Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?
- No vigorous physical activities
- 1 day per week
- 2 days per week
- 3 days per week
- 4 days per week
- 5 days per week
- 6 days per week
- 7 days per week

How much time did you usually spend doing **vigorous** physical activities on one of those days?

- Hours per day: __________
- Minutes per day: __________

Think about all the **moderate** activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time. Think only about those physical activities that you did for at least 10 minutes at a time.
During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

- No moderate physical activities
- 1 day per week
- 2 days per week
- 3 days per week
- 4 days per week
- 5 days per week
- 6 days per week
- 7 days per week

How much time did you usually spend doing moderate physical activities on one of those days?
Hours per day:
Minutes per day:

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
- No walking
- 1 day per week
- 2 days per week
- 3 days per week
- 4 days per week
- 5 days per week
- 6 days per week
- 7 days per week

How much time did you usually spend walking on one of those days?
Hours per day:
Minutes per day:

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

During the last 7 days, how much time did you spend sitting on a week day?
Hours per day:
Minutes per day:

High School Sport Participation
During your junior and senior years of high school, on how many sports teams did you play?

(Count any teams run by your school or community groups.)

☐ 0 teams
☐ 1 team
☐ 2 teams
☐ 3 or more teams
**Past Year Physical Activity**

Consider all the activity you have done over the past year. For each activity listed below, indicate the number of months you did the activity in the past year (max 12). Leave blank if you did not do the activity. For each activity you indicated number of months for, estimate the typical number of hours per week during a month you did that activity. For example, I tend to run May-September, so I would indicate 5 months on the "Jogging" line. I usually run 3 days a week for 30 minutes at a time, so I would indicate 1.5 hours per week.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number of Months</th>
<th>Typical number of hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking for exercise (outdoor, indoor at mall, treadmill)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hiking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair-climbing machine</td>
<td></td>
<td></td>
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<tr>
<td>Jogging or running (outdoor, treadmill)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycling (stationary, outdoor)</td>
<td></td>
<td></td>
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<tr>
<td>Horseback riding</td>
<td></td>
<td></td>
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<tr>
<td>Dancing (social, ballet, tap)</td>
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<td></td>
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<tr>
<td>Gymnastics</td>
<td></td>
<td></td>
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<tr>
<td>Calisthenics/toning exercises</td>
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<td></td>
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<tr>
<td>Yoga</td>
<td></td>
<td></td>
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<tr>
<td>Aerobics/Jazzercise</td>
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<tr>
<td>Lifting weights</td>
<td></td>
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<tr>
<td>Swimming for exercise (i.e., laps)</td>
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<td></td>
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<tr>
<td>Rowing/canoeing/kayaking/rowing machine</td>
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<td></td>
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<tr>
<td>Water skiing</td>
<td></td>
<td></td>
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<tr>
<td>Downhill skiing</td>
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<td></td>
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<tr>
<td>X-country skiing/ski machine</td>
<td></td>
<td></td>
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<tr>
<td>Skating (ice, roller, in-line)</td>
<td></td>
<td></td>
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<tr>
<td>Tennis</td>
<td></td>
<td></td>
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<tr>
<td>Other racquet sports</td>
<td></td>
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<tr>
<td>Softball/baseball</td>
<td></td>
<td></td>
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<tr>
<td>Golf (use golf cart)</td>
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<tr>
<td>Golf (walking)</td>
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<tr>
<td>Volleyball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td></td>
<td></td>
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<tr>
<td>Bowling</td>
<td></td>
<td></td>
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<tr>
<td>Other:</td>
<td></td>
<td></td>
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</tbody>
</table>
High School Physical Activity

Now we'd like you to consider all the activity you did during your last two years of high school. For each activity listed below, indicate the number of years you did the activity in the last two years of high school (max 2). Leave blank if you did not do the activity. Then, indicate the average number of months you did the activity. For each activity you indicated number of years and months for, estimate the typical number of hours per week during a month you did that activity. For example, I did calisthenics/toning my senior, but not my junior, year of high school-- I would indicate 1 year, 4 months because I did it Fall semester, and 2 hours per week.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number of Years</th>
<th>Number of Months</th>
<th>Typical number of hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking for exercise (outdoor, indoor at mall, treadmill)</td>
<td></td>
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<td>Hiking</td>
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<td>Stair-climbing machine</td>
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<tr>
<td>Jogging or running (outdoor, treadmill)</td>
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</tr>
<tr>
<td>Bicycling (stationary, outdoor)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horseback riding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dancing (social, ballet, tap)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gymnastics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calisthenics/toning exercises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoga</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerobics/Jazzercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifting weights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swimming for exercise (i.e., laps)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rowing/canoeing/kayaking/rowing machine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water skiing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downhill skiing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-country skiing/ski machine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skating (ice, roller, in-line)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tennis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other racquet sports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softball/baseball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golf (use golf cart)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golf (walking)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volleyball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Physical Activity Intentions

National recommendations for physical activity are 150 minutes per week of moderate activity OR 75 minutes of vigorous activity OR an equivalent combination of the two.

I intend to...

<table>
<thead>
<tr>
<th>Activity</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...exercise several times a week</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...work up a sweat regularly</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...exercise regularly</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...meet national recommendations for physical activity</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...increase my leisure time activity</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Physical Activity Intentions: IPAQ-Congruent

Over the **next 2 weeks**, on how many days per week do you intend to do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling? Do not include moderate activities or walking.
- No intention
- 1 day per week
- 2 days per week
- 3 days per week
- 4 days per week
- 5 days per week
- 6 days per week
- 7 days per week

How much time do you intend to spend doing **vigorous** physical activities on one of those days?
- Hours per day:
- Minutes per day:

Over the **next 2 weeks**, on how many days per week do you intend to do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
- No intention
- 1 day per week
- 2 days per week
- 3 days per week
- 4 days per week
- 5 days per week
- 6 days per week
- 7 days per week

How much time do you intend to spend doing **moderate** physical activities on one of those days?
- Hours per day:
- Minutes per day:

## Self-Efficacy (Task)

Certain barriers make it hard to exercise. How confident are you that you can exercise regularly?

<table>
<thead>
<tr>
<th></th>
<th>Not at all confident</th>
<th>Somewhat confident</th>
<th>Completely confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can change to a physically active lifestyle.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can be physically active once a week.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can be physically active at least 3 times a week for 30 minutes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can do 150 minutes per week of moderate activity OR 75 minutes of vigorous activity OR some combination of the two</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Self-Efficacy (Maintenance)**

How confident are you that you can maintain a physically active lifestyle?
I am sure I can be physically active on a regular basis...

<table>
<thead>
<tr>
<th></th>
<th>Not at all confident</th>
<th>Somewhat confident</th>
<th>Completely confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>even if it takes me a long time to make it a habit.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I am worried and troubled.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I don’t see success at once.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I am tired.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I am stressed out.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I feel tense.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I won’t get social support for my first attempts.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if I have to start all over again several times until I succeed.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if my partner/ family isn’t physically active.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if my cholesterol doesn’t improve immediately.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>even if my blood pressure doesn’t improve immediately.</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

### Spontaneous Action Planning

Do you already have specific plans with regard to exercising? I already have specific plans for...

<table>
<thead>
<tr>
<th>Not at all true</th>
<th>Some what true</th>
<th>Completely true</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
</tr>
<tr>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
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<tr>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
</tr>
</tbody>
</table>

...when to exercise.
...where to exercise.
...how to exercise.
...how often to exercise.
...with whom to exercise.

---

### Spontaneous Coping Planning

Do you already have specific plans for your new exercise schedule (habits)? I already have specific plans for...

<table>
<thead>
<tr>
<th>Not at all true</th>
<th>Some what true</th>
<th>Completely true</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
</tr>
<tr>
<td><img src="true" alt="checkmark" /></td>
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<tr>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
<td><img src="true" alt="checkmark" /></td>
</tr>
</tbody>
</table>

...what to do if something gets in my way.
...what to do if I miss an exercise session.
…what to do in difficult situations in order to stick to my intentions.
…what to watch out for in order to stay committed.

---

**Behavioral Regulation in Exercise Questionnaire (Self-Concordance)**

Please indicate the extent to which each statement below is true for you.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not true for me</th>
<th>Sometim es true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>I exercise because other people say I should</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I take part in exercise because my friends/family/spouse say I should</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I exercise because others will not be pleased with me if I don't</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I feel under pressure from my friends/family to exercise</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I feel guilty when I don’t exercise</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I feel ashamed when I don’t exercise</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I feel like a failure when I haven’t exercise in a while</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I value the benefits of exercise</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>It’s important to me to exercise regularly</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I think it is important to make the effort to exercise regularly</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I get restless if I don’t exercise regularly</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I exercise because it’s fun</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I enjoy my exercise sessions</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I find exercise a pleasurable activity</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I get pleasure and satisfaction from participating in exercise</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a reserved and cautious attitude toward life.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My thinking is usually careful and purposeful.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am not one of those people who blurt out things without thinking.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I like to stop and think things over before I do them.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I don't like to start a project until I know exactly how to proceed.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I tend to value and follow a rational, &quot;sensible&quot; approach to things.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I usually make up my mind through careful reasoning.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am a cautious person.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Before I get into a new situation I like to find out what to expect from it.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I usually think carefully before doing anything.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Before making up my mind, I consider all the advantages and disadvantages.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have trouble controlling my impulses.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have trouble resisting my cravings (for food, cigarettes, etc.).</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I often get involved in things I later wish I could get out of.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I feel bad, I will often do things I later regret in order to make myself feel better now.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I am upset I often act without thinking.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I feel rejected, I will often say things that I later regret.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>It is hard for me to resist acting on my feelings.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I often make matters worse because I act without thinking when I am upset.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>In the heat of an argument, I will often say things that I later regret.</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am always able to keep my feelings under control.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>Sometimes I do things on impulse that I later regret.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I generally seek new and exciting experiences and sensations.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I'll try anything once.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I like sports and games in which you have to choose your next move very quickly.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would enjoy water skiing.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I quite enjoy taking risks.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would enjoy parachute jumping.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would like to learn to fly an airplane.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I sometimes like doing things that are a bit frightening.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would enjoy the sensation of skiing very fast down a high mountain slope.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would like to go scuba diving.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I would enjoy fast driving.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I generally like to see things through to the end.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I tend to give up easily.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>Unfinished tasks really bother me.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>Once I get going on something I hate to stop.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I concentrate easily.</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I finish what I start.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>I'm pretty good about pacing myself so as to get things done on time.</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am a productive person who always gets the job done.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>Once I start a project, I almost always finish it.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td>There are so many little jobs that need to be done that I sometimes just ignore them all.</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
</tr>
</tbody>
</table>

Goldberg Big 5 Personality Markers

How accurately can you describe yourself? Please use this list of common human traits to describe yourself as accurately as possible. Describe yourself as you see yourself at the present time, not as you wish to be in the future. Describe yourself as you are generally or typically, as compared with other persons you know of the same sex and of roughly your same age.

Before each trait, please write a number indicating how accurately that trait describes you, using the following rating scale:

<table>
<thead>
<tr>
<th>Inaccurate</th>
<th>Accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely</td>
<td>9</td>
</tr>
<tr>
<td>Very</td>
<td>8</td>
</tr>
<tr>
<td>Quite</td>
<td>7</td>
</tr>
<tr>
<td>Slightly</td>
<td>6</td>
</tr>
<tr>
<td>Neither</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active</th>
<th>Extraverted</th>
<th>Negligent</th>
<th>Trustful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreeable</td>
<td>Fearful</td>
<td>Nervous</td>
<td>Unadventurous</td>
</tr>
<tr>
<td>Anxious</td>
<td>Fretful</td>
<td>Organized</td>
<td>Uncharitable</td>
</tr>
<tr>
<td>Artistic</td>
<td>Generous</td>
<td>Philosophical</td>
<td>Uncooperative</td>
</tr>
<tr>
<td>Assertive</td>
<td>Haphazard</td>
<td>Pleasant</td>
<td>Uncreative</td>
</tr>
<tr>
<td>Bashful</td>
<td>Harsh</td>
<td>Practical</td>
<td>Undemanding</td>
</tr>
<tr>
<td>Bold</td>
<td>Helpful</td>
<td>Prompt</td>
<td>Undependable</td>
</tr>
<tr>
<td>Bright</td>
<td>High-strung</td>
<td>Quiet</td>
<td>Unemotional</td>
</tr>
<tr>
<td>Careful</td>
<td>Imaginative</td>
<td>Relaxed</td>
<td>Unenvious</td>
</tr>
<tr>
<td>Careless</td>
<td>Imperceptive</td>
<td>Reserved</td>
<td>Unexcitable</td>
</tr>
<tr>
<td>Cold</td>
<td>Imperturbable</td>
<td>Rude</td>
<td>Unimaginative</td>
</tr>
<tr>
<td>Complex</td>
<td>Impractical</td>
<td>Self-pitying</td>
<td>Uninquisitive</td>
</tr>
<tr>
<td>Conscientious</td>
<td>Inconsistent</td>
<td>Selfish</td>
<td>Unintellectual</td>
</tr>
<tr>
<td>Considerate</td>
<td>Inefficient</td>
<td>Shallow</td>
<td>Unintelligent</td>
</tr>
<tr>
<td>Cooperative</td>
<td>Inhibited</td>
<td>Shy</td>
<td>Unkind</td>
</tr>
<tr>
<td>Creative</td>
<td>Innovative</td>
<td>Simple</td>
<td>Unreflective</td>
</tr>
<tr>
<td>Daring</td>
<td>Insecure</td>
<td>Sloppy</td>
<td>Unrestrained</td>
</tr>
<tr>
<td>Deep</td>
<td>Intellectual</td>
<td>Steady</td>
<td>Unsophisticated</td>
</tr>
<tr>
<td>Demanding</td>
<td>Introjective</td>
<td>Sympathetic</td>
<td>Unsympathetic</td>
</tr>
<tr>
<td>Disorganized</td>
<td>Introverted</td>
<td>Systematic</td>
<td>Unsystematic</td>
</tr>
<tr>
<td>Distrustful</td>
<td>Irritable</td>
<td>Talkative</td>
<td>Talkative</td>
</tr>
<tr>
<td>Efficient</td>
<td>Jealous</td>
<td>Temperamental</td>
<td>Verbal</td>
</tr>
<tr>
<td>Emotional</td>
<td>Kind</td>
<td>Thorough</td>
<td>Vigorous</td>
</tr>
<tr>
<td>Energetic</td>
<td>Moody</td>
<td>Timid</td>
<td>Warm</td>
</tr>
<tr>
<td>Envious</td>
<td>Neat</td>
<td>Touchy</td>
<td>Withdrawn</td>
</tr>
</tbody>
</table>

Executive/Cognitive Proxies

What is your current overall GPA?

In what year did you take the SAT and ACT, and what were your scores? Leave the spaces blank for any test you did not take.

SAT year:
SAT score:
ACT year:
ACT score:

Demographics

Gender
○ Male
○ Female

Age

Height
Feet
Inches

Weight in pounds (lbs)

What is your race/ethnicity? If you identify with more than one race/ethnicity, please select all that apply.
○ White/Caucasian
○ African American
○ Hispanic
○ Asian
○ Native American
○ Pacific Islander
○ Other (please specify) ____________________
Implementation Intention Memory

Think back to the plans you formed last week in regard to your physical activity. Please recall those plans as accurately as possible in the spaces below. Try to remember the exact plans you set, whether or not you completed them this week.

Confidence in Plan Memory

<Recalled Plan 1 shown here>
How confident are you that this reflects the plan you set last week?

<table>
<thead>
<tr>
<th>Not at all confident</th>
<th>Somewhat confident</th>
<th>Completely confident</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<Recalled Plan 2 shown here>
How confident are you that this reflects the plan you set last week?

<table>
<thead>
<tr>
<th>Not at all confident</th>
<th>Somewhat confident</th>
<th>Completely confident</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(etc.)

Execution of Plans

Execution of Plans Part A
<Recalled Plan 1 shown here>
Did you carry out this plan in the last week?
- Carried out the plan exactly
- Carried out the plan with modifications >> Execution Part B
- Did not carry out the plan at all >> Execution Part C
Execution of Plans Part B
Please check the box next to any modifications you made to this plan during the week, and describe the change in the space provided.

- Changed day
- Changed time
- Changed activity
- Changed duration
- Changed location
- Other

Describe the change you made:
__________________________________________________________________________

Execution of Plans Part C
What prevented you from carrying out this plan? (Check all that apply)

- I forgot about it
- I didn’t have the time
- I didn’t have the motivation
- I didn’t have the resources (e.g., no facility to exercise at or no way to get to exercise facility)
- I didn’t have enough support from friends or family
- I didn’t want to feel the discomfort of exercise
- Other: ______________

(etc. for each recalled plan)

Debriefing Questions

What do you think the purpose of this study was?
APPENDIX B

EXPERIMENTAL MANIPULATION MATERIALS
APPENDIX B

EXPERIMENTAL MANIPULATION MATERIALS

Information-Only Control
(Information-Only Control, II, and II+T Conditions)

We're going to share some information about national recommendations for physical activity. These provide good guidelines for the amount of physical activity adults need to experience the health benefits of physical activity. Please read carefully through the following information. Pay close attention because there will be a short quiz after you finish!

Do you know the national recommendations for physical activity? Each week, adults should get either:

- 150 minutes of moderate-intensity activity, OR
- 75 minutes of vigorous-intensity activity, OR
- An equivalent combination of moderate and vigorous activity

Moderate-intensity aerobic activity means you're working hard enough to raise your heart rate and break a sweat. One way to tell is that you'll be able to talk, but not sing the words to your favorite song. Here are some examples of activities that require moderate effort:

- Walking fast
- Doing water aerobics
- Riding a bike on level ground or with few hills
- Playing doubles tennis
- Pushing a lawn mower

Which of the following is NOT a moderate-intensity exercise?

- Walking fast (1)
- Breaking a sweat on the elliptical (2)
- Cleaning the kitchen (3)
- Going on a bike ride (4)

If Cleaning the kitchen is selected
Correct! Cleaning the kitchen is NOT a moderate-intensity activity. It is a light intensity activity.

If Cleaning the kitchen is not selected
Incorrect. The activity that is NOT a moderate-intensity activity is cleaning the kitchen. It is a light intensity activity.
Vigorous-intensity aerobic activity means you're breathing hard and fast, and your heart rate has gone up quite a bit. If you're working at this level, you won't be able to say more than a few words without pausing for a breath. Here are some examples of activities that require vigorous effort:

- Jogging or running
- Swimming laps
- Riding a bike fast or on hills
- Playing singles tennis
- Playing basketball

----

Which of the following is a vigorous-intensity exercise?

- Leisurly swimming in the pool (1)
- Going for a run (2)
- Breaking a sweat on the stationary bike (3)
- Brisk walking (4)

**Answer If Going for a run Is Selected**
Correct! Going for a run is a vigorous-intensity activity. The other options are either light (leisurely swimming) or moderate (breaking a sweat on a stationary bike and brisk walking).

**Answer If Going for a run Is Not Selected**
Incorrect. Going for a run is a vigorous-intensity activity. The other options are either light (leisurely swimming) or moderate (breaking a sweat on a stationary bike and brisk walking).

----

Jesse is trying to meet the national guidelines for physical activity. Which of the following would meet the recommendations?

- Walking briskly for 30 minutes 5 days a week (1)
- Taking a 40-minute vigorous martial arts class two days a week (2)
- Taking a 35-minute vigorous spin/cycling class, and walking briskly for 30 minutes 3 days a week (3)
- All of the above meet the recommendations. (4)

**Answer If All of the above meet the recommendations. Is Selected**
Correct! All of the options would meet national recommendations, which state that each week, adults should get either: 150 minutes of moderate-intensity activity, OR 75 minutes of vigorous-intensity activity, OR An equivalent combination of moderate and vigorous activity.

**Answer If All of the above meet the recommendations. Is Not Selected**
Incorrect. All of the options would meet national recommendations, which state that each week, adults should get either: 150 minutes of moderate-intensity activity, OR 75 minutes of vigorous-intensity activity, OR An equivalent combination of moderate and vigorous activity.
Information-Only Select Screenshots:

We're going to share some information about national recommendations for physical activity. These provide good guidelines for the amount of physical activity adults need to experience the health benefits of physical activity.

Please read carefully through the following information. Pay close attention because there will be a short quiz after you finish!

**Moderate**-intensity aerobic activity means you're working hard enough to raise your heart rate and break a sweat. One way to tell is that you'll be able to talk, but not sing the words to your favorite song. Here are some examples of activities that require moderate effort:

- Walking fast
- Doing water aerobics
- Riding a bike on level ground or with few hills
- Playing doubles tennis
- Pushing a lawn mower
Which of the following is **NOT** a moderate-intensity exercise?

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking fast</td>
</tr>
<tr>
<td>Breaking a sweat on the elliptical</td>
</tr>
<tr>
<td>Cleaning the kitchen</td>
</tr>
<tr>
<td>Going on a bike ride</td>
</tr>
</tbody>
</table>

Correct! Cleaning the kitchen is **NOT** a moderate-intensity activity. It is a light intensity activity.
Traditional Implementation Intention Intervention  
(II and II+T Conditions)

Usually, it is easier to implement our good intentions to be physically active on a regular basis if we have a good plan regarding what kind of activities we want to perform, when and where we want to perform them.

Researchers have found that plans tend to be especially helpful when they are made as "if - then" statements, such as "If I am hungry and want an unhealthy snack after work, then I will eat an apple instead!" or "If it is 8pm on a weekday, then I will prepare a healthy lunch for tomorrow!" Notice that the "if" statement can refer to an internal cue like a craving or feeling or to an external cue such as a particular time of day or a moment in time.

Please take a few minutes to form at least one, and up to three if-then plans about where, when and how you will be physical active over the next week in the space below.

1. If ________________________________________________________, then _______________________________________________________

2. If ________________________________________________________, then _______________________________________________________

3. If ________________________________________________________, then _______________________________________________________

Many obstacles could occur when we want to integrate physical activity in our daily lives. In order to overcome these obstacles, the first step is to identify them. Please list your main obstacles to being physically active in the space below. For now, don’t worry about order.

_______________
_______________
_______________

Now, take a moment to consider your obstacles and rank order them, with “1” being your most important obstacle, “2” being your next most important, and so on.

_____
You indicated that your most important obstacle was: <<highest-ranked obstacle shows here>>

Now that you have identified your most important barrier, take a moment to contemplate potential solutions to overcome it. (e.g., “If I am too tired to cook dinner at 7pm, then I will eat a prepared salad!” or “If I forget to make my lunch the night before, then I will make it first thing in the morning when I wake up!”) Please take a few minutes to form three if-then plans about overcoming this barrier to physical activity in the spaces below.

Please take a few minutes to form at least one, and up to three if-then plans about overcoming this barrier to physical activity in the spaces below.

1. If ___________________________________________________________,
   then _________________________________________________________

2. If ___________________________________________________________,
   then _________________________________________________________

3. If ___________________________________________________________,
   then _________________________________________________________

Please take a moment to read through the plans you have created. Many people find it helpful to visualize their if-then plans. The "next" button will not display until 15 seconds have passed, but feel free to take as much time as you need! When you're done, you can click the "next" button.
Traditional Implementation Intention Condition Select Screenshots:

Usually, it is easier to implement our good intentions to be physically active on a regular basis if we have a good plan regarding what kind of activities we want to perform, as well as when and where we want to perform them.

Researchers have found that plans tend to be especially helpful when they are made as "if-then" statements, such as "If I am hungry and want an unhealthy snack after work, then I will eat an apple instead!" or "If it is 8pm on a weekday, then I will prepare a healthy lunch for tomorrow!" Notice that the "if" statement can refer to an internal cue like a craving or feeling or to an external cue such as a particular time of day or a moment in time.

Please take a few minutes to form three if-then plans about where, when and how you will physically active **over the next two weeks** in the space below.

Please note that you should write down plans for **physical activity**, NOT plans for other health behaviors (e.g., don’t write diet or study plans here!)

**Plan 1:**

If... 
then...

It is a weekday
I will go to the rec center for a half hour

**Plan 2:**

If...
then...

The weather is nice Saturday
I will go on a hike

**Plan 3:**

If...
then...

I finish class at 5pm on Tuesday
I will go to my yoga class
Many obstacles could occur when we want to integrate physical activity in our daily lives. In order to overcome these obstacles, the first step is to identify them. Please list your main obstacles to being physically active in the space below. For now, don’t worry about order.

1. feeling too lazy
2. not having enough time
3. wanting to do other things instead

Now, take a moment to consider your obstacles and rank order them, with “1” being your most important obstacle, “2” being your next most important, and so on.

1. not having enough time
2. wanting to do other things instead
3. feeling too lazy
You indicated that your most important obstacle was:

not having enough time

Now that you have identified your most important barrier, take a moment to contemplate potential solutions to overcome it. (e.g., "If I am too tired to cook dinner at 7pm, then I will eat a prepared salad!" or "If I forget to make my lunch the night before, then I will make it first thing in the morning when I wake up!"

Please take a few minutes to form three if-then plans about overcoming this barrier to physical activity in the spaces below.

Plan 1:

If... I don't have enough time to go to the gym
then... I will do a 15 minute workout video at home

Plan 2:

If... I don't have enough time to do a full workout
then... I will take 2-minute breaks to do high intensity activity

Plan 3:

If... it's a weekday evening
then... I will set my alarm for 5:30am so I can go to the gym early
Training Module: Plan Instrumentality and Specificity
(II+T Condition)

Planning is important, but not all plans are equally effective—it is important to make a high quality plan. Research shows that when people form high quality plans, they are more likely to reach their goals. What does a high quality plan look like? There are two important components: first, that your plan is instrumental—that it actually will actually help you reach your goal—and second, that your plan is specific—that it includes all the details so that you can recognize a good opportunity to put your plan into action, and so you don’t have to make decisions in the moment. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (often day/time), and for how long you’ll do it.

Today, you’ll learn to critique other people’s plans to become better at creating and critiquing your own. First, we’ll walk you through a few examples of good and bad plans, describing along the way the components you should look for. Then, we’ll give you a short practice test in which you’ll be critiquing people’s plans.

The examples you’ll be seeing are from people who have a goal of learning to play piano. Keep this in mind as you read through the examples. Keep this in mind as you read through the examples.

Instrumentality:
Instrumentality refers to whether or not your plan is effective—whether it will actually help you achieve your goal. An instrumental goal is one that will conceivably help you reach your goal. A non-instrumental goal is one that does not help you reach your goal (and might even hinder you from reaching your goal!). This probably sounds like common sense, but, believe it or not, we see a lot of plans that are not instrumental!

Let’s compare the following two plans:

Non-instrumental:
If I don’t feel motivated to practice piano, then I’ll watch TV instead.

Instrumental:
If I don’t feel motivated to practice piano, then I’ll set a timer and practice for 10 minutes.

Notice how the non-instrumental plan essentially gives into the temptation not to practice! This plan does not help the individual toward their goal of learning to play piano. The instrumental plan, on the other hand, helps the individual stay on track to learn to play!
We always want our plans for healthy behaviors to be instrumental. Otherwise we put ourselves at risk of sabotaging our goals. Here’s another example of a non-instrumental plan and a much better instrumental alternative.

Non-instrumental:

If I get home from school tomorrow afternoon, then I'll relax for 30 minutes.

Instrumental:

If I get home from school tomorrow afternoon, then I'll practice piano for 30 minutes before relaxing.

Now that you’ve got the hang of instrumental and non-instrumental plans, let’s talk about specificity.

Specificity:

Plan specificity is all about how many details you include in your plan. The thought behind this is that the more specific you make your plan, the more automatic the behavior will be—rather than having to make decisions at the critical moment, you’ve already made those decisions and can simply carry them out. Unlike instrumentality, specificity isn’t a yes or no thing, it’s a spectrum. Your plan can be really vague or really specific. What’s more, we can look at specificity of both the cue—the “if” part of the plan—and the response—the “then” part of the plan.

Let’s start with a plan that has a really non-specific cue and build on it until it’s a much better and more specific plan.

Very vague cue:

If I have time, then I'll practice piano.

You can see in this example that the cue (“If I have time”) is very vague. The problem with a vague cue is that it will apply to so many moments, it will be virtually impossible to detect those moments as a time to act. Let’s make the cue more specific:

Somewhat specific cue:

If it's Wednesday, then I'll practice piano.

The cue is now somewhat specific because we’ve specified a certain time period—Wednesday. Now, instead of the cue applying to "if I have time," it’s specific to the exact day. However, we can make the cue even more specific:

Highly specific cue:

If I have just finished dinner at home on Wednesday evening, then I'll practice piano.
Now, the cue will be more easily brought to mind because it’s tied to a specific place (home) and a time (evening; right after dinner). *This is a good cue!*

---

Let’s look at one more set of if-then plans with different degrees of cue specificity:

**Very vague cue:**

*If I’m feeling unmotivated, then I’ll remind myself that the recital is in 2 weeks and I want to perform well.*

**Somewhat specific cue:**

*If it’s time to practice and I’m feeling unmotivated, then I’ll remind myself that the recital is in 2 weeks and I want to perform well.*

**Highly specific cue:**

*If it’s time to practice on Monday afternoon and I’m feeling unmotivated, then I’ll remind myself that the recital is in 2 weeks and I want to perform well.*

Again, the most specific cue is particular about when and where you should do the behavior. This is much more likely to lead to success than a very vague or only somewhat specific cue.

---

Let’s think now about the level of specificity in a *response*. Again, we’ll start with a very vague response and build on it until we have a specific response.

**Very vague response:**

*If I wake up on Saturday morning, then I will try to do something piano-related.*

The response “try to do something piano-related” is vague in that it could encompass a wide variety of things (reading books on piano, looking up sheet music, listening to music, practicing). The problem with a vague response is that, in the moment, you don’t have a precise plan for what to do. That makes it much harder to put into action when the time comes.

**Somewhat specific response:**

*If I wake up on Saturday morning, then I will practice piano.*

The response is now somewhat specific because the behavior is clearer--the individual will practice piano. However, the response could be specified even more clearly.

**Very specific response:**

*If I wake up on Saturday morning, then I will spend 30 minutes practicing my scales and assigned songs for the week.*
Now, the response contains not only a very specific behavior (practicing scales and songs), but also the duration that the activity will last. Now, when the individual wakes up on Saturday, he or she knows exactly what to do. This highly specific response is much more likely to lead to success than the less specific responses.

----

Let’s look at one more set of if-then plans with different degrees of response specificity:

Very vague response:
   *If I am invited to meet up with friends during my scheduled practice time, then I will prioritize piano practice.*

Somewhat specific response:
   *If I am invited to meet up with friends during my scheduled practice time, then I will practice piano before going out.*

Highly specific response:
   *If I am invited to meet up with friends during my scheduled practice time, then I will practice piano my recital music for at least 20 minutes before going out.*

Hopefully, at this point, you have a better understanding of what a very specific cue and response look like!

----

**Practice Test on Specificity and Instrumentality of Plans**

We’re going to give you a short practice test to see how much you’ve learned! We will be grading your responses as you go, so please do your best!

----

In the instructional section, we used the example of people who were trying to eat more healthfully. In this practice test, we’re going to use a different behavior. All of the examples will pertain to an individual trying to improve their study habits.

----

**Problem # 1**

Use the following if-then plan to answer the next three questions:

   *If I have free time, then I will spend 30 minutes creating flashcards for my Biology exam.*

Is this an instrumental or non-instrumental plan?
- Instrumental
- Non-instrumental
Answer If Instrumental Is Selected

Correct! This is an instrumental plan!

Answer If Non-instrumental Is Selected

Incorrect. This plan is instrumental because creating flashcards is indeed promoting better study habits. Thus, it is supporting the individual's goal of improving their study habits.

----

Are the cue and response highly specific?
- Only the cue is highly specific
- Only the response is highly specific
- Neither the cue nor the response are highly specific
- Both the cue and the response are highly specific

Answer If Only the response is highly specific Is Selected

Correct! The cue (if I have free time) is not highly specific, but the response (then I will spend 30 minutes creating flashcards for my Biology exam) is highly specific because it details the activity as well as its duration.

Answer If Only the response is highly specific Is Not Selected

Incorrect. The cue (if I have free time) is not highly specific, but the response (then I will spend 30 minutes creating flashcards for my Biology exam) is highly specific because it details the activity as well as its duration.

----

Which of the following is the most specific option to replace the cue?

- If I have free time between classes...
- If it’s my break between Biology class and English class...
- If there is an exam tomorrow...

Answer If It’s my break between Biology class and English class on Monday… Is Selected

Correct! "If it's my break between Biology class and English class on Monday" is the most specific cue because the moment in time is most clearly specified. "If I have free time between classes" is too vague because it applies to too many situations. "If there is an exam tomorrow" is too vague because it doesn't specify the particular moment--it could apply to any time before the day of the exam.

Answer If It’s my break between Biology class and English class on Monday… Is Not Selected

Incorrect. "If it's my break between Biology class and English class on Monday" is the most specific cue because the moment in time is most clearly specified. "If I have free time between classes" is too vague because it applies to too many situations. "If there is an exam tomorrow" is too vague because it doesn't specify the particular moment--it could apply to any time before the day of the exam.
Problem # 2
Use the following if-then plan to answer the next three questions:
If I get home from class on a weekday and I feel like watching TV instead of studying, then I will immediately pack up my study materials and go to the library to study for an hour.

Is this an instrumental or non-instrumental plan?
- Instrumental
- Non-instrumental

Answer If Instrumental Is Selected
Correct! This is an instrumental plan because it is viable and will help the individual in their goal to improve study habits.

Answer If Instrumental Is Not Selected
Incorrect. This is an instrumental plan because it is viable and will help the individual in their goal to improve study habits.

Are the cue and response highly specific?
- Only the cue is highly specific
- Only the response is highly specific
- Neither the cue nor the response are highly specific
- Both the cue and the response are highly specific

Answer If Both the cue and the response are highly specific Is Selected
Correct! Both the cue and the response are highly specific!

Answer If Both the cue and the response are highly specific Is Not Selected
Incorrect. Both the cue and the response are highly specific.

Problem # 3
Use the following if-then plan to answer the next three questions:
If friends invite me out when I am supposed to be studying, then I will go out with them for just an hour or two.

Is this an instrumental or non-instrumental plan?
- Instrumental
- Non-instrumental
Answer If Non-instrumental Is Selected
Correct! This is a non-instrumental plan because the response does not support the goal of improving study habits.

Answer If Non-instrumental Is Not Selected
Incorrect! This is a non-instrumental plan because the response does not support the goal of improving study habits.

Which of the following is the most specific option to replace the plan?

- If friends invite me out when I am supposed to be studying, then I’ll work on my study guide for my Statistics exam for one hour before I meet up with them.
- If friends invite me out when I am supposed to be studying, then I’ll study for a bit before I meet up with them because studying is more important than hanging out with my friends.
- If friends invite me out when I am supposed to be studying, then I’ll study for one hour before I meet up with them.

Answer If If friends invite me out when I am supposed to be studying, then I’ll work on my study guide for my Statistics exam for one hour before I meet up with them. Is Selected
Correct! The most specific option says, "I’ll work on my study guide for my Statistics exam for one hour before I meet up with them." This is the most specific option because it clearly details the behavior -- not just studying, but working on a statistics study guide -- and it specifies the duration (one hour).

Answer If If friends invite me out when I am supposed to be studying, then I’ll work on my study guide for my Statistics exam for one hour before I meet up with them. Is Not Selected
Incorrect. The most specific option says, "I’ll work on my study guide for my Statistics exam for one hour before I meet up with them." This is the most specific option because it clearly details the behavior -- not just studying, but working on a statistics study guide -- and it specifies the duration (one hour).

Problem # 4
Use the following if-then plan to answer the next three questions:
If it’s 8:00pm on a weeknight and I don’t feel like studying, then I will try to work for a little bit.

Is this an instrumental or non-instrumental plan?

- Instrumental
- Non-instrumental
Answer If Instrumental Is Selected
Correct! This is an instrumental plan because studying does indeed help the individual in their goal of building better study habits.

Answer If Instrumental Is Not Selected
Incorrect. This is an instrumental plan because studying does indeed help the individual in their goal of building better study habits.

Are the cue and response highly specific?
- Only the cue is highly specific
- Only the response is highly specific
- Neither the cue nor the response are highly specific
- Both the cue and the response are highly specific
Answer If Only the cue is highly specific Is Selected
Correct! Only the cue is highly specific. The response ("I will study for just a little bit") is not highly specific. It could be formed in greater detail.
Answer If Only the cue is highly specific Is Not Selected
Incorrect. Only the cue is highly specific. The response ("I will study for just a little bit") is not highly specific. It could be formed in greater detail.

----

Which of the following is the most specific (and instrumental) option to replace the response?

- …then I will watch TV for a little bit until I feel like studying.
- …then I will sit at my desk, set a timer for 15 minutes and do as much as I can for just 15 minutes, then take a 5 minute break
- …then I will tell myself I need to get serious about my studying.

Answer If …then I will sit at my desk, set a timer for 15 minutes and do as much as I can for those 15 minutes. Is Selected
Correct! "Setting a timer for 15 minutes..." is the most specific and instrumental option. It specifies the behavior and the duration.
Answer If …then I will sit at my desk, set a timer for 15 minutes and do as much as I can for those 15 minutes. Is Not Selected
Incorrect. "Setting a timer for 15 minutes..." is the most specific and instrumental option. It specifies the behavior and the duration.

----

Problem # 5
Use the following if-then plan to answer the next three questions:

If it's the weekend, then I’ll study at least once.

Is this an instrumental or non-instrumental plan?
- Instrumental
- Non-instrumental

Answer If Instrumental Is Selected
Correct! This is an instrumental plan because studying does indeed help the individual in their goal of building better study habits.
Answer If Instrumental Is Not Selected
Incorrect. This is an instrumental plan because studying does indeed help the individual in their goal of building better study habits.

----
Are the cue and response highly specific?
- Only the cue is highly specific
- Only the response is highly specific
- Neither the cue nor the response are highly specific
- Both the cue and the response are highly specific

Answer If Neither the cue nor the response are highly specific Is Selected
Correct! Neither the cue nor the response are highly specific. The cue does not clearly specify the moment (weekend is very broad) or the place, and the response does not clearly specify the precise behavior or the duration of that behavior.

Answer If Neither the cue nor the response are highly specific Is Not Selected
Incorrect. Neither the cue nor the response are highly specific. The cue does not clearly specify the moment (weekend is very broad) or the place, and the response does not clearly specify the precise behavior or the duration of that behavior.

Which of the following is the most specific (and instrumental) option to replace the plan?
- If it’s Saturday or Sunday, then I’ll go to the library for 3 hours to work on my assigned essays.
- If it’s Saturday at 10:00am, then I’ll go to the library and study as long as I can
- If it’s Saturday at 10:00am, then I’ll go to the library for 3 hours to work on my assigned essays.

Answer If If it’s Saturday at 10:00am, then I’ll go to the library for 3 hours to work on my assigned essays. Is Selected
Correct! "Saturday at 10am" is the most specific cue, and "go to the library for 3 hours to work on assigned essays" is the most specific response. This plan indicates the activity/behavior, the moment, the location, and duration!

Answer If If it’s Saturday at 10:00am, then I’ll go to the library for 3 hours to work on my assigned essays. Is Not Selected
Incorrect. "Saturday at 10am" is the most specific cue, and "go to the library for 3 hours to work on assigned essays" is the most specific response. This plan indicates the activity/behavior, the moment, the location, and duration!
Today, you’ll learn to critique other people’s plans, and in the process, become better at creating and critiquing your own. First, we’ll walk you through a few examples of good and bad plans, describing along the way the components you should look for. Then, we’ll give you a short practice test in which you’ll be critiquing people’s plans.

The examples you’ll be seeing are from people who have a goal of learning to play piano. Keep this in mind as you read through the examples.

**Instrumentality:**
Instrumentality refers to whether or not your plan is effective—whether it will actually help you achieve your goal. An instrumental goal is one that will conceivably help you reach your goal. A non-instrumental goal is one that does not help you reach your goal (and might even hinder you from reaching your goal!). This probably sounds like common sense, but, believe it or not, we see a lot of plans that are not instrumental.

Let’s compare the following two plans:

Non-instrumental:
*If I don’t feel motivated to practice piano, then I’ll watch TV instead.*

Instrumental:
*If I don’t feel motivated to practice piano, then I’ll set a timer and practice for 10 minutes.*

Notice how the non-instrumental plan essentially gives into the temptation not to practice? This plan does not help the individual toward their goal of learning to play piano. The instrumental plan, on the other hand, helps the individual stay on track to learn to play!
Let's start with a plan that has a really non-specific cue and build on it until it's a much better and more specific plan.

Very vague cue:
   *If I have time, then I'll practice piano.*

You can see in this example that the cue ("If I have time") is very vague. The problem with a vague cue is that it will apply to so many moments, it will be virtually impossible to detect those moments as a time to act. Let's make the cue more specific:

Somewhat specific cue:
   *If it's Wednesday, then I'll practice piano.*

The cue is now somewhat specific because we've specified a certain time period—Wednesday. Now, instead of the cue applying to "If I have time," it's specific to the exact day. However, we can make the cue even more specific:

Highly specific cue:
   *If I have just finished dinner at home on Wednesday evening, then I'll practice piano.*

Now, the cue will be more easily brought to mind because it's tied to a specific place (home) and a time (evening; right after dinner). *This is a good cue!*

---

**Test on Specificity and Instrumentality of Plans**

In the instructional section, we used the example of people who were trying to eat more healthfully. In this practice test, we're going to use a different behavior. All of the examples will pertain to an individual trying to improve their study habits.
Problem #1
Use the following if-then plan to answer the next three questions:

If I have free time, then I will spend 30 minutes creating flashcards for my Biology exam.

Is this an instrumental or non-instrumental plan?

- Instrumental
- Non-instrumental

Problem #1
Use the following if-then plan to answer the next three questions:

If I have free time, then I will spend 30 minutes creating flashcards for my Biology exam.

Correct! This is an instrumental plan!
Revision of Physical Activity Plans (Training Module)  
(II+T Condition)

We're now going to ask you to review your own plans for physical activity. We'll start by assessing the instrumentality of each of your plans for where, when and how you will be physical active. Remember that **instrumentality** is all about whether or not your plan is effective—whether it will actually help you achieve your goal. Pay special attention to your response in each plan to ensure that the action is something that will help you to make progress toward your exercise goals.

Here are your original plans for where, when and how you will be physical active:

**<Action Plan 1>**
- ☐ This plan is already instrumental (1)
- ☐ This plan is not instrumental (2)

**<Action Plan 2>**
- ☐ This plan is already instrumental (1)
- ☐ This plan is not instrumental (2)

**<Action Plan 3>**
- ☐ This plan is already instrumental (1)
- ☐ This plan is not instrumental (2)

**Answer If This plan is already instrumental Is Not Selected**
Use the spaces below to revise your plan for instrumentality.

Original plan:  
<Action Plan>

New plan:  
If ___________________________________________________________,  
then _________________________________________________________

----
We're now going to ask you to review those same plans for where, when and how you will be physically active, but this time, we'll ask you to critique them for specificity. Remember that specificity is all about how many details you include in your plan. Look at the cue and the response and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (often day/time), and for how long you’ll do it.

---

**Action Plan 1 – Revised if applicable**

- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

**Action Plan 2 – Revised if applicable**

- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

**Action Plan 3 – Revised if applicable**

- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

Answer If Either the cue or response (or both) is not highly specific Is Selected

Use the spaces below to revise your plans for specificity. Remember that specificity is all about how many details you include in your plan. Look at the cue and the response and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (day/time or a specific moment), and for how long you’ll do it.

Original plan:

**<Action Plan – Revised if applicable>**

New plan:

If ___________________________________________________________,

then _________________________________________________________

---

Take a minute to read and visualize your three plans for when, where and how you'll be active:

**<Action Plan 1 – Revised if applicable>**

**<Action Plan 2 – Revised if applicable>**

**<Action Plan 3 – Revised if applicable>**

---
We're now going to ask you to review your own plans for coping with your most important barrier. Remember that you indicated your most important obstacle was:

<highest-ranked barrier>

We'll start by assessing the instrumentality of each of your plans for dealing with this barrier. Remember that instrumentality is all about whether or not your plan is effective—whether it will actually help you achieve your goal. Pay special attention to your response in each plan to ensure that the action is something that will help you to make progress toward your exercise goals.

Here are your original plans for dealing with <highest-ranked barrier>

<Coping Plan 1>
- This plan is already instrumental (1)
- This plan is not instrumental (2)

<Coping Plan 2>
- This plan is already instrumental (1)
- This plan is not instrumental (2)

<Coping Plan 3>
- This plan is already instrumental (1)
- This plan is not instrumental (2)

**Answer If This plan is already instrumental Is Not Selected**

Use the spaces below to revise your plan for instrumentality.

Original plan:  
<Coping Plan>

New plan:
- If _________________________________,
  then ________________________________

----
We're now going to ask you to review those same plans for where, when and how you will be physically active, but this time, we'll ask you to critique them for specificity. Remember that specificity is all about how many details you include in your plan. Look at the cue and the response and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (often day/time), and for how long you’ll do it.

**<Coping Plan 1 – Revised if applicable>**
- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

**<Coping Plan 2 – Revised if applicable>**
- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

**<Coping Plan 3 – Revised if applicable>**
- Both the cue and the response are highly specific (1)
- Either the cue or response (or both) is not highly specific. (2)

Answer If Either the cue or response (or both) is not highly specific Is Selected

Use the spaces below to revise your plans for specificity. Remember that specificity is all about how many details you include in your plan. Look at the cue and the response and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (day/time or a specific moment), and for how long you’ll do it.

Original plan:
<Copin Plan – Revised if applicable>

New plan:
If ________________________________________________________________,
then ________________________________________________________________

----

Take a minute to read and visualize your three plans for when, where and how you'll be active:
<Copin Plan 1 – Revised if applicable>
<Copin Plan 2 – Revised if applicable>
<Copin Plan 3 – Revised if applicable>

----
Please take a moment to read through the plans you have created. Many people find it helpful to visualize their if-then plans. The "next" button will not display until 15 seconds have passed, but feel free to take as much time as you need! When you're done, you can click the "next" button

<Action Plan 1 – Revised if applicable>
<Action Plan 2 – Revised if applicable>
<Action Plan 3 – Revised if applicable>
<Coping Plan 1 – Revised if applicable>
<Coping Plan 2 – Revised if applicable>
<Coping Plan 3 – Revised if applicable>
We’re now going to ask you to review your own plans for physical activity. We’ll start by assessing the instrumentality of each of your plans for where, when and how you will be physical active. Remember that instrumentality is all about whether or not your plan is effective—whether it will actually help you achieve your goal. Pay special attention to your response in each plan to ensure that the action is something that will help you to make progress toward your exercise goals.

Here are your original plans for where, when and how you will be physical active.

If it is a weekday, then I will go to the rec center for a half hour

- This plan is already instrumental
- This plan is not instrumental

If the weather is nice Saturday, then I will go on a hike

- This plan is already instrumental
- This plan is not instrumental

If I finish class at 5pm on Tuesday, then I will go to my yoga class

- This plan is already instrumental
- This plan is not instrumental
We're now going to ask you to review those same plans for where, when and how you will be physical active, but this time, we'll ask you to critique them for **specificity**. Remember that specificity is all about how many details you include in your plan. Look at the **cue** and the **response** and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include **what activity** you'll do, **where** you'll do it, **when** you'll do it (often day/time), and for **how long** you'll do it.

If it is a weekday, then I will go to the rec center for a half hour

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If I finish class at 5pm on Tuesday, then I will go to my yoga class

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</tbody>
</table>
Use the spaces below to revise your plans for specificity. Remember that specificity is all about how many details you include in your plan. Look at the cue and the response and, just as you did in the practice test, evaluate the specificity of the plans. For physical activity, a good plan will include what activity you’ll do, where you’ll do it, when you’ll do it (day/time or a specific moment), and for how long you’ll do it.

Original plan:
If it is a weekday, then I will go to the rec center for a half hour.

New plan:

If... it is a weekday at 4:30pm
then... I will go to the rec center and work out on the elliptical for 30min

Original plan:
If the weather is nice Saturday, then I will go on a hike.

New plan:

If... it is Saturday afternoon and the weather isn’t bad
then... I will go on a hike at CVNP with my friend for an hour

Take a minute to read and visualize your three plans for when, where and how you’ll be active:

If it is a weekday at 4:30pm, then I will go to the rec center and work out on the elliptical for 30min.

If it is Saturday afternoon and the weather isn’t bad, then I will go on a hike at CVNP with my friend for an hour.

If I finish class at 5pm on Tuesday, then I will go to my yoga class.