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Effects of Absorption Training on Positive Activity Experiences for Individuals with Anhedonia: A Single Case Series

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Existing literature has suggested an association between being absorbed in activities and improved experience in activities in terms of better mood gain and reducing rumination. This single-case series aimed to collect methodological information and preliminary data for future trials regarding the effects of absorption training; a rumination-focused CBT component, on improving positive activity experiences among individuals with anhedonia using a multiple baseline design (N=16). There were no significant effects of absorption training found regarding the level of absorption, positive affect, and rumination during the positive activities which might be due to high baselines, limiting the effects of intervention. The effect sizes indicated that absorption training might have larger effects on improving absorption and reducing rumination than increasing positive affect during activities. In terms of suggestions for methodology, future clinical trials should target participants with higher levels of anhedonia using a larger and homogenous sample and provide higher-intensity training. It is also worth exploring whether absorption training has larger effects on specific types of populations such as clinically depressed individuals.

Keywords: absorption training, Rumination-focused CBT, absorption, positive activities, rumination

'A good life is characterised by complete absorption of what one does' (Nakamura & Csikszentmihalyi, 2009, p.195). Studies have suggested that being fully absorbed in activities is crucial to well-being and happiness (Csikszentmihalyi, 1990; Nakamura & Csikszentmihalyi, 2009; Tse et al., 2020). Specifically, the inability to be absorbed in pleasurable activities seems to prevent people from enjoying the associated benefits such as improving one's positive mood (Killingsworth & Gilbert, 2010; Lambert & Csikszentmihalyi, 2020; Watkins, 2016). For instance, Killingsworth and Gilbert (2010) found that individuals reported being less happy when their minds wandered regardless of how enjoyable the activities were. Furthermore, previous studies also raised the possibility that increased absorption in activities may counter rumination (Hvenegaard et al., 2019; Watkins et al., 2011; Watkins et al., 2012) which may interfere with an individual's ability to experience pleasure and rewards from positive activities (Watkins, 2016). This study sets out to explore the effects of Absorption Training (AT), a component of rumination-focused cognitive behavioural therapy (RFCBT), which aims to increase absorption, in improving the experiences of positive activities in terms of positive affect and rumination among individuals with anhedonia, as suggested by the literature.

Absorption and Positive affect

One potential benefit of increased absorption is improving positive affect (PA) gained from activities (Asakawa, 2004; Collin et al., 2008; Fullagar & Kelloway, 2009; Rogatko, 2007; Tse et al., 2020). Absorption is conceptualised as a flow experience that is associated with positive experiences and affect (Norsworthy et al., 2021). Flow, introduced by Csikszentmihalyi (1975), refers to a state of deep absorption in an activity (Csikszentmihalyi, 1999). This absorbing state is characterised by nine components such as simultaneous feelings of action-awareness merging, time transformation, complete concentration, a sense of control, a loss of self-consciousness, and an intrinsically rewarding experience (Csikszentmihalyi, 1990; Nakamura & Csikszentmihalyi, 2009). Furthermore, individuals possessing traits like curiosity and persistence may have higher tendencies to experience flow (Csikszentmihalyi, 1990; Nakamura & Csikszentmihalyi, 2009). According to Csikszentmihalyi (1990), through repeated experiences of flow from positive activities providing potential for growth such as sports or work, people's happiness and life satisfaction would increase (Csikszentmihalyi, 1999).

This association between flow and PA is supported by empirical studies (Asakawa, 2004; Collin et al., 2008; Fullagar & Kelloway, 2009; Rogatko, 2007; Tse et al., 2020). In Asakawa's (2004) experience-sampling study (ESS) of Japanese undergraduates' experiences of daily activities, participants' levels of PA, such as enjoyment, were the highest in the flow condition compared to feeling relaxed or apathetic. Similarly, more intense daily flow experiences were associated with higher daily PA in a diary study of US adults (Collins et al., 2008). However, it is worth noting that the causal relationship between flow and PA is not strongly established since most studies on the two are correlational (Asakawa, 2004; Collin et al., 2008; Tse et al., 2020).

Nevertheless, there is some indirect evidence regarding the causal relationship between flow and PA (Fullagar & Kelloway, 2009; Rogatko, 2007). For instance, the experimental study by Rogatko (2007) found that participants' levels of PA were higher after conducting high-flow than low-flow-inducing activities, yet, since flow and PA were measured simultaneously after the activities, the study could not conclude their temporal relationship. An ESS on architectural students doing studio work also found a positive association between the two and importantly, its time-lag analysis suggested flow preceded the changes in affect (Fullagar & Kelloway, 2009). Though more direct evidence regarding the causal relationship is required, these studies provide support that interventions that can increase absorption in positive activities may increase PA gain.

Absorption and Rumination

In addition to increasing PA, increased absorption may also reduce maladaptive rumination (Watkins et al., 2011; Watkins et al., 2012; Watkins, 2016). Rumination has been suggested as both a state response (Martin & Tesser, 1996) and a trait-like tendency (Nolen- Hoeksema, 1991) while maladaptive state rumination (MSR) is defined as the momentary thoughts of focusing on implications and causes of one's distress (Marchetti et al., 2018; Nolen-Hoeksema et al., 2008). Through repeated occurrences of goal discrepancies, MSR may develop into a habitual tendency of depressive rumination (Watkins & Nolen-Hoeksema, 2014) which is suggested as a transdiagnostic process of multiple mental disorders (Ehring & Watkins, 2008; Nolen-Hoeksema, 2000; Nolen-Hoeksema et al., 2008; Nolen-Hoeksema & Watkins, 2011; Watkins, 2008). Furthermore, maladaptive rumination may interfere with the ability to experience rewards from positive activities and contribute to anhedonia (Watkins, 2016), the reduced ability to experience pleasure in normally pleasurable activities (American Psychiatric Association, 2013). These hypothesised effects are supported by existing findings where the negative perception of feedback on one's performance might reduce flow level and its associated benefits such as better performance (Lambert & Csikszentmihalyi, 2020). Similarly, negative mind-wandering was associated with reduced pleasure while doing pleasurable activities (Killingsworth & Gilbert, 2010).

Encouragingly, increased absorption in activities is suggested to counter maladaptive rumination based on several theoretical principles (Watkins, 2016). First, it may shift the abstract processing style characteristic of depressive rumination to a more process-focused and concrete mindset (Dykman, 1998; Watkins, 2008, 2016; Watkins & Roberts, 2020). Additionally, being more immersed and connected in positive activities may counter rumination such as running commentaries that evaluate one's performance in mind and enhance individuals' ability to experience pleasure and rewards from the activities (Watkins, 2016). These theories support the hypothesis that interventions that increase absorption may reduce rumination during activities. However, it is important to note that these proposed effects have not yet been examined.

Absorption Training

Absorption Training, a component of RFCBT, was developed based on the theoretical and empirical evidence in the literature regarding the association between increased absorption on improving PA and reducing maladaptive rumination. RFCBT is a treatment for residual depression by targeting depressive rumination in which absorption is conceptualised as a flow experience (Watkins, 2016). Specifically, AT involves a mental imagery exercise of using a memory of being absorbed in activities to help individuals recapture the experience of being in an absorbed state of mind. Through daily practice, it aims to help participants activate the absorbed mindset more easily during positive activities (Watkins, 2016). It is suggested that by doing more positive activities with an absorbed state of mind, the training can reduce rumination by facilitating a shift to a more helpful absorbed mindset and counter the running commentary that evaluates one's performance during activities (Watkins, 2016). Moreover, it may also help individuals improve their PA by better connecting them with the experiences and rewards of positive activities (Watkins, 2016) based on the suggested association between flow and PA in existing research.

Nevertheless, these proposed effects of AT on absorption, PA, and rumination are yet to be examined. There is indirect evidence of its effects on rumination where previous trials demonstrated that RFCBT has been effective in reducing depressive rumination (Hvenegaard et al., 2019; Watkins et al., 2011; Watkins et al., 2012). Yet, these trials did not examine AT as an isolated component (Hvenegaard et al., 2019; Watkins et al., 2011) and its effects on improving individuals'

experiences of positive activities have not been tested. Previous studies have found that concrete mental imageries of positive memories may increase positive mood (Werner-Seidler & Moulds, 2012), and cognitive training using positive mental imageries may reduce anhedonia in daily activities among depressed individuals (Blackwell et al., 2015). It is yet to be examined whether mental imagery of an absorbing memory can induce an absorbed mindset in positive activities in the present and thus improve the experiences. Hence, studies examining AT as an isolated component are needed to better understand such effects (Hvenegaard et al., 2019; Watkins et al., 2011). Additionally, experimental methodological information is required for examining AT's effects in future clinical trials.

Current Study

The study will explore the effects of absorption training. Its first aim is to use a single case series (SCS) to explore the effects of absorption training in improving individuals' experiences of positive activities based on their levels of absorption (flow), positive affect, and maladaptive state rumination. Specifically, this study targets individuals with anhedonia and examines AT's effects on their experiences of positive activities. The second aim is to collect methodological information for designing future clinical trials.

The hypotheses are as follows: Participants' level of absorption while completing their selected activities will be higher after the introduction of AT compared to baseline (H1). Based on the association between increased absorption on PA and rumination (Asakawa, 2004; Csikszentmihalyi, 1990; Watkins, 2016), it is also hypothesised that while conducting AT, participants will gain more PA from doing their selected activities (H2) and their levels of MSR in selected activities will decrease (H3).

To explore these, this SCS will adopt a multiple baseline design (MBD) to evaluate AT's effects on each participant individually. MBD involves using a baseline period as a control for each individual and introducing intervention at varying baseline lengths. The intervention effects are then explored within the individual and across the participants (Morley et al., 2015). Specifically, this study will take repeated daily measurements of participants' levels of absorption, PA, and MSR in positive activities during the baseline and AT phases and introduce AT to the participants at varying lengths of baseline from seven to fourteen days (Tanious & Onghena, 2019). The changes in the three variables after the introduction of AT will then be examined. As a preliminary study with resource constraints, a single-case experimental design (SCED) allows detailed and individualised data to be collected with fewer resources, such as not requiring a control group. (Morley et al., 2015; Tanious & Onghena, 2019). Furthermore, by evaluating the intervention effects across multiple participants concurrently within the same general period with the intervention being introduced at various time points, the MBD can increase the likelihood that the changes in the three variables are due to the effects of AT instead of factors such as history, cohort effect, and regression to mean (Morley et al., 2015; Onghena, 2020). Additionally, participants' tendencies to experience pleasure, flow, and maladaptive rumination will be measured.

Method

Participants

Forty-one individuals were recruited through the University of Exeter research platform, SONA, (N=16), and snowball sampling on the messaging platform – WhatsApp (N=25). Inclusion criteria included individuals aged 18 or above in the UK with access to electronic devices and reporting at least mild levels of anhedonia by scoring 1 or above on the Snaith-Hamilton Pleasure Scale (Snaith et al., 1995). Twenty-five individuals were found eligible after screening and four were unvailable during the study, yielding a final sample of twenty-one participants.

Five participants were excluded from the data analysis since four were unable to carry out the planned activities three times per week and one reported having issues with AT, discontining practice. The remaining 16 participants were included in the analysis. See Table 1 for participants' demographic details. All participants provided written informed consent and received reimbursement of £30 Amazon voucher upon completing the study. The study was approved by the University of Exeter Psychology Research Ethics Committee.

Design

The single case series aimed to explore the effects of absorption training on the experiences of positive activities in terms of absorption, positive affect, and maladaptive state rumination for individuals with anhedonia. A multiple baseline design was employed with participants randomly assigned by an

algorithm using their assigned anonymized participant identifier to varying baseline lengths ranging from 1 to 2 weeks before conducting the AT which lasted for 7 to 14 days. The baseline lengths allowed sufficient time for obtaining a stable baseline which can minimize the effects of confounds such as maturation (Carr, 2005), and sufficient data to explore intervention effects where participants conducted their chosen activities for a minimum of three times in both the baseline and intervention periods.

Materials and Measures

Screening and Dispositional Measures

Individuals who were interested in joining the study completed the screening measure in the online survey during recruitment. The dispositional measures (Dispositional Flow Scale – 2 and Ruminative Response Scale – Short Form) were sent to eligible individuals via email. Participants were required to complete the dispositional measures either before or during the first meeting with the researchers.

Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995). The SHAPS is a 14-item self-report measure of the ability to experience pleasure (e.g., I would find pleasure in my hobbies and pastimes) using a 4-point scale (0 - disagree to 3 - strongly agree). Higher total scores indicate lower tendencies to experience pleasure (range 0 to 14). The scale has shown good criterion validity and satisfactory internal reliability, yielding a Kuder-Richardson score of 0.857 (Snaith et al., 1995). It was used as a screening measure to include individuals reporting elevated levels of anhedonia (scored 1 or above).

Dispositional Flow Scale – 2 short form (DFS-2 SF; Jackson et al., 2008). The DFS-2 SF is a 9-item self-report instrument that assesses the tendency of experiencing flow in a target activity (e.g., I am completely focused on the task at hand) using a Likert scale from 1(never) to 5 (always). The scale has shown acceptable internal consistency (α=.77) and good construct and divergent validities (Jackson et al., 2008). Its instruction was modified in this study to target frequencies of flow experiences in 'all daily activities' instead of in a specific activity.

Ruminative Response Scale – Short Form (RRS-SF; Treynor et al., 2003). The RRS-SF is a 10-item, 4-point Likert scale (1 - almost never to 4 - almost always) self-report measure of ruminative tendencies in response to sad and depressive moods. Higher total scores suggest higher tendencies to ruminate (range 10 to 40). It has two subscales – brooding and reflection with brooding suggested as the most pathological rumination (Treynor et al., 2003). Hence, five items from the Brooding subscale which has shown satisfactory internal consistency (α=.77) (Treynor et al., 2003) were administered at the start of the study (e.g., When you feel sad, down, or depressed, how often do you think "Why can't I handle things better?") to assess participants' maladaptive ruminative tendency.

Daily Survey

Throughout the 21-day study, participants were prompted to complete a daily survey once via email or text messages at their preferred time before midnight with questions assessing their levels of absorption, PA, and MSR in positive activities stemming from the validated scales below.

Flow State Scale. The 36-item, 5-point Likert scale (1 - strongly disagree to 5 -strongly agree), Flow State Scale (FSS; Jackson & Marsh, 1996) is a self-report instrument that assesses the situational-specific experience of flow with a satisfactory internal consistency reported (α =.83) (Jackson & Marsh, 1996). Six items from the FSS (e.g., 'When doing the activity, time seemed to alter 'either slowed down or speeded up') measuring absorption-related dimensions - complete concentration, time distortion, loss of self-consciousness, action-awareness merging, autotelic experience (Norsworthy et al., 2021) were included in the daily survey to assess AT's effects on participants' levels of absorption in activities.

Positive Affect. The impacts of AT on participants' PA in activities were assessed by the item 'Doing this activity improved my positive mood' using a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Brief State Rumination Inventory. The Brief State Rumination Inventory (BSRI; Marchetti et al., 2018) is an eight-item self-report measure of MSR in response to negative mood using a visual analogue scale from 0 (completely disagree) to 100 (completely agree). Higher total scores represent higher degrees of MSR (range from 0 to 800). It has shown high internal consistency (α=.91) and good construct and criterion validities (Marchetti et al., 2018). Five items that correlate positively with the RRS Brooding subscale (Treynor et al., 2003) were included in the daily survey (e.g., 'When doing the activity, it is hard for me to shut off negative thoughts about myself ') to assess whether

AT can reduce participants' level of MSR in activities.

Activities Planning

During the first meeting, participants were guided to select a positive activity to undertake during the study. Specifically, they were first guided to consider a few suitable positive activities. The selection criteria are any activities (1) that they found positive, (2) they could get absorbed in doing, (3) they enjoy doing the activities and would like to do more of them and (4) they could get distracted sometimes and found it hard to engage in the activities. They then selected one planned activity they would like to undertake three times per week and scheduled the time to do it during the study.

Absorption Training

The AT was tailored to the participants' planned activities with a training session followed by daily practices. First, a training session guided by the AT manual was conducted where participants were first guided to identify a memory of being absorbed in the planned activity according to the flow criteria (Csikszentmihalyi, 1990). Participants were then prompted to imagine themselves in the memory and describe their sensory-perceptual experiences, such as body sensations, smell, and sounds. Next, a mental imagery exercise was conducted to help participants recreate that absorbing experience with the researcher prompting them to recapture the sensory-perceptual experience using the participants' descriptions of the experience. The exercise was recorded while being conducted. After the exercise, the researcher checked whether the participants had a positive experience by asking about their feelings or levels of energy. Participants were then instructed to conduct and schedule the daily practice. Following the session, participants received the audio recordings of the exercise via email or text messages and practiced activating the absorbed mindset by listening to the audio recordings daily.

Procedure

The study targeted individuals who wanted to improve their engagement and performance in activities that they enjoy by advertising on SONA or WhatsApp. Individuals interested in participating clicked on the SONA or WhatsApp link, directing them to an online survey. In the survey, participants first read an information sheet about the study and were told it would investigate whether a mental strategy can improve their moods and performance in pleasurable activities. Those who gave their informed consent to participate could continue with the survey. They then completed the screening measure and were instructed to create their anonymized identifier at the end of the survey. Individuals eligible for the study were later contacted within 48 hours via email or text messages with the link to the baseline measures and arranged a meeting with the researchers. Individuals not eligible were notified and received a debriefing form via email. The participant identifiers of the eligible individuals were sent to the research supervisor via email and were allocated to various baseline lengths using an algorithm by the research supervisor. The researchers were then notified of the randomization results via email.

During the 21-day study, participants completed three meetings with the researchers via video conferencing to encourage participation throughout the study and allow the researchers to make adjustments promptly if participants raised any concerns regarding conducting the planned activities and AT during subsequent meetings. In the first meeting, participants first completed the baseline measures on dispositional flow, trait rumination, and demographic questions followed by an explanation of the study's requirements by researchers and activity planning.

Following the meeting, participants conducted the planned activities a few times per week and recorded their experiences over the 21 days by completing a daily survey as instructed. Participants received the link to the survey once on the online survey tool, Qualtrics, via email or text messages daily at their preferred times and completed it before midnight. Following the baseline period ranging from 1 to 2 weeks, a second meeting was arranged where AT was introduced. Afterward, participants practiced AT daily alongside doing the planned activities and the daily survey until the third meeting. At the end of the study, a third meeting was conducted to review the effects of AT and debrief the participants. Lastly, participants received the reimbursement (£30 vouchers) via email.

Data Analysis

Visual analysis of participants' data on graphical plots (Morley, 2015) and statistical analyses using the RcmdrPlugin.SCDA plug-in package for R software (Bulté & Onghena, 2013) was performed.

To determine the statistical significance of the results, a non-parametric significance test – randomization test (RT), which requires arrangements of intervention being randomized, was used since repeated

measurements of each participant in SCED might result in autocorrelation and violate parametric assumptions (Heyvaert & Onghena, 2014; Tanious & Onghena, 2019). RT was performed for each participant to obtain the individual p-value for AT's effects on absorption, PA, and MSR. The combined p-values were computed from the meta-analyses of individual p-values using Pearson's method (1934) (Bulté & Onghena, 2013).

Regarding effect sizes calculation, the non-parametric effect size index – percentage of data exceeding the median (PEM) which calculates the proportion of data points during the AT phase that exceeds the median of baseline data (Ma, 2006) was used for computing individual effect sizes for the three variables. PEM smaller than 0.7, between 0.7 and 0.89, and between 0.9 and 1, represent questionable, moderate, and high effectiveness (Ma, 2006). The overall effect sizes were computed by taking the average of all individual effect sizes.

Data of participants who did not complete the planned activities and surveys at least three times in both the baseline and intervention periods and did not conduct AT during the intervention period at least three times were excluded from the data analysis.

Results

Statistical Analysis: Randomization Test and Effect Size Calculations

A non-parametric significance test – RT (Tanious & Onghena, 2019) was used to examine whether AT can increase participants' levels of absorption and PA and reduce their level of MSR in the planned activities. The effect sizes regarding the three outcomes were calculated using the index – PEM (Ma, 2006).

The results showed that there were mean increases in absorption (0.38 points) and PA (0.35 points) and decreases in MSR (-30.29 points) after the introduction of AT among the participants. Medium effect sizes were found for the changes in absorption (79.70%) and MSR (77.06%) and a small effect size was found for PA (49.75%) (Table 2). However, the RT indicated that the changes were not significant ($p > 0.05$).

Regarding the effects of AT on non-planned activities, only three participants conducted the non-planned activities at least twice in both baseline and AT phases. The amount of data collected was limited for conducting a significant statistical analysis.

Visual Analysis

The impacts of AT on participants' experiences of positive activities in this SCS was also examined by visual inspection of the multiple-baseline data in graphical plots concerning the changes in level and trend (Morley, 2015) of absorption, PA, and MSR while doing positive activities across the baseline and AT phases. Data representing the daily scores reported by each participant regarding the three variables during the planned and non-planned activities are presented in Figures 1, 2, and 3 respectively.

Regarding the change in absorption, the daily scores reported for most of the baseline periods were stable. Seven participants showed an increase in absorption after the introduction of AT and four exhibited a slight upward trend continuously. However, the scores of nine participants reflected no change during the AT phase.

Regarding the change in PA, most baseline periods were stable while one participant showed a pattern of decrease. Three participants showed an increase in PA gained after the introduction of AT while one continued to show an upward trend; the level of PA remained stable for the other two participants during the AT phase. Five participants showed no change and conclusions could not be drawn for seven participants due to unstable scores across both phases. One participant's level of PA decreased contrary to the hypothesis.

Regarding the change in MSR, most of the baseline scores were stable or decreasing. After the introduction of AT, three participants exhibited decreases in MSR levels compared to baseline. Ten participants showed no obvious change during the AT phase. Conclusions cannot be drawn for three participants due to unstable scores across both phases.

The visual inspection results were consistent with the RT results for each individual, indicating that there were no significant effects of AT on the three variables shown.

Dispositional Tendencies

Participants reported tendencies to experience flow, pleasure, and rumination. Participants reported moderate tendencies to experience flow (Mean: 2.84, SD: 0.58). The tendencies to experience pleasure (scores ranging from 1 to 14) and rumination (scores ranging from 8 to 20) varied across participants (Table 3).

Discussion

To our knowledge, this single case series is the first to explore the effects of absorption training on

improving the experiences of positive activities among individuals with mild levels of anhedonia. This preliminary study also aimed to collect methodology information for future clinical trials. It is hypothesized that AT can improve absorption and positive affect and reduce maladaptive state rumination experienced during the planned positive activities. Although there were expected increases in absorption and PA and a decrease in MSR shown after AT was introduced, the results indicated that the effects of AT were not significant.

Absorption

Analyses did not show a strong effect of AT on increasing participants' absorption levels during planned activities. This contrasts with the proposed effects of AT where by practicing getting into the absorbed state daily using a mental imagery exercise of an absorbing memory, individuals will be more likely to activate an absorbed mindset during activities (Watkins, 2016). Methodological issues could have contributed to the results, such as participants reporting fairly positive experiences in the planned activities and varied levels of anhedonia at baseline, and the effectiveness of training sessions and daily practice were not monitored. Methodological issues will be discussed further in later sections. Moreover, the medium effect size found for changes in absorption could mean that a larger effect may be found in larger samples.

Positive Affect

Questionable effects of AT on improving PA gained from doing the planned activities were also indicated by the results. Another proposed effect of AT is that by better connecting individuals with the experiences and rewards of positive activities and improving their abilities to experience pleasure with increased absorption, there will be improved positive mood gain (Watkins, 2016). The proposed effect is supported by previous findings demonstrating individuals' PA increased during flow despite their causal relationship not being strongly established (Asakawa, 2004; Collin et al., 2008; Fullagar & Kelloway, 2009; Rogatko, 2007; Tse et al., 2020). The study's results could be due to the negligible increase in absorption among participants after the introduction of AT being insufficient to improve participants' PA. Furthermore, only a small effect size was found which may be explained by only one item being used to measure the changes in PA. Single-item measures could be more prone to random error and are less able to capture different facets of PA (Sarstedt & Wilczynski., 2009). Moreover, nine participants reported a median of four on the item's 5-point scale at baseline meaning only reporting the highest point of the survey during the AT phase would pass the thresholds for effect size calculations. To address these issues, future studies could use multiple-item measurements such as the Positive and Negative Affect Schedule scale (Watson et al., 1988) which measures different types of PA and has shown high sensitivity to momentary fluctuations of mood (Watson et al., 1988).

Maladaptive State Rumination

Similarly, no particular effects of AT on reducing the MSR experienced by participants during the planned activities were shown. Existing literature suggested AT may reduce rumination by getting individuals immersed in the process of the activities instead of evaluating their performances and inducing the concrete absorbed mindset to counter the ruminative thinking style (Watkins, 2016). Likewise, the result could be due to the increase in absorption in this study following AT being insufficient to counter rumination. Previous findings demonstrated that RFCBT, with AT as a component, was effective in reducing depressive rumination (Hvenegaard et al., 2019; Watkins et al., 2011; Watkins et al., 2012). However, it is important to note that previous RCTs had higher intensities of treatment with multiple therapy sessions. Nevertheless, the medium effect size found suggested that future studies with improved design may detect a stronger effect.

Methodological Limitations and Suggestions

This study has identified methodological information that may be valuable for future large-scale trials. First, the effects of AT shown might be limited by high levels of absorption and PA and low levels of MSR reported at baselines. As this study targeted activities that participants found enjoyable and potentially absorbing, participants might have high activity-specific tendencies to experience flow and PA in these activities despite exhibiting generally mild levels of anhedonia. As previous findings indicated, the results of dispositional measures are not the same as aggregated assessments of momentary trait-relevant behaviour (Augustine & Larsen, 2012). Targeting dispositional tendencies within a particular context such as participants' tendencies to experience flow in a specific activity may better predict participants' experiences than a general dispositional measure (Jackson et al., 2008). Thus, to obtain the desired baseline

levels of the three variables to better examine AT's effects, future studies could use measures assessing participants' activities-specific flow propensity such as the DFS-SF (Jackson et al., 2008) during activities selection to select relatively low-flow inducing activities.

Second, the participants reported varied levels of anhedonia (ranging from 1 to 14). It could be possible that the intensity of AT in this study was insufficient to improve the experiences of positive activities for individuals with high levels of anhedonia. To better explore AT's effects in a population with anhedonia and target individuals with less positive experiences in activities, future studies could include a larger and more homogenous sample of individuals with higher levels of anhedonia; those scoring 3 or above, the cut-off score for anhedonia, in SHAP (Snaith et al., 1995). It may also be useful to explore AT's effects in specific types of population such as those with higher ruminative tendencies.

Third, the study did not monitor the effectiveness of the training session which may impact the intervention outcomes. Mental imagery research has found that higher levels of imagery vividness reported in the training session led to greater reductions in depression symptoms (Blackwell et al., 2015). Although researchers had checked participants' moods or levels of energy after the training session, participants' responses might have been subject to demand characteristics where they overstated the training's effects (Nichols & Maner, 2008). To limit the impacts of demand characteristics and assess the effects of the training session, future studies should administer validated scales such as the FSS (Jackson & Marsh, 1996) to assess participants' level of state flow during the training session.

Fourth, the adherence rates of daily practice were low and only three participants completed the daily practice. Though the impacts of the frequency of daily practice on AT's effects are uncertain due to the small sample size, large effect sizes were found for some changes in absorption, PA, and MSR among participants who completed the AT daily suggesting the impacts of frequency daily practice may be worth exploring. Moreover, there was no measurement of active engagement during the daily practice such as how absorbed participants were. Previous evidence suggested more active engagements with the intervention had led to better treatment outcomes in mental imagery intervention (Blackwell et al., 2015). To examine whether AT could have larger effects, future studies should require higher completion rates (80%) of daily practice and include measures to monitor the effectiveness of daily practice such as participants' levels of absorption.

Fifth, the study only lasted for a short period with a single training session and a daily practice period of 7 to 14 days. A study examining RFCBT reported latency of treatment effects where the effects only showed within two to six weeks after initiation of treatment (Watkins, 2007). Subsequent RCT also indicated significant treatment effects on reducing depressive rumination resulting from 12 to 16 sessions of RFCBT (Hvenegaard et al., 2019; Watkins et al., 2011; Watkins et al., 2012). Despite this study being conducted in a non-clinical context, a longer period allows potential latency effects to be shown and more data collection. Moreover, multiple sessions may be required to provide more training according to the participants' progress (Blackwell et al., 2015). To improve the training's quality, a longer study period with more than two weeks of daily practice and multiple training sessions may be beneficial.

Sixth, the duration of activities conducted by participants, which might affect their level of absorption, was not recorded. Previous research has suggested that a sufficiently long period may be required to enter into flow (Copperstone, 2004; Rogatko, 2007). For instance, Rogatko (2007) found a positive association between PA and high-flow-inducing activities that were conducted for one hour. In contrast, Copperstone (2004) found no significant improvements for flow components such as time distortion, loss of self-consciousness, and action-awareness merging among counselors in a 10-minute psychotherapy session after receiving flow training. However, it is important to note that the flow training was different from AT and the study by Copperstone (2004) targeted psychotherapy sessions instead of pleasurable activities. Nevertheless, future studies can require participants to conduct the activities for longer periods such as 30 minutes, and examine whether AT's effects would increase.

Lastly, without a control group, this study's results can be attributed to other factors such as history, cohort effect, or regression to mean instead of AT (Morley et al., 2015; Onghena, 2020). Although the MBD could arguably reduce the possibility that the results were influenced by these factors (Morley et al., 2015; Onghena, 2020), future group studies should include control groups to better examine the effects of AT.

Implications and Future Directions

This study indicated that AT warrants further studies with refined methodology. In terms of practice implications, the study raised the possibility that it may benefit individuals who want to improve their experiences in positive activities. However, this assumption requires caution since no strong evidence regarding the effects of AT was found. Nevertheless, nearly all participants reported expected changes in absorption, PA, and MSR, and the medium effect sizes for absorption and rumination were found. This suggested that stronger effects of AT may be found particularly regarding the absorption and rumination in studies with larger sample sizes and refined methodology.

Apart from methodological issues, there are several issues future studies should address. First, it is crucial to explore whether dispositional tendencies to experience rumination, flow or pleasure may influence AT's effects. Stratification of intervention recipients is crucial in examining interventions' effects, which enables early prediction of recipients' response patterns and allows interventions to be tailored to the individual (Fu et al., 2013).

Furthermore, AT's effects on depressed individuals are also worth exploring. Previous evidence found that concrete mental imagery of positive memories can improve mood in depressed individuals (Werner-Seidler & Moulds, 2012). Similarly, AT, a mental imagery exercise recapturing the sensory-perceptual experiences in absorbing memory, may induce an absorbed mindset in positive activities (Watkins, 2016). However, depressed patients were found to have reduced vividness when generating mental imagery of positive memories (Werner-Seidler & Moulds, 2011) and were more prone to compare their current states with the positive memories (Holmes et al., 2016; Rimes & Watkins, 2005; Treynor et al., 2003; Watkins, 2008). These findings indicate that evidence of AT in a non-clinically diagnosed population may not be directly transferable to depressed individuals and a higher intensity of AT interventions may be needed for the clinical population.

Conclusion

In conclusion, this preliminary study is the first to examine the effects of absorption training of rumination-focused CBT in improving experiences of positive activities for individuals with anhedonia, which could be a new application of mental imagery exercises apart from those evidenced in the existing literature. The effect sizes indicated that absorption training might have stronger effects on improving absorption and reducing rumination than increasing positive affect in activities. Future studies can further explore whether it can benefit individuals to improve their experiences in positive activities for both clinical and non-clinical populations. Additionally, several methodological issues merit consideration in designing future trials, such as high benchmark levels of absorption, rumination, and positive activities in activities at baseline, varied levels of anhedonia reported, and uncertain effectiveness of training components. To refine the methodology and better conclude the effects of absorption training, future studies should target larger and homogenous samples with higher levels of anhedonia and their experiences of low flow-inducing activities. Future studies should also provide higher-intensity training such as having multiple training sessions, requiring more frequent daily practice, and monitoring participants' training progress. As for stratification of intervention recipients to better understand which group will benefit the most from absorption training, exploring whether the effects of absorption training would vary among individuals with different dispositional tendencies such as those with high rumination tendencies and depressed individuals could be beneficial for future intervention development.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org.ezproxy.frederick.edu/10.1176/appi.books.9780890425596

Arain, M., Campbell, M. J., Cooper, C. L., & Lancaster, G. A. (2010). What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC Medical Research Methodology, 10*, 1-7.

Asakawa, K. (2004). Flow Experience and Autotelic Personality in Japanese College Students: How Do They Experience Challenges in Daily Life? *Journal of Happiness Studies, 5*(2), 123–154. https://doi.org/10.1023/b:johs.0000035915.97836.89

Augustine, A. A., & Larsen, R. J. (2012). Is a Trait Really the Mean of States? *Journal of Individual Differences, 33*(3), 131–137. https://doi.org/10.1027/1614-0001/a000083

Blackwell, S. E., Browning, M., Mathews, A., Pictet,

A., Welch, J., Davies, J., Watson, P., Geddes, J. R., & Holmes, E. A. (2015). Positive Imagery-Based Cognitive Bias Modification as a Web-Based Treatment Tool for Depressed Adults. *Clinical Psychological Science, 3*(1), 91–111. https://doi.org/10.1177/2167702614560746

Bulté, I. & Onghena, P. (2013). The single-case data analysis package: Analysing single-case experiments with R software. *Journal of Modern Applied Statistical Methods, 12*, 450-478. https://doi.org/10.22237/jmasm/1383280020

Carr, J. E. (2005). Recommendations for reporting multiple-baseline designs across participants. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs, 20*(3), 219-224. https://doi.org/10.1002/bin.191

Collins, A. L., Sarkisian, N., & Winner, E. (2008). Flow and Happiness in Later Life: An Investigation into the Role of Daily and Weekly Flow Experiences. *Journal of Happiness Studies, 10*(6), 703–719. https://doi.org/10.1007/s10902-008-9116-3

Copperstone, J. S. (2004). *The effects of flow-based training on counselor-trainees' and clients' perceptions of the counseling experience.* (Unpublished doctoral dissertation), Arizona State University.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper and Row.

Csikszentmihalyi, M. (1999). If we are so rich, why aren't we happy? *American Psychologist, 54*(10), 821–827. https://doi.org/10.1037/0003-066x.54.10.821

Csíkszentmihályi, M. (2000). *Beyond boredom and anxiety: experiencing flow in work and play*. San Francisco, CA: Jossey-Bass.

Csikszentmihalyi, M., & Rathunde, K. (1993). The measurement of flow in everyday life: Toward a theory of emergent motivation. In J. E. Jacobs (Ed.), *Nebraska Symposium on Motivation, 1992: Developmental perspectives on motivation* (pp. 57–97). University of Nebraska Press.

Dykman, B. M. (1998). Integrating cognitive and motivational factors in depression: initial tests of a goal-orientation approach. *Journal of personality and social psychology, 74*(1), 139. https://doi.org/10.1037/0022-3514.74.1.139

Ehring, T., & Watkins, E. R. (2008). Repetitive Negative Thinking as a Transdiagnostic Process. *International Journal of Cognitive Therapy, 1*(3), 192–205. https://doi.org/10.1521/ijct.2008.1.3.192

Falcón, J. C. S., Ramírez, E. S., Martín, M. B. G., Bernal, P. A., Sierra, M. A., Ruiz, F. J., & Montero, K. B. (2017). Psychometric properties and factor structure of the ruminative responses scale-short form in Colombia. *International Journal of Psychology and Psychological Therapy, 17*(2), 199-208. https://dialnet.unirioja.es/descarga/articulo/6032259.pdf

Fu, C. H., Steiner, H., & Costafreda, S. G. (2013). Predictive neural biomarkers of clinical response in depression: A meta-analysis of functional and structural neuroimaging studies of pharmacological and psychological therapies. *Neurobiology of Disease, 52*, 75–83. https://doi.org/10.1016/j.nbd.2012.05.008

Fullagar, C. J., & Kelloway, E. K. (2009). Flow at work: An experience sampling approach. *Journal of Occupational and Organizational Psychology, 82*(3), 595–615. https://doi.org/10.1348/096317908x357903

Heyvaert, M., & Onghena, P. (2014). Analysis of single-case data: Randomisation tests for measures of effect size. *Neuropsychological Rehabilitation, 24*(3–4), 507–527. https://doi.org/10.1080/09602011.2013.818564

Holmes, E. A., Blackwell, S. E., Burnett Heyes, S., Renner, F., & Raes, F. (2016). Mental Imagery in Depression: Phenomenology, Potential Mechanisms, and Treatment Implications. *Annual Review of Clinical Psychology, 12*(1), 249–280. https://doi.org/10.1146/annurev-clinpsy-021815-092925

Hvenegaard, M., Moeller, S. B., Poulsen, S., Gondan, M., Grafton, B., Austin, S. F., Kistrup, M., Rosenberg, N. G. K., Howard, H., & Watkins, E. R. (2019). Group rumination-focused cognitive-behavioural therapy (CBT) v. group CBT for depression: phase II trial. *Psychological Medicine, 50*(1), 11–19. https://doi.org/10.1017/s0033291718003835

Jackson, S. A., & Eklund, R. C. (2002). Assessing Flow in Physical Activity: The Flow State Scale–2 and Dispositional Flow Scale–2. *Journal of Sport and Exercise Psychology, 24*(2), 133–150. https://doi.org/10.1123/jsep.24.2.133

Jackson, S. A., Ford, S. K., Kimiecik, J. C., & Marsh, H. W. (1998). Psychological Correlates of Flow

in Sport. *Journal of Sport and Exercise Psychology, 20*(4), 358–378. https://doi.org/10.1123/jsep.20.4.358

Jackson, S. A., & Marsh, H. W. (1996). Development and Validation of a Scale to Measure Optimal Experience: The Flow State Scale. *Journal of Sport and Exercise Psychology, 18*(1), 17–35. https://doi.org/10.1123/jsep.18.1.17

Jackson, S. A., Martin, A. J., & Eklund, R. C. (2008). Long and Short Measures of Flow: The Construct Validity of the FSS-2, DFS-2, and New Brief Counterparts. *Journal of Sport and Exercise Psychology, 30*(5), 561–587. https://doi.org/10.1123/jsep.30.5.561

Jackson, S. A., Thomas, P. R., Marsh, H. W., & Smethurst, C. J. (2001). Relationships between Flow, Self-Concept, Psychological Skills, and Performance. *Journal of Applied Sport Psychology, 13*(2), 129–153. https://doi.org/10.1080/104132001753149865

Joaquín Rodríguez Vidal, Diana Riaño Hernández, Juan Carlos Suárez Falcón, & Carmen Luciano. (2016). Effect of a One-Session ACT Protocol in Disrupting Repetitive Negative Thinking: A Randomized Multiple-Baseline Design. *International Journal of Psychology and Psychological Therapy, 16*(3), 213–233. https://dialnet.unirioja.es/descarga/articulo/5679128.pdf

Johnson, J. A., Keiser, H. N., Skarin, E. M., & Ross, S. R. (2014). The Dispositional Flow Scale–2 as a Measure of Autotelic Personality: An Examination of Criterion-Related Validity. *Journal of Personality Assessment, 96*(4), 465–470. https://doi.org/10.1080/00223891.2014.891524

Killingsworth, M. A., & Gilbert, D. T. (2010). A Wandering Mind Is an Unhappy Mind. *Science, 330*(6006), 932. https://doi.org/10.1126/science.1192439

Lambert, J., & Csikszentmihalyi, M. (2019). Facilitating or foiling flow: the role of momentary perceptions of feedback. *The Journal of Positive Psychology, 15*(2), 208–219. https://doi.org/10.1080/17439760.2019.1578893

Ma, H. H. (2006). An alternative method for quantitative synthesis of single subject researches: Percentage of data points exceeding the median. *Behavior Modification, 30*(5), 598-617. https://doi.org/10.1177/0145445504272974

Marchetti, I., Mor, N., Chiorri, C., & Koster, E. H. W. (2018). The Brief State Rumination Inventory (BSRI): Validation and Psychometric Evaluation. *Cognitive Therapy and Research, 42*(4), 447–460. https://doi.org/10.1007/s10608-018-9901-1

Martin, L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer (Vol. Ed.), *Ruminative thoughts: Advances in social cognition*: Vol. IX, (pp. 1–47). Mahwah, NJ: Erlbaum.

Moberly, N. J., & Watkins, E. R. (2006). Processing Mode Influences the Relationship Between Trait Rumination and Emotional Vulnerability. *Behavior Therapy, 37*(3), 281–291. https://doi.org/10.1016/j.beth.2006.02.003

Moeller, S. B., Austin, S. F., Hvenegaard, M., Kistrup, M., Gran, S., & Watkins, E. (2019). Rumination-focused cognitive behaviour therapy for non-responsive chronic depression: an uncontrolled group study. *Behavioural and Cognitive Psychotherapy, 48*(3), 376–381. https://doi.org/10.1017/s1352465819000584

Morley, S. (2015). *Visual analysis for single-case data: Draft chapter*. Retrieved from https://www.researchgate.net/publication/278300494_Visual_analysis_for_single_ case_data_Draft_chapter

Morley, S., Linton, S., & Vlaeyen, J. (2015). Single case research methodology in clinical pain management–An introduction and practical workshop. In *9th Congress of the European Pain Federation EFIC*.

Mundell, C. E. (2000). The role of perceived skill, perceived challenge, and flow in the experience of positive and negative affect. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 61*(5-B), 2802.

Nakamura, J., & Csikszentmihalyi, M. (2002). Flow theory and research. *Handbook of positive psychology, 195*, 206.

Nichols, A. L., & Maner, J. K. (2008). The Good-Subject Effect: Investigating Participant Demand Characteristics. *The Journal of General Psychology, 135*(2), 151–166. https://doi.org/10.3200/genp.135.2.151-166

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*(4), 569–582. https://doi.org/10.1037/0021-843x.100.4.569

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*(3), 504–511. https://doi.org/10.1037/0021-843x.109.3.504

Nolen-Hoeksema, S., & Watkins, E. R. (2011). A Heuristic for Developing Transdiagnostic Models of Psychopathology. *Perspectives on Psychological Science, 6*(6), 589–609. https://doi.org/10.1177/1745691611419672

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science, 3*(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Norsworthy, C., Jackson, B., & Dimmock, J. A. (2021). Advancing our understanding of psychological flow: A scoping review of conceptualizations, measurements, and applications. *Psychological Bulletin, 147*(8), 806. https://doi.org/10.1037/bul0000337

Onghena, P. (2020). One by one: The design and analysis of replicated randomized single-case experiments. In *Small Sample Size Solutions* (pp. 87-101). Routledge.

Pearson, K. (1934). On a new method of determining "goodness of fit." *Biometrika, 26*, 425–442.

Peifer, C., & Engeser, S. (2021). *Advances in Flow Research: Second Revised and Extended Edition* (2nd ed.). Springer.

Rimes, K. A., & Watkins, E. (2005). The effects of self-focused rumination on global negative self-judgements in depression. *Behaviour Research and Therapy, 43*(12), 1673–1681. https://doi.org/10.1016/j.brat.2004.12.002

Rogatko, T. P. (2007). The Influence of Flow on Positive Affect in College Students. *Journal of Happiness Studies, 10*(2), 133–148. https://doi.org/10.1007/s10902-007-9069-y

Sarstedt, M., & Wilczynski, P. (2009). More for less? A comparison of single-item and multi-item measures. *Die Betriebswirtschaft, 69*, 211.

Scruggs, T. E., Mastropieri, M. A., Cook, S. B., & Escobar, C. (1986). Early Intervention for Children with Conduct Disorders: A Quantitative Synthesis of Single-Subject Research. *Behavioral Disorders, 11*(4), 260–271. https://doi.org/10.1177/019874298601100408

Sheldon, K. M., Prentice, M., & Halusic, M. (2014). The Experiential Incompatibility of Mindfulness and Flow Absorption. *Social Psychological and Personality Science, 6*(3), 276–283. https://doi.org/10.1177/1948550614555028

Snaith, R. P., Hamilton, M., Morley, S., Humayan, A., Hargreaves, D., & Trigwell, P. (1995). A Scale for the Assessment of Hedonic Tone the Snaith–Hamilton Pleasure Scale. *British Journal of Psychiatry, 167*(1), 99–103. https://doi.org/10.1192/bjp.167.1.99

Tanious, R., & Onghena, P. (2019). Randomized Single-Case Experimental Designs in Healthcare Research: What, Why, and How? *Healthcare, 7*(4), 143. https://doi.org/10.3390/healthcare7040143

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive therapy and research, 27*, 247-259. https://doi.org/10.1023/A:1023910315561

Tse, D. C. K., Nakamura, J., & Csikszentmihalyi, M. (2020). Living well by "flowing' well: The indirect effect of autotelic personality on well-being through flow experience. *The Journal of Positive Psychology, 16*(3), 310–321. https://doi.org/10.1080/17439760.2020.1716055

Watkins, E. (2004). Adaptive and maladaptive ruminative self-focus during emotional processing. *Behaviour Research and Therapy, 42*(9), 1037–1052. https://doi.org/10.1016/j.brat.2004.01.009

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*(2), 163–206. https://doi.org/10.1037/0033-2909.134.2.163

Watkins, E. R. (2016). *Rumination-Focused Cognitive-Behavioral Therapy for Depression*. New York, NY: Guilford Press.

Watkins, E. R., Mullan, E., Wingrove, J., Rimes, K., Steiner, H., Bathurst, N., Eastman, R., & Scott, J. (2011). Rumination-focused cognitive–behavioural therapy for residual depression: phase II randomised controlled trial. *British Journal of Psychiatry, 199*(4), 317–322. https://doi.org/10.1192/bjp.bp.110.090282

Watkins, E. R., & Nolen-Hoeksema, S. (2014). A habit-goal framework of depressive rumination. *Journal of Abnormal Psychology, 123*(1), 24–34. https://doi.org/10.1037/a0035540

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mecha-

nisms and treatment of rumination. *Behaviour Research and Therapy, 127*, 103573. https://doi.org/10.1016/j.brat.2020.103573

Watkins, E., Scott, J., Wingrove, J., Rimes, K., Bathurst, N., Steiner, H., Kennell–Webb, S., Moulds, M., & Malliaris, Y. (2007). Rumination-focused cognitive behaviour therapy for residual depression: A case series. *Behaviour Research and Therapy, 45*(9), 2144–2154. https://doi.org/10.1016/j.brat.2006.09.018

Watkins, E. R., Taylor, R. S., Byng, R., Baeyens, C. B., Read, R., Pearson, K., & Watson, L. (2012). Guided self-help concreteness training as an intervention for major depression in primary care: A Phase II randomized controlled trial. *Psychological Medicine, 42*, 1359–1371. https://doi.org/10.1017/S0033291711002480

Watson, D., Clark, L. A., & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. *Journal of Abnormal Psychology, 97*(3), 346–353. https://doi.org/10.1037/0021-843x.97.3.346

Werner-Seidler, A., & Moulds, M. L. (2011). Autobiographical memory characteristics in depression vulnerability: Formerly depressed individuals recall less vivid positive memories. *Cognition &Amp; Emotion, 25*(6), 1087–1103. https://doi.org/10.1080/02699931.2010.531007

Werner-Seidler, A., & Moulds, M. L. (2012). Mood repair and processing mode in depression. *Emotion, 12*(3), 470–478. https://doi.org/10.1037/a0025984

Table 1

Demographic data for participants

	Gender	Age	Ethnicity	Education level
Participant 1	Female	18 - 30 years old	Black	Bachelor's degree
Participant 2	Female	45 + years old	White	Trade/technical/vocational training
Participant 3	Male	18 - 30 years old	Asian	High school/college graduate, diploma or equivalent
Participant 4	Female	18 - 30 years old	White	Bachelor's degree
Participant 5	Male	45 + years old	White	Less than high school
Participant 6	Male	18 - 30 years old	Black	Bachelor's degree
Participant 7	Male	18 - 30 years old	Black	Bachelor's degree
Participant 8	Male	18 - 30 years old	White	Bachelor's degree
Participant 9	Female	18 - 30 years old	Black	Bachelor's degree
Participant 10	Female	18 - 30 years old	Asian	Master's degree
Participant 11	Female	30 - 45 years old	Other ethnic group	Master's degree
Participant 12	Male	18 - 30 years old	Mixed	Bachelor's degree
Participant 13	Female	18 - 30 years old	White	Master's degree
Participant 14	Male	18 - 30 years old	Mixed	Bachelor's degree
Participant 15	Female	18 - 30 years old	Asian	High school/college graduate, diploma or equivalent
Participant 16	Female	18 - 30 years old	Asian	Master's degree

Table 2

Scores at baseline and during absorption training for 16 participants

Outcomes[d]	Score				Analysis		
	Baseline		Absorption training		Mean difference in change of scores[a]	*p*-value[b]	Effect size (PEM)[c]
	Mean	SD	Mean	SD			
Absorption[e]	3.33	0.36	3.71	0.30	0.38	0.12	79.70%
Positive Affect[f]	3.45	0.56	3.80	0.54	0.35	0.18	49.75%
Rumination[g]	134.86	46.49	104.56	31.51	-30.29	0.96	77.06%

Note. PEM, the percentage of data points exceeding the median

[a]Test statistics used in randomization test: mean difference of change in scores from AT to baseline phases (AT-baseline) of all participants

[b]combined p-values computed by meta-analysis of individual p-values with the multiplicative approach using Pearson's method (1934) in RcmdrPlugin.SCDA plug-in (Bulté & Onghena, 2013)

[c]Average effect size for all participants. PEM: <70% reflects questionable effectiveness. 70% to 89% reflects moderate effectiveness. 90% or above suggests large effects (Ma, 2006)

[d]Average scores from daily survey questions – *Baseline phase*: Questions 4-9[e]; Questions 15[f]; Questions 10-14[g]; *Absorption training phase*: Questions 5-10[e]; Questions 16[f]; Questions 11-15[g]

Table 3

Participants' dispositional tendencies to experience rumination, flow, and pleasure

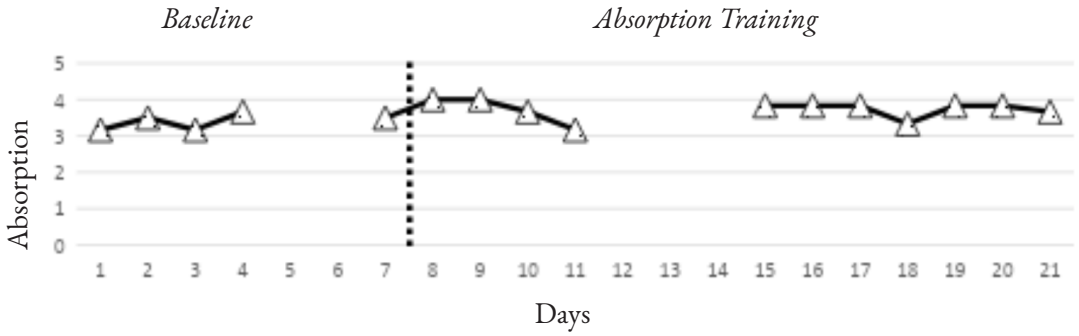
	Scores		
	RRS-SF (scores range from 5 to 20)	**DFS-2 SF (scores range from 1 to 5)**	**SHAPS (scores range from 0 to 14)**
Participant 1	11	2.44	12
Participant 2	12	3.00	3
Participant 3	9	3.11	5
Participant 4	14	4.22	2
Participant 5	10	2.56	1
Participant 6	12	2.00	8
Participant 7	13	3.33	9
Participant 8	8	3.00	7
Participant 9	10	2.00	14
Participant 10	11	3.67	1
Participant 11	9	2.78	3
Participant 12	12	2.89	7
Participant 13	20	1.78	10
Participant 14	10	2.78	5
Participant 15	10	3.22	1
Participant 16	14	2.67	12
Mean Score for all participants	11.56	2.84	6.25
SD	3.61	0.58	4.66

Note. RRS-SF, Ruminative Response Scale – SF; DFS-2 SF, Dispositional Flow Scale – 2 short form; SHAPS, Snaith-Hamilton Pleasure Scale.

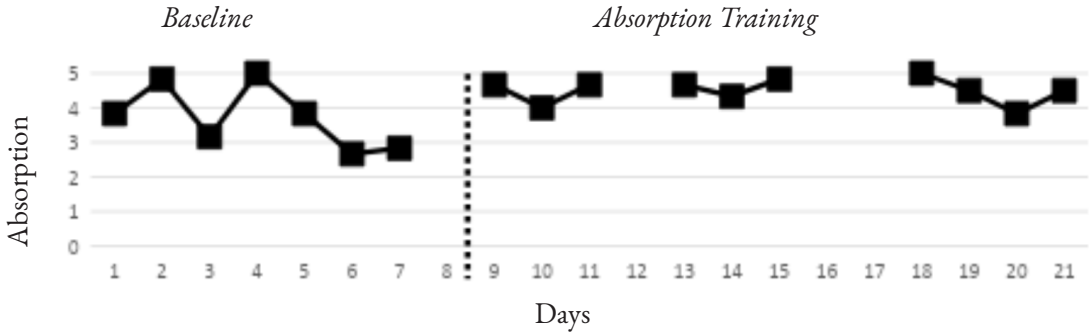
Figure 1

Sixteen participants' levels of absorption during positive activities in a 21-day period

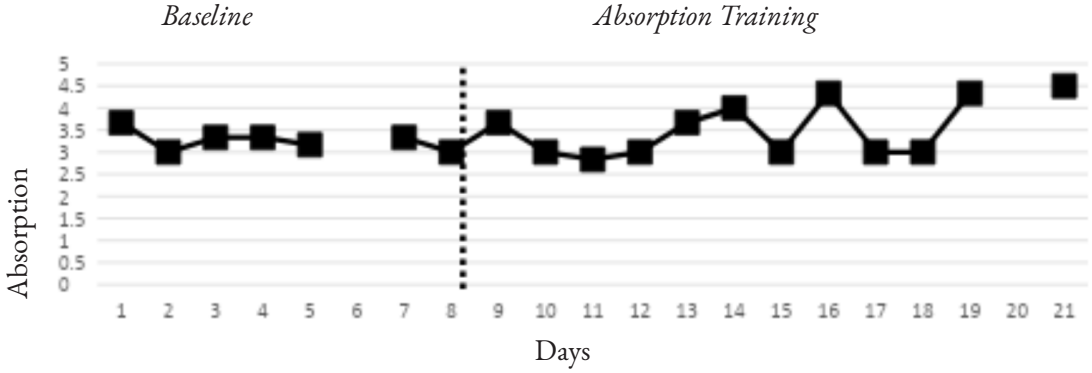
Participant 1



Participant 2



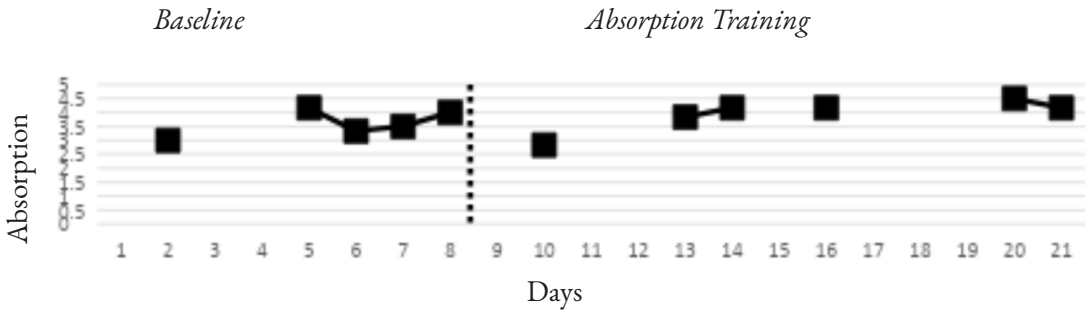
Participant 3



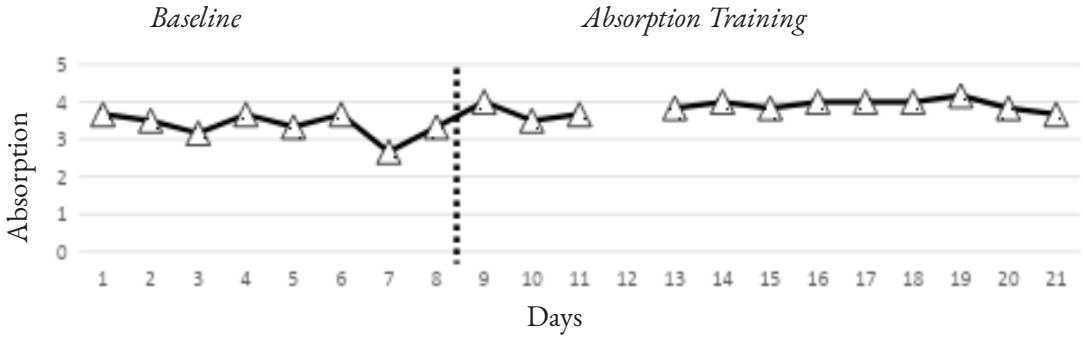
Note. The vertical dotted line is the point of transition from baseline to introduction of absorption training.

Figure 1 (cont.)

Participant 4



Participant 5



Participant 6

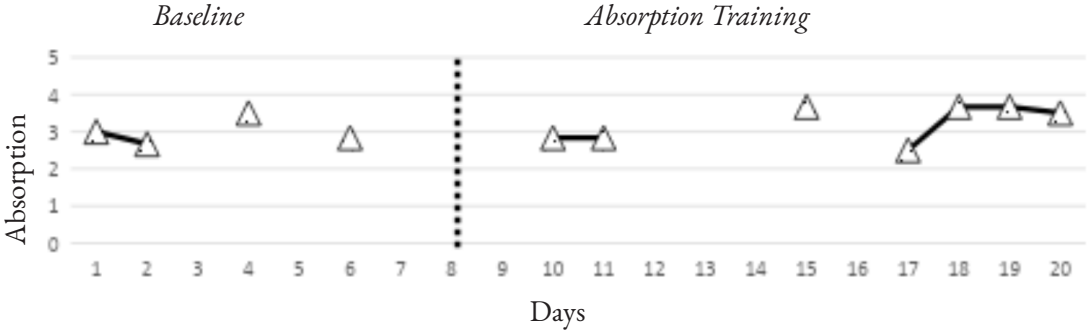
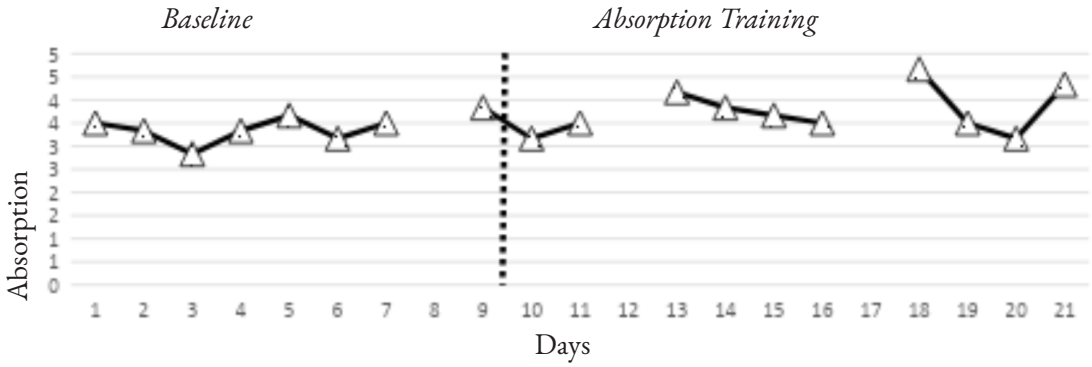
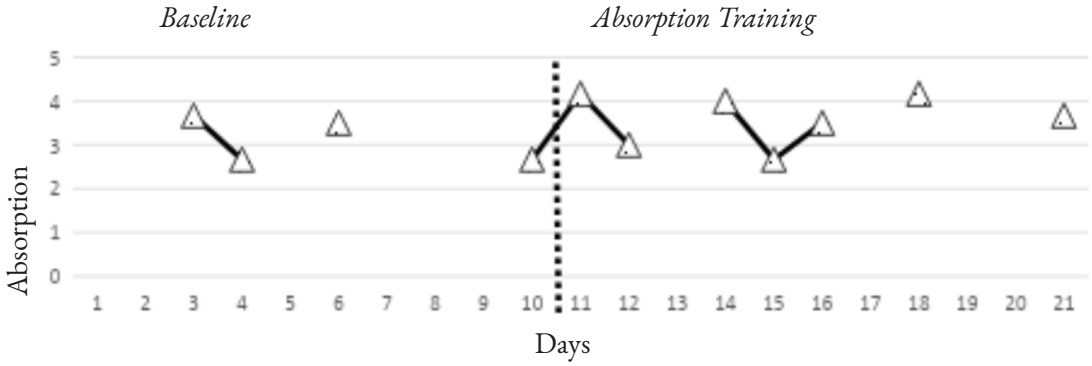


Figure 1 (cont.)

Participant 7



Participant 8



Participant 9

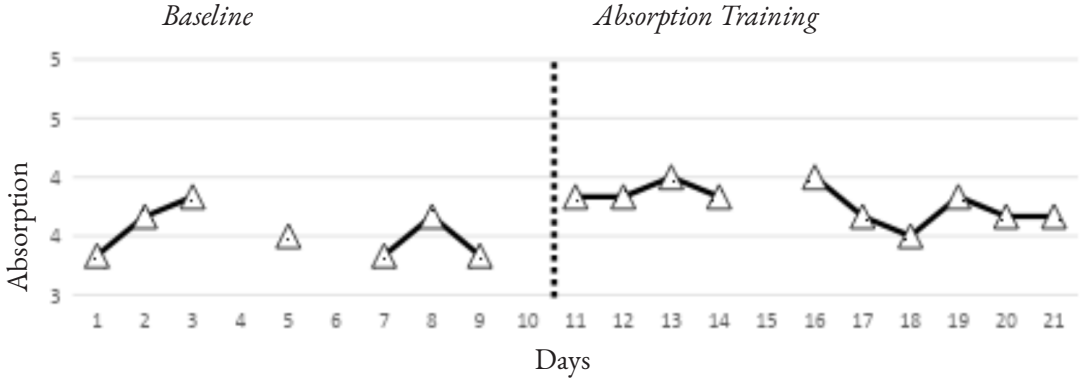
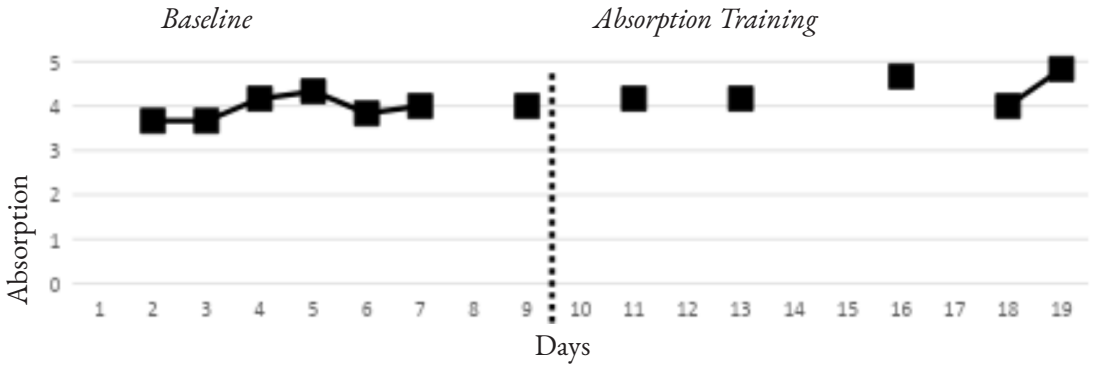
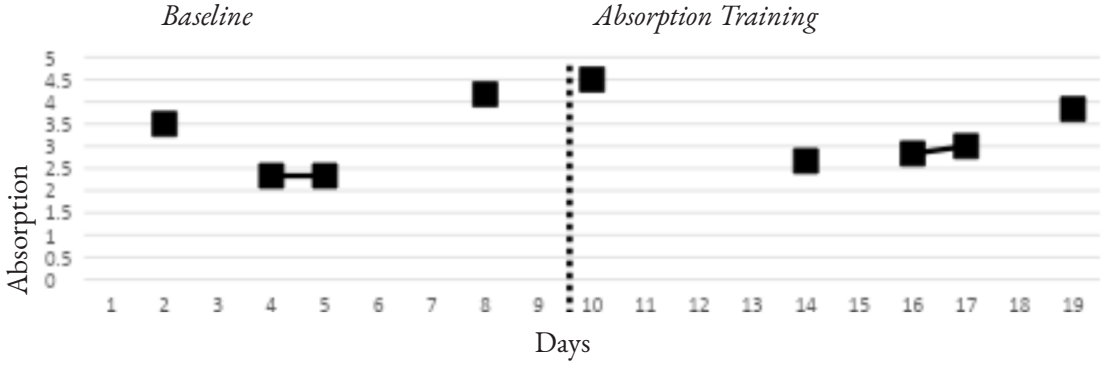


Figure 1 (cont.)

Participant 10



Participant 11



Participant 12

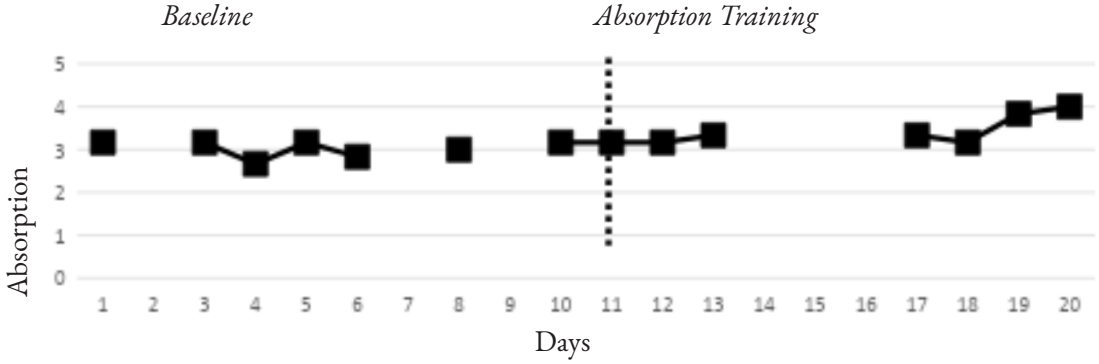
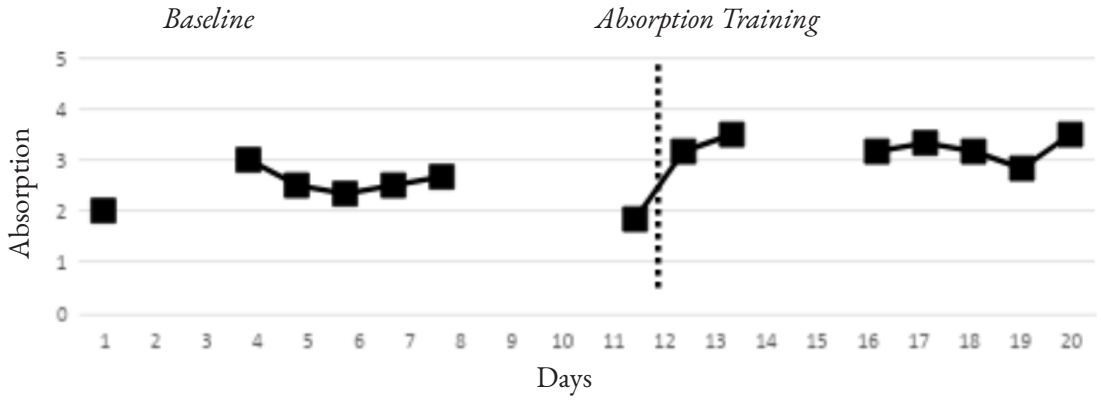
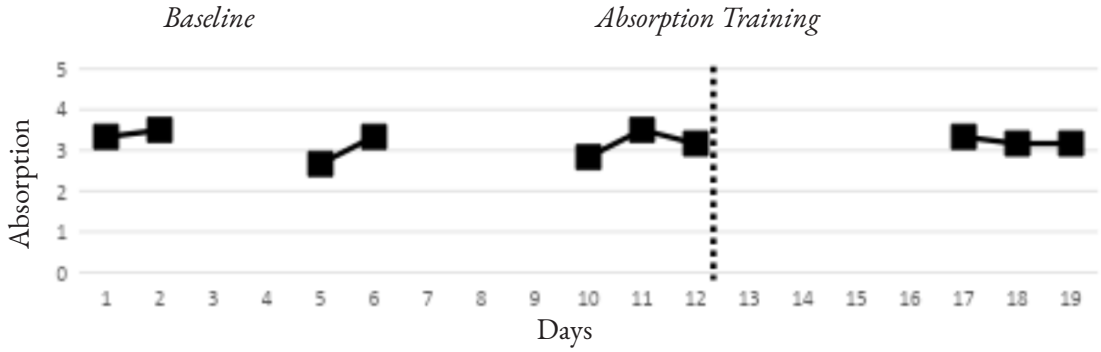


Figure 1 (cont.)

Participant 13



Participant 14



Participant 15

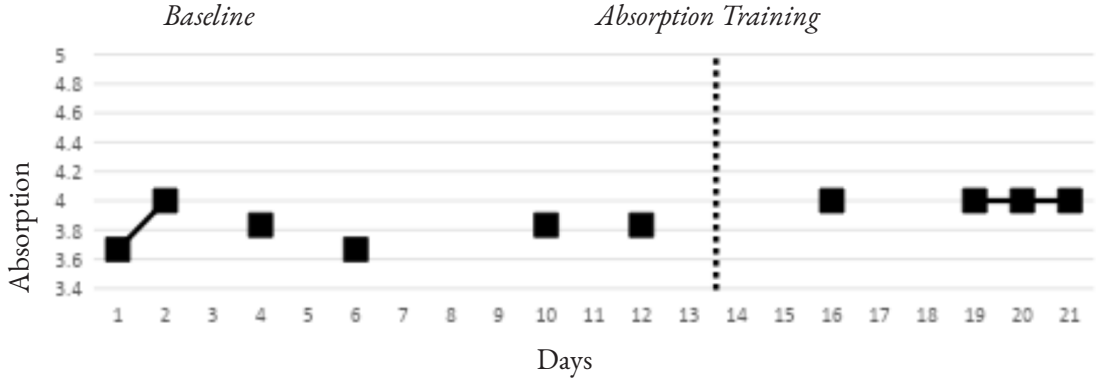


Figure 1 (cont.)

Participant 16

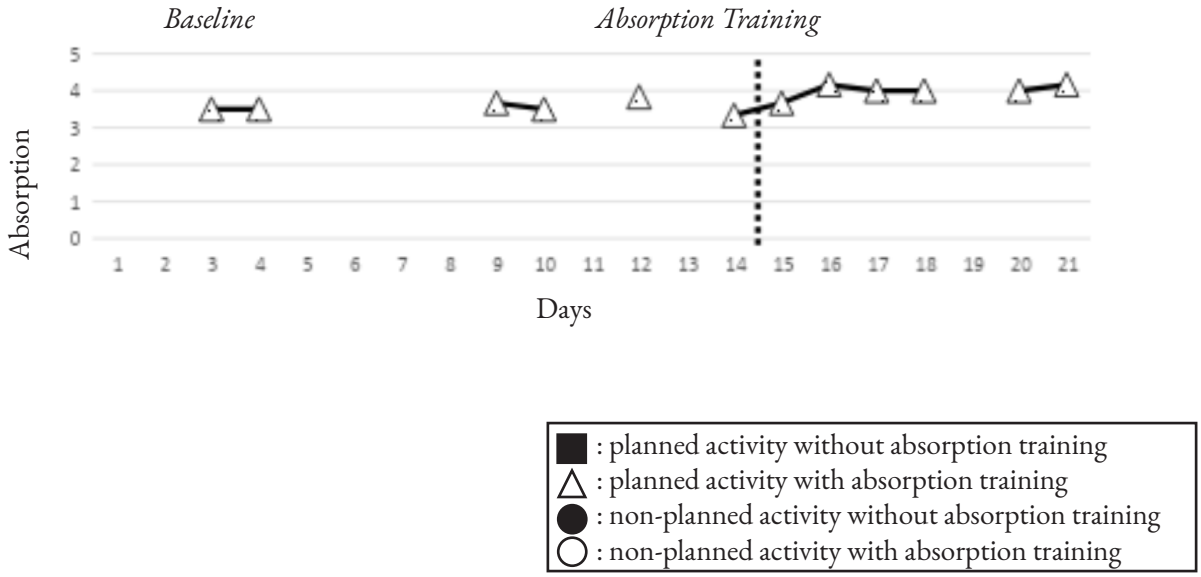
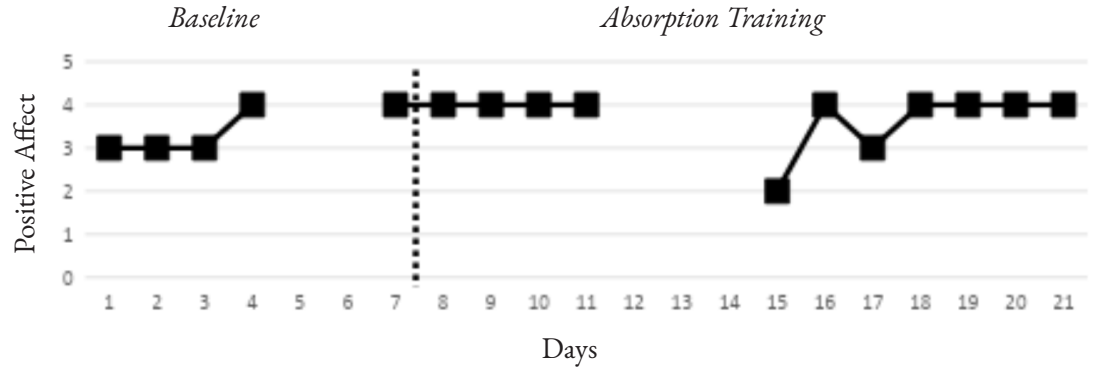


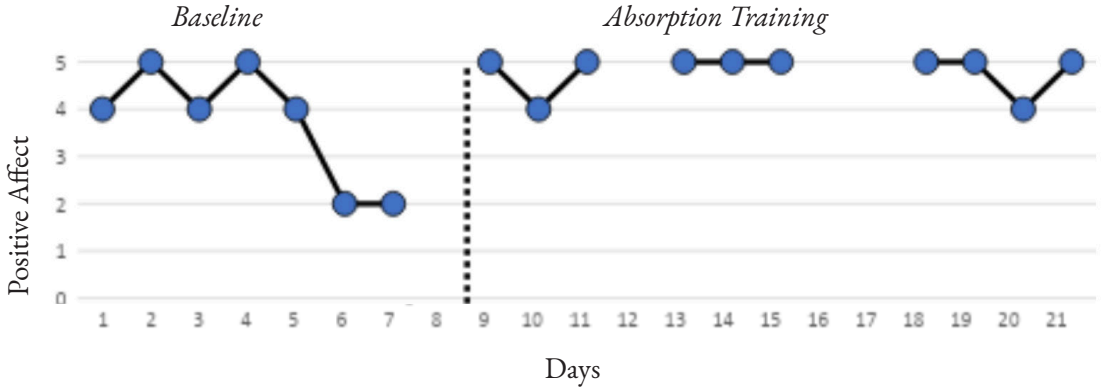
Figure 2

Sixteen participants' levels of positive affect during positive activities in a 21-day period.

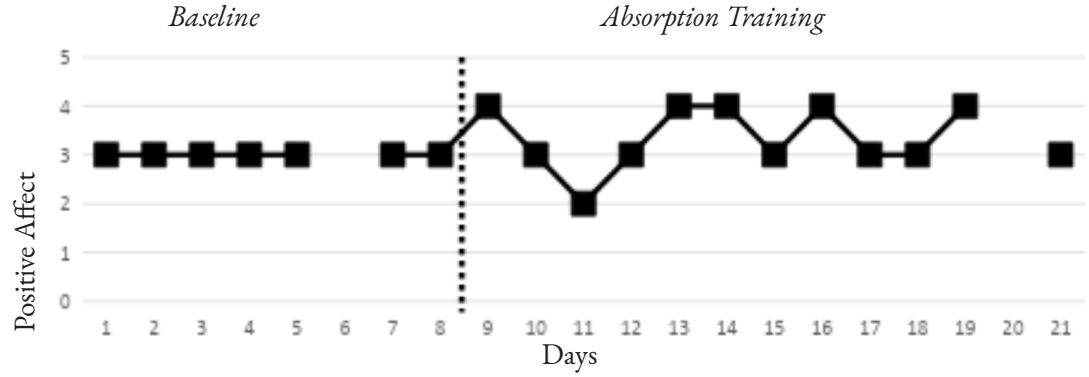
Participant 1



Participant 2



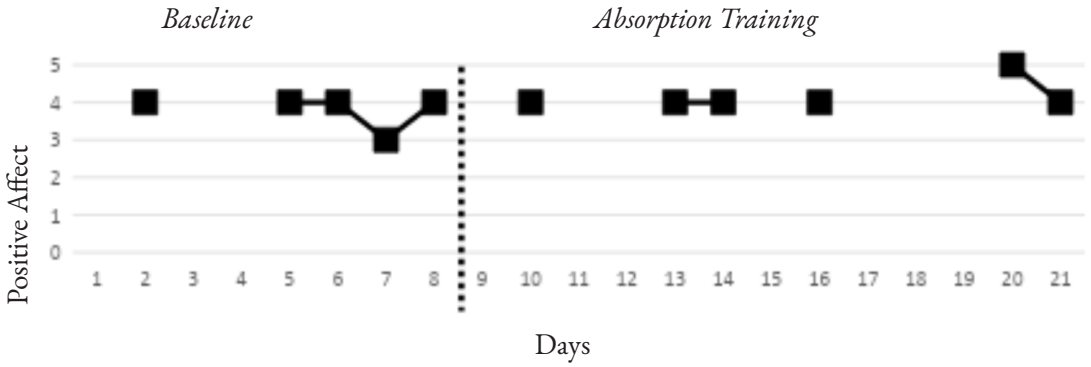
Participant 3



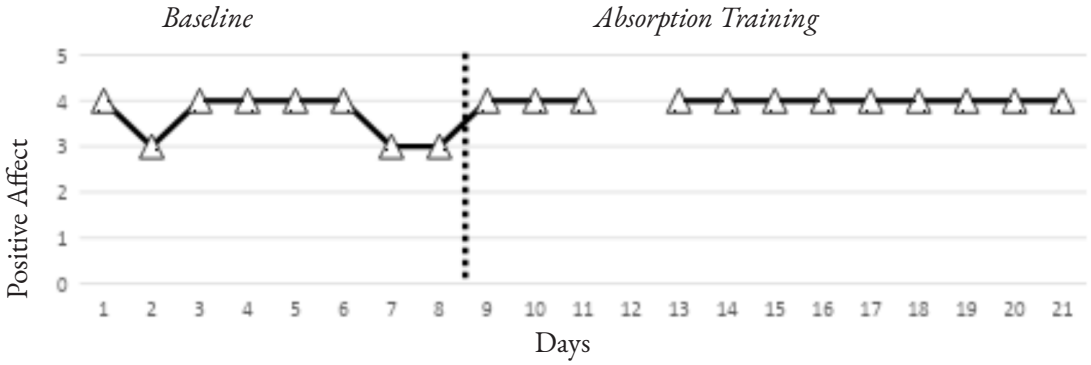
Note. The vertical dotted line is the point of transition from baseline to introduction of absorption training.

Figure 2 (cont.)

Participant 4



Participant 5



Participant 6

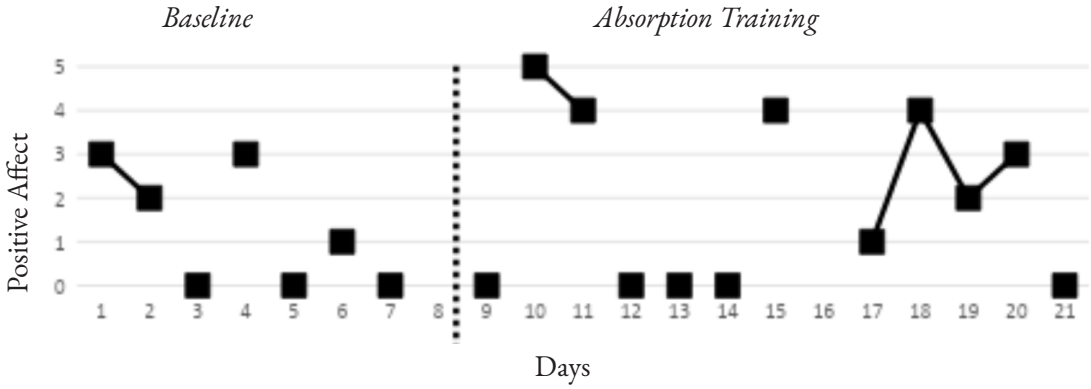
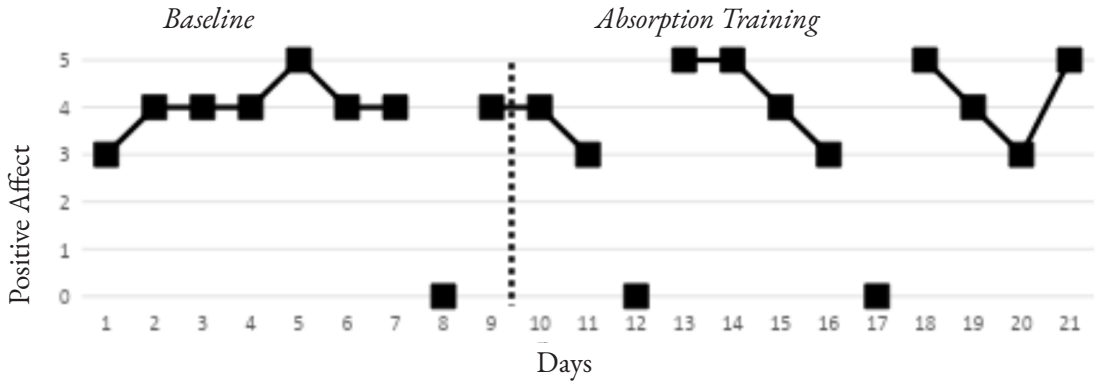
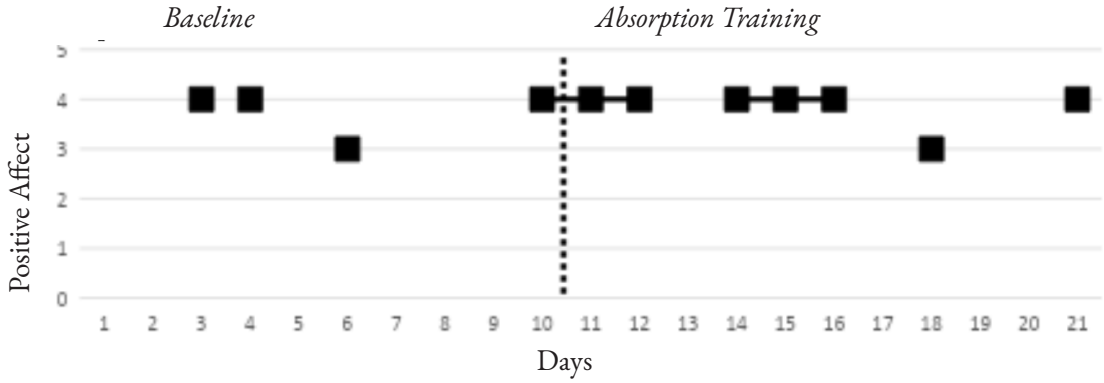


Figure 2 (cont.)

Participant 7



Participant 8



Participant 9

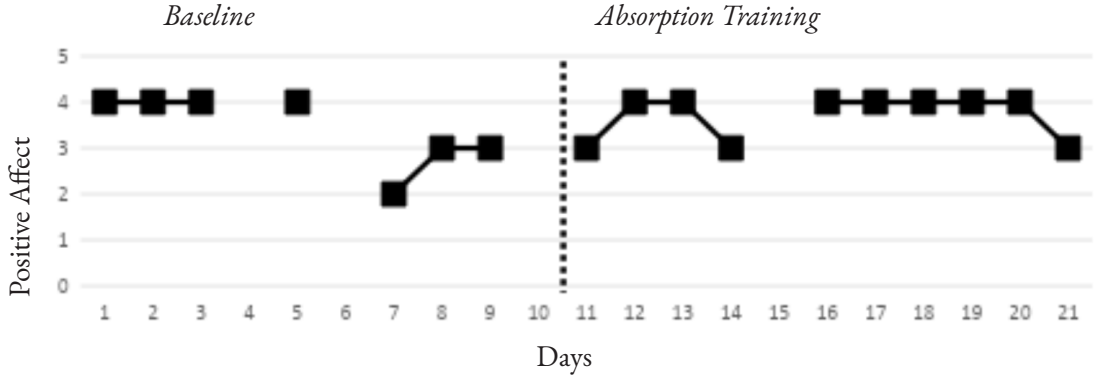
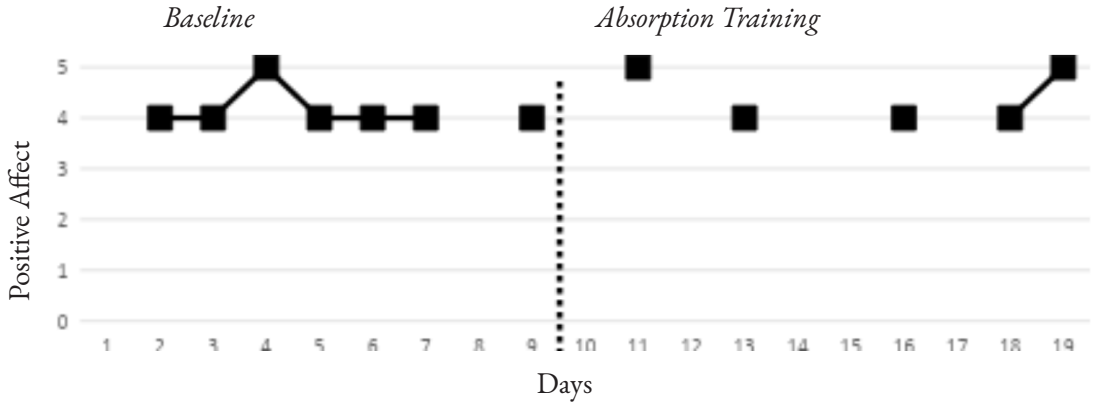
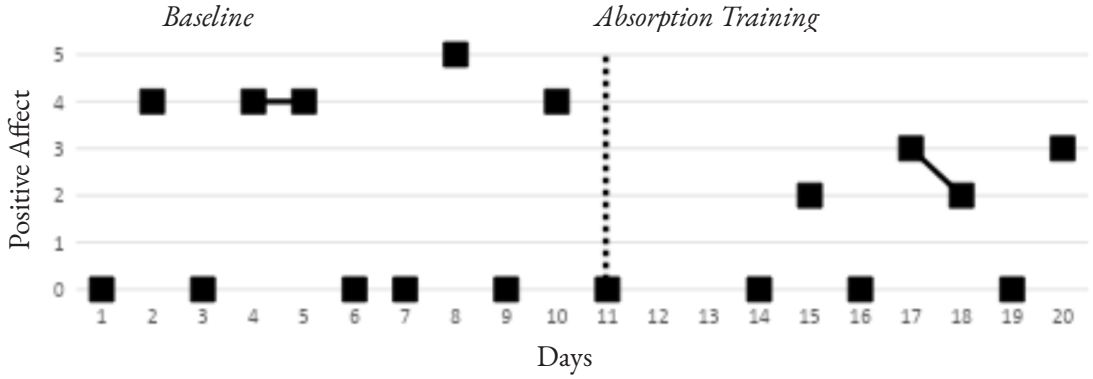


Figure 2 (cont.)

Participant 10



Participant 11



Participant 12

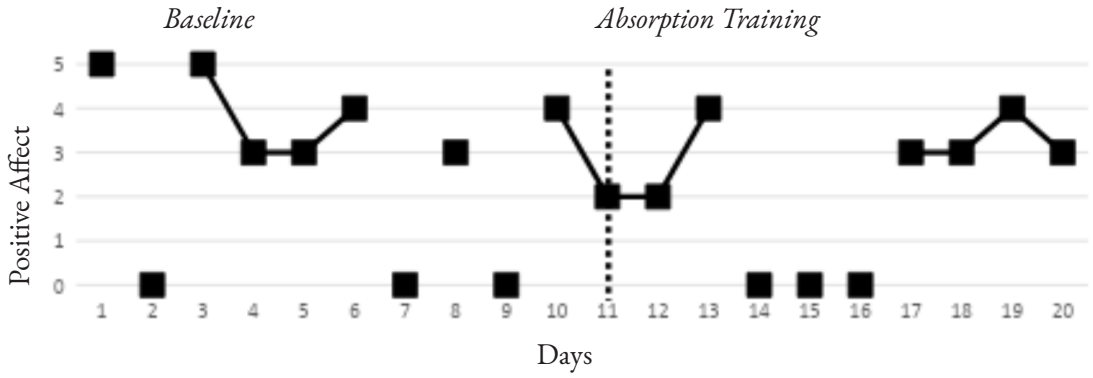
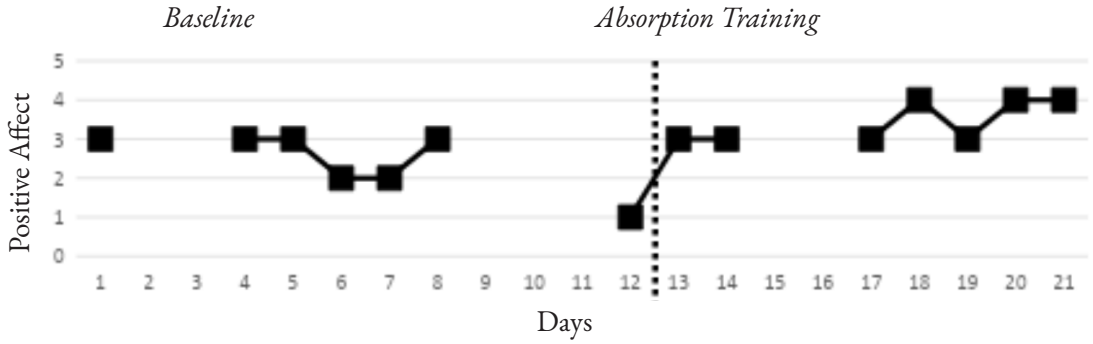
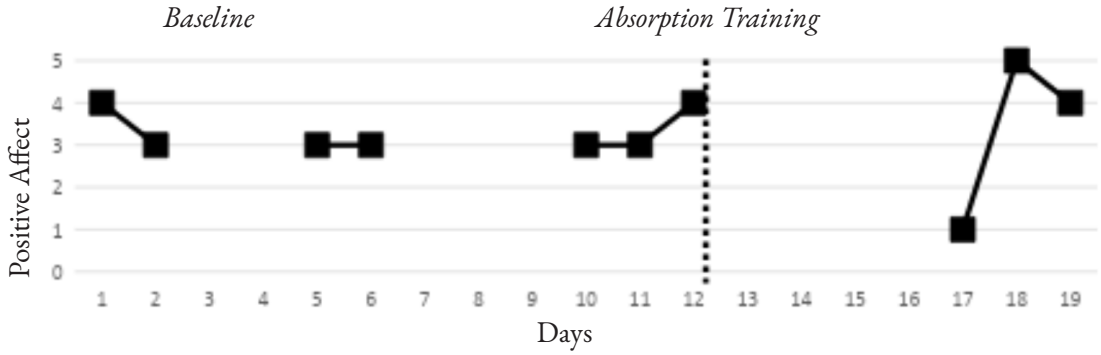


Figure 2 (cont.)

Participant 13



Participant 14



Participant 15

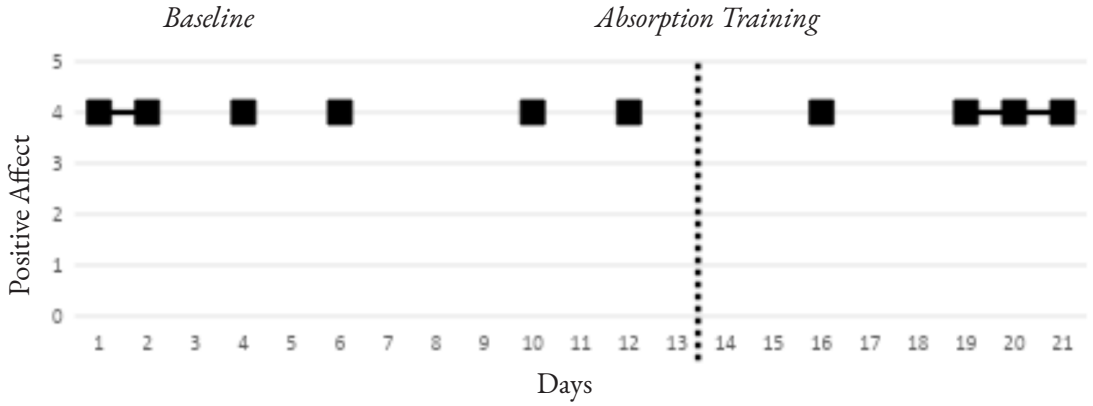
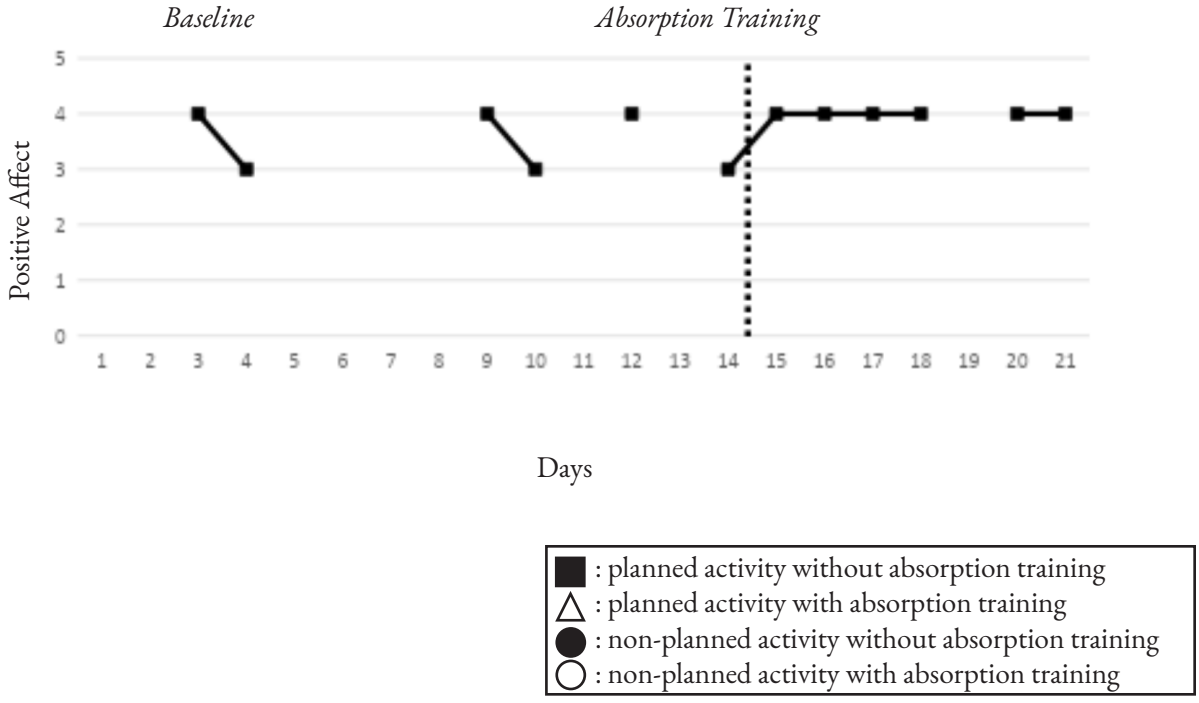


Figure 2 (cont.)

Participant 16

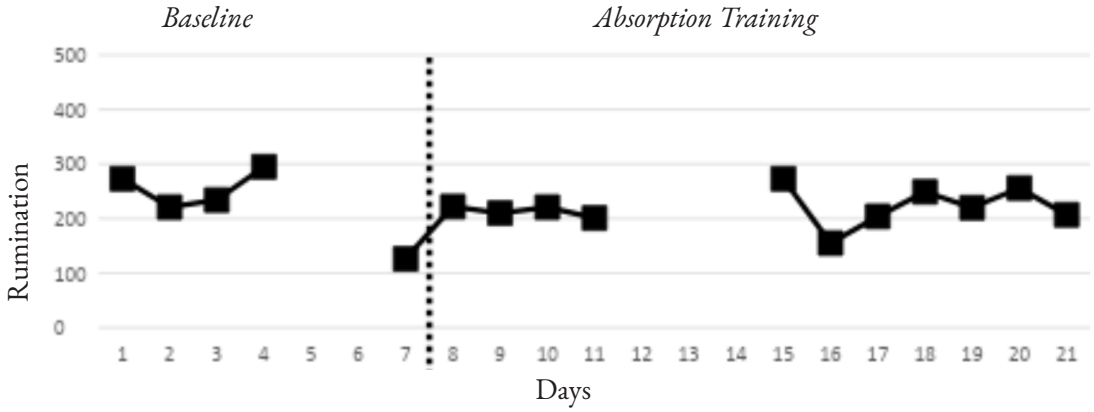


ABSORPTION TRAINING, POSITIVE ACTIVITIES

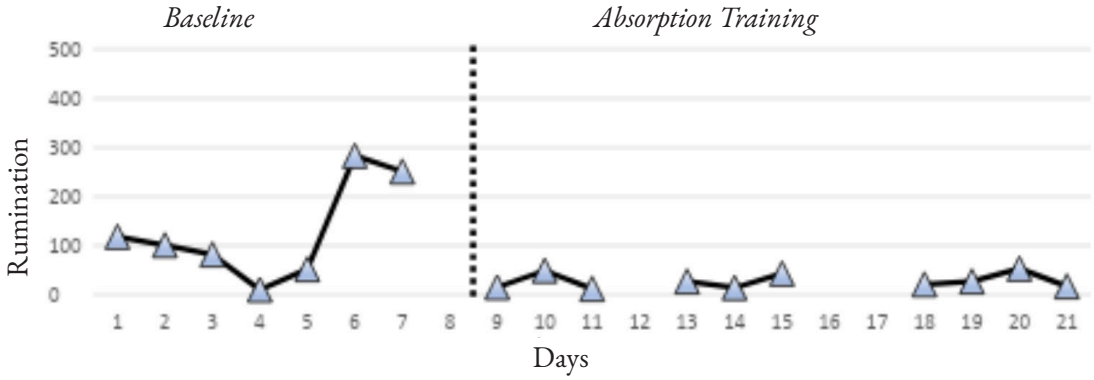
Figure 3

Sixteen participants' levels of maladaptive state rumination during positive activities in a 21-day period.

Participant 1



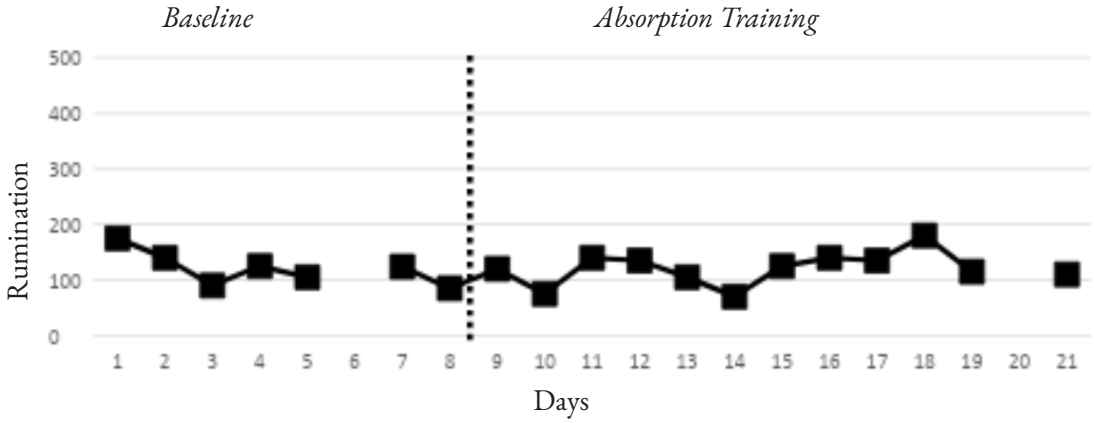
Participant 2



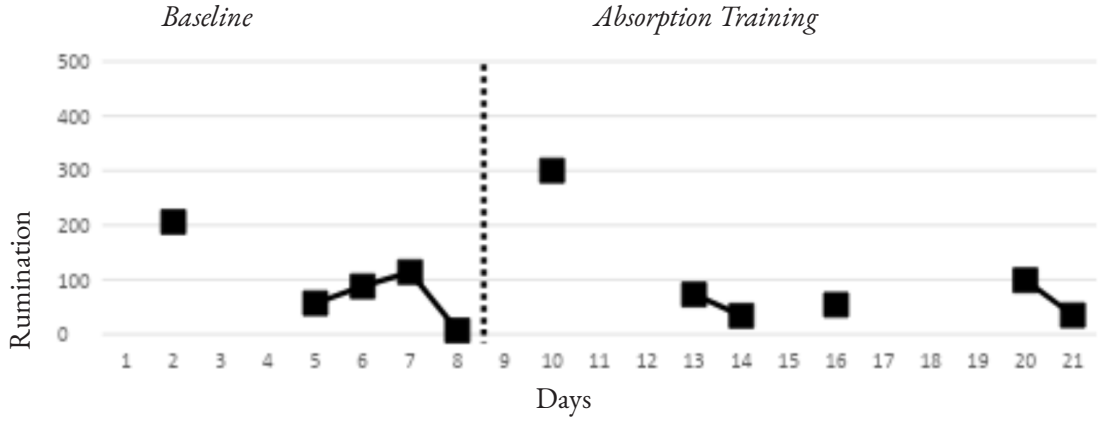
Note. The vertical dotted line is the point of transition from baseline to introduction of absorption training.

Figure 3 (cont.)

Participant 3



Participant 4



Participant 5

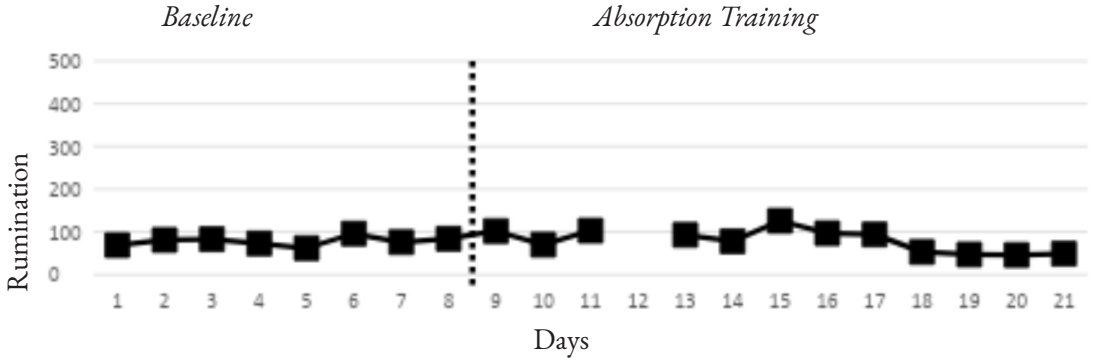
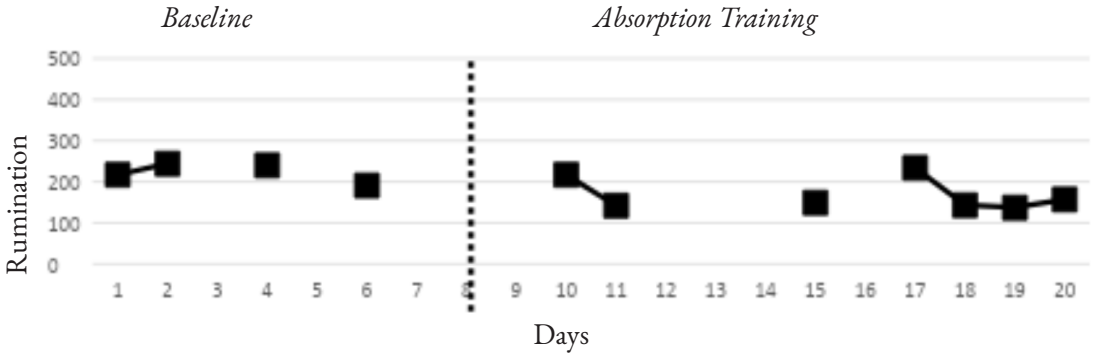
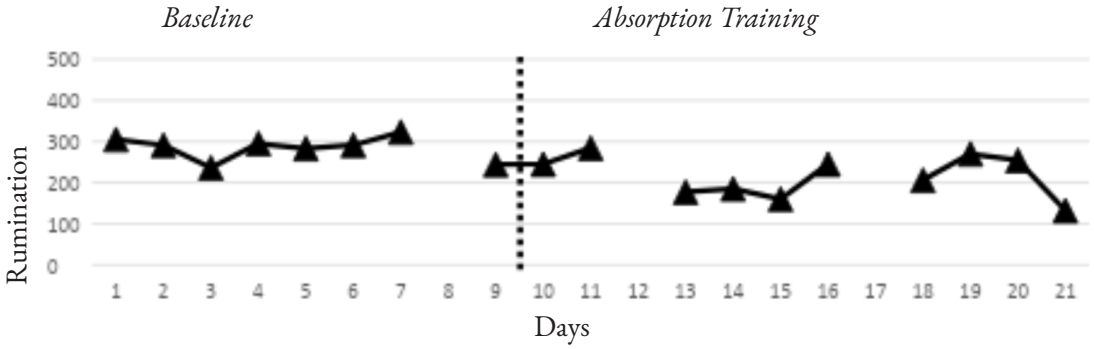


Figure 3 (cont.)

Participant 6



Participant 7



Participant 8

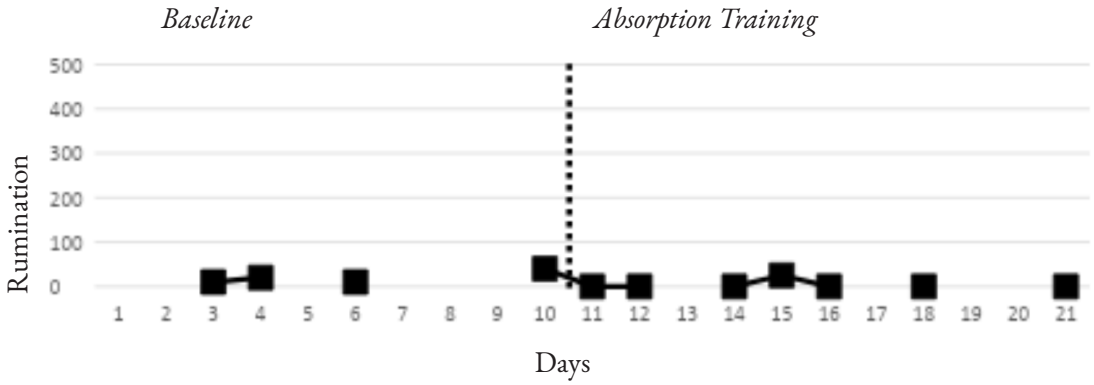
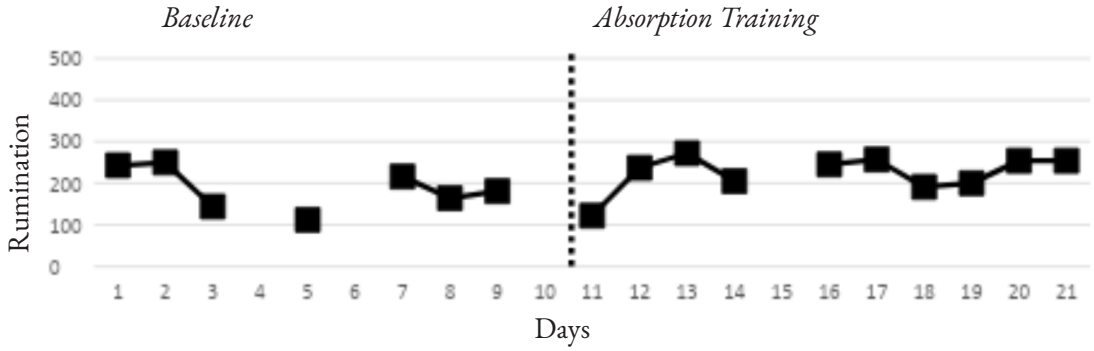
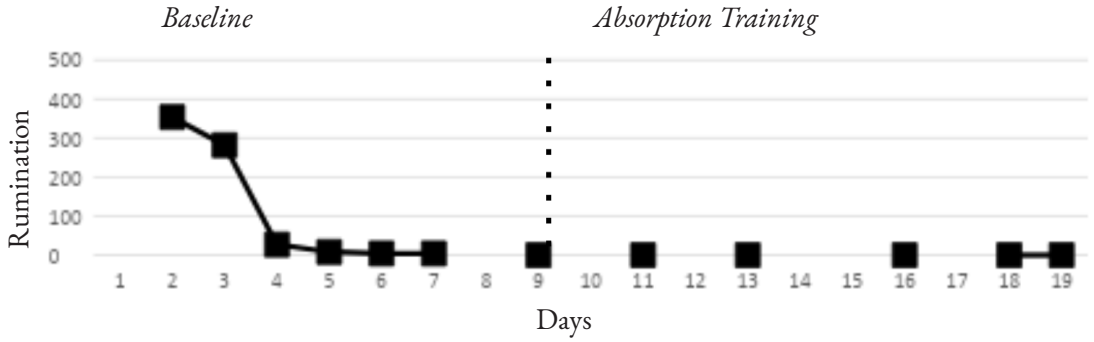


Figure 3 (cont.)

Participant 9



Participant 10



Participant 11

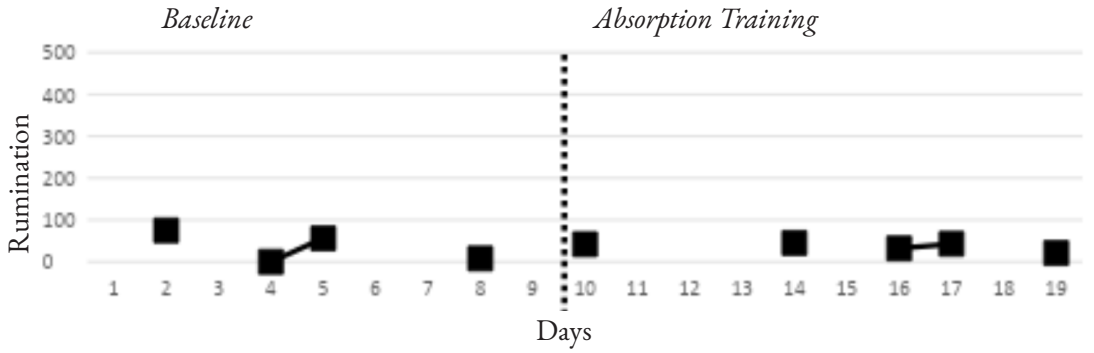
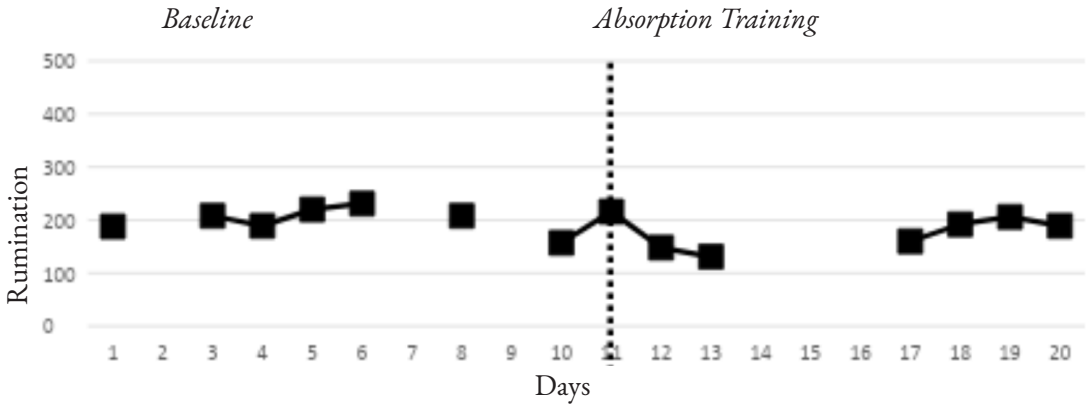
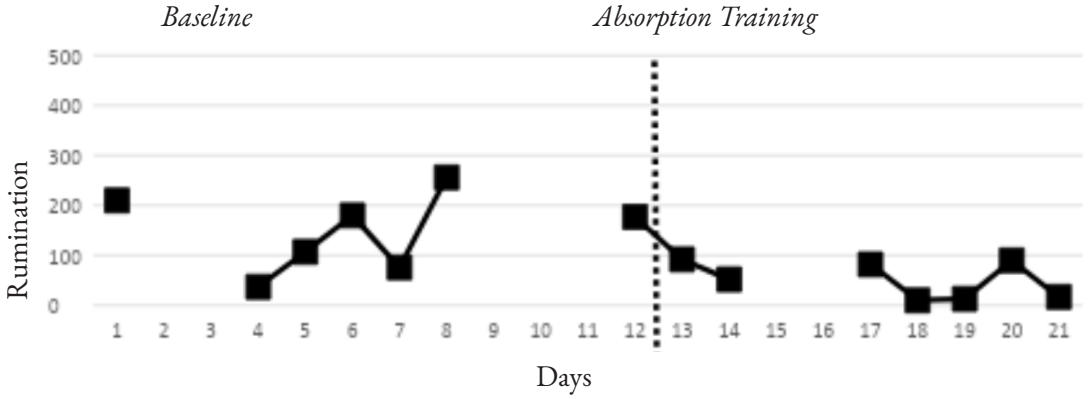


Figure 3 (cont.)

Participant 12



Participant 13



Participant 14

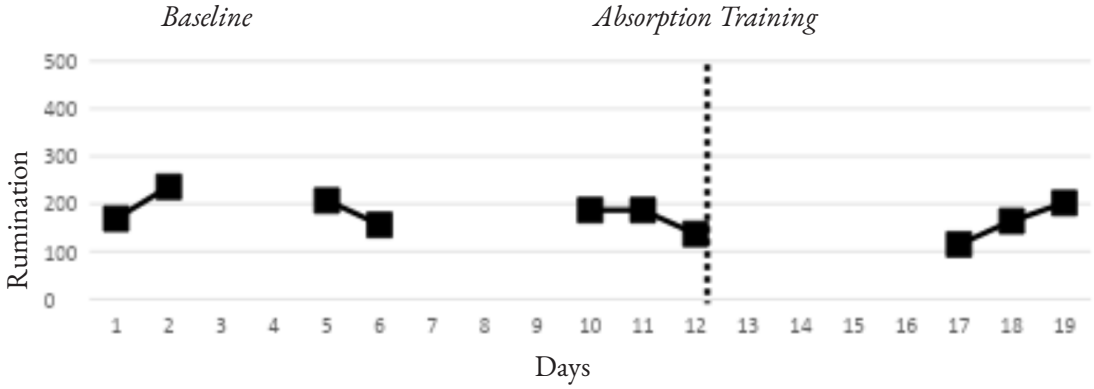
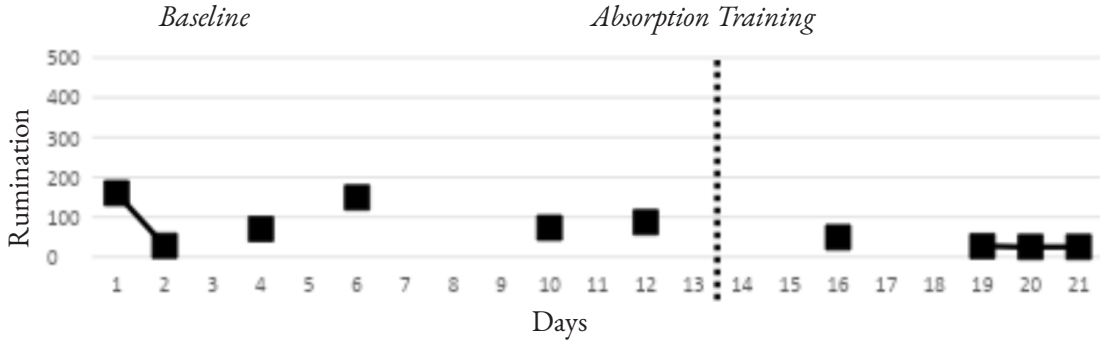
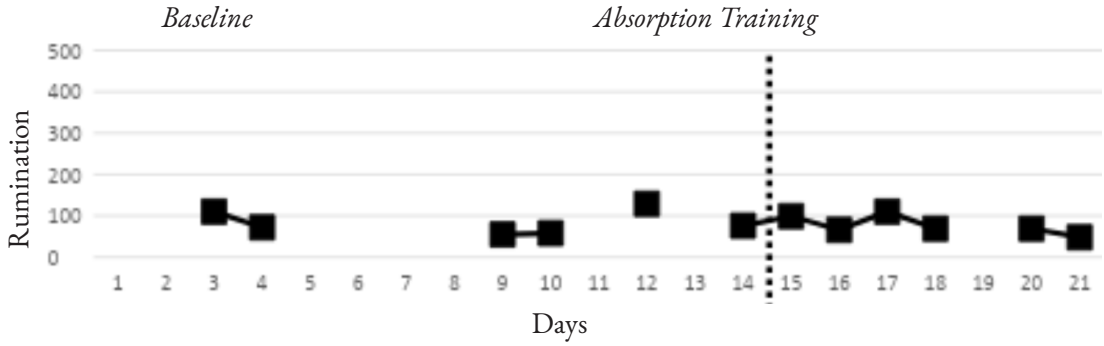


Figure 3 (cont.)

Participant 15



Participant 16



■ : planned activity without absorption training
△ : planned activity with absorption training
● : non-planned activity without absorption training
○ : non-planned activity with absorption training