

# Impacts of Reading Habits on Mindfulness and Psychological Status: A Further Analysis

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## Abstract

The present study examined whether and how daily reading habits including reading time and speed may be associated with dispositional mindfulness and desirable psychological status. Based on a preliminary analysis by Miyata (2016), this article reports outcomes from further statistical analyses. A total of 881 Japanese participants, naïve to mindfulness-based training, meditation, or any specific training in reading, completed Japanese versions of psychological scales on dispositional mindfulness (FFMQ), subjective well-being (SWBS), depression (BDI), positive/negative affect (PANAS), and empathy (IRI) on an online platform. Participants also self-reported time spent reading per day, self-estimated daily reading speed, and measured reading time after reading a well-known Japanese novel. Correlation analyses showed that reading time was significantly associated with higher scores on mindfulness, subjective well-being, positive affect, and empathy, and lower scores on depression. Multiple regression analyses that involved reading time and speed and demographic variables as independent variables further revealed that reading time significantly predicts higher scores on mindfulness, subjective well-being, and positive affect. Self-reported reading speed also significantly predicted higher scores on positive affect, although the reading speed measured during the survey was significantly associated with lower scores on positive affect and empathy and higher scores on depression. Furthermore, mediation analyses indicated that mindfulness completely mediates the relationships between reading time and lower scores on depression and partially mediates those between reading time and higher scores on subjective well-being and positive affect. These data support the idea that daily cognitive activities such as reading can contribute to desirable psychological status and that mindfulness tendencies mediate these relationships in a population with no explicit mindfulness-based training or meditation. It will be an important challenge for the forthcoming studies to better distinguish between different styles of reading, such as paper-based and online, and different content of reading, including novels, critical essays, articles, and so on.

**Keywords:** reading; mindfulness; subjective well-being; positive affect; mediation

## Introduction

There is no doubt that reading forms an essential part of our everyday intellectual activities. Reading is suggested to have cognitive benefits by developing not only vocabulary but also mathematical skills during childhood and adolescence (Sullivan & Brown, 2015a). Cognitive benefits of reading are also considered to include a longer life span such as middle and old ages, because reading can slow down the age-related decline in memory and other mental capabilities (Bavishi et al., 2016; Sullivan & Brown, 2015b). Reading is also suggested to have considerable benefits on psychological health. For example, bibliotherapy involves reading of specific texts for therapeutic purposes. Bibliotherapy has been shown to be effective in adults with depression, with its treatment gains lasting more than three years (Gualano et al., 2017; Smith et al., 1997). Regarding stress relief effect of reading, Rizzolo et al. (2009) involved university students and found that a 30-minute reading intervention significantly reduced stress as measured by heart rate and blood pressure, which was comparable to yoga and humor interventions. Reading has also been linked to empathy. Mar et al. (2006) found that more frequent readers of narrative fictions tend to perform better on empathy tasks than less frequent readers. Based on these findings, it seems worthwhile asking what psy-

chological constructs may potentially mediate the relationships between daily reading activities and desirable psychological outcomes.

The present study focused on whether and how daily reading habits may be related to dispositional mindfulness and relevant psychological status. The idea of mindfulness is based on the traditional Eastern contemplative practices originated in the ancient Buddhism. According to Kabat-Zinn (1994), mindfulness refers to a psychological state in which an individual is “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally (Kabat-Zinn, 1994, p. 4).” In clinical contexts during the past decades, interventions including mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982; 1990) and mindfulness-based cognitive therapy (MBCT; Segal et al., 2002) programs have been effectively applied to reduce perceived pain, stress, and relevant psychological symptoms (Kabat-Zinn et al., 1985), as well as in reducing proportions of recurrence in patients of depression (Teasdale et al., 2000). In more recent years, mindfulness is also deemed as a personality trait in non-clinical contexts. For example, Miyata et al. (2015) showed that dispositional mindfulness was significantly positively correlated with subjective well-being and positive affect, and negatively with depression and negative affect, not only in a population of Japanese yoga practitioners but also in non-practitioners included as controls. Sugiura and Sugiura (2018) reported that multiple dimensions of trait mindfulness moderate the relationships between income and psychological well-being. In those low in mindfulness facets (i.e., non-judging and verbal describing of experiences), income was positively related to psychological well-being. By contrast, those high in these mindfulness facets reported higher psychological well-being regardless of income (Sugiura & Sugiura, 2018). These data seem consistent with the idea that dispositional mindfulness is positively associated with desirable psychological functions and negatively with non-desirable ones, in populations experiencing no specific training of mindfulness-based training or meditation.

How would reading be related to mindfulness? Although some studies suggest that mindfulness-based training can improve reading comprehension as well as other cognitive processes including working memory (e.g., Mrazek et al., 2013), relatively little is known whether and how daily reading activities are associated with dispositional mindfulness. Miyata and Sasaki (2019) conducted a cross-sectional study that compared mindfulness and psychological health outcomes in 53 practitioners of the Park-Sasaki method of speed-reading, and 100 untrained participants as controls. The Park-Sasaki method is a speed-reading technique developed in Japan that involves contemplative training comparable to focused-attention meditation (Miyata, 2015; Miyata et al., 2012). The trainees self-reported higher mindfulness and psychological health than untrained participants. In the trainees, self-reported daily reading speed predicted larger scores on mindfulness, subjective well-being, and positive affect, and self-reported reading time per day predicted larger scores on positive affect. However, these associations were much less apparent in untrained participants, with no statistically significant correlations found between reading time or speed and total scores from any psychological scales. By involving a larger number of participants naïve to speed-reading or meditation, Miyata (2016) preliminarily examined how reading time and speed would be associated with dispositional mindfulness and desirable psychological outcomes. Partial correlations controlling for age and household income (but not sex or marital status) showed that self-reported reading time per day was significantly positively correlated with the scores on mindfulness, subjective well-being, positive affect, and empathy, and negatively with the those on depression and negative affect. Self-reported daily reading speed was also significantly positively correlated with the scores on mindfulness, and negatively with those on depression.

Miyata (2016) not only failed to sufficiently control for demographic variables, but also failed to suggest potential roles of mindfulness in the relations between reading and psychological outcomes. A number of studies suggest that self-reported mindfulness mediate the relationships between practice and psychological outcomes. Carmody and Baer (2008) showed that increase in mindfulness mediate the relationships between practice time and decrease in psychological symptoms and depression, and between practice time and increase in psychological well-being, after participation in a clinical MBSR program. Campos et al. (2016) found that the observing facet of mindfulness mediate the relationship between frequency of daily meditation and happiness. De la Fuente-Anuncibay et al. (2019) suggested a mediating role of self-reported mindfulness in the relationships between mindfulness practice and empathy in university students. Given the abovementioned psychological benefits of reading, it would be reasonable to

assume that dispositional mindfulness mediate the relationships between reading habits and psychological outcomes.

The purposes of the present study were to verify the following hypotheses in a non-clinical context. The first was that daily reading habits including time spent reading and/or reading speed are associated with higher dispositional mindfulness and more desirable psychological outcomes, including subjective well-being, positive affect, empathy, and reduced depression and negative affect. The second was that dispositional mindfulness mediate the relationships between reading habits and desirable psychological outcomes. For these purposes, the data obtained from healthy Japanese participants naïve to mindfulness-based training or meditation, which was used in Miyata (2016), were largely re-analyzed by introducing multiple regression and mediation analyses.

## Materials and Methods

### Participants and Procedure

Participants were 881 healthy Japanese (246 females and 635 males; age: 15–78 years; mean age = 47.2 years;  $SD = 13.5$ ) who did not practice meditation nor engage in any specific training program of reading (e.g., speed-reading). Age ranges of these participants were: 2.4 % teenagers, 8.2 % twenties, 20.0 % thirties, 24.5 % forties, 27.5 % fifties, 11.7 % sixties, and 5.8 % seventies. All participants were monitors of an online survey system iResearch, run by NEO MARKETING INC., Tokyo, Japan. The system had more than three million Japanese monitors who had provided their demographic and socio-economic properties and agreed to participate in multiple online questionnaire surveys. Participants reported demographic variables including marital status (61.9 % married; 38.1 % unmarried) and household income level (8.1 % below 2,000,000 Japanese yen; 29.6 % between 2,000,000 and 4,990,000 yen; 35.4 % between 5,000,000 and 8,990,000 yen; 26.9 % above 9,000,000 yen). Another 1,387 individuals who reported that they did not know their household income did not proceed to the psychological scales, whose data were not included in the analysis.

To indicate characteristics of daily reading activities, participants provided the following three measures. The first was mean time spent reading per day (minutes) estimated by each participant, which is referred to as *reading time*. The second was self-estimated mean reading speed when they enjoy reading in daily life (characters per minute), referred to as *self-reported reading speed*. In order to help participants to report daily reading speeds, they were informed that each page of a Japanese paperback involved approximately 500 Japanese characters. Third, participants were instructed to read a well-known Japanese novel, Hashire Melos (Run, Melos!) written by Osamu Dazai (9,795 characters long), on the online platform arranged for this study and to report self-measured reading time (seconds). Participants started to read the novel by pressing a designated button on the website, and the sentences appeared as pop-up displays on the monitor. Each page display included 445.2 characters on average in 20 lines, and the whole story consisted of 22 pages. After finishing the initial page, participants scrolled the screen to proceed to the next pages. Participants were instructed to read through the novel once at their own ordinary reading speed in a way that they can comprehend the story. Reading speed (characters per minute) while reading this novel was calculated based on the reported reading time, which is referred to as *measured reading speed*.

At the beginning of the online survey, all participants selected a checkbox on the website to indicate that they had agreed to cooperate. Participants were next informed that the aim of the study is to know the daily psychological status of each participant and that the survey does not intend to evaluate any individuals. Participants were also instructed that they should always provide honest answers, because there were no good or bad answers to each item. Participants then completed the following psychological scales by clicking relevant checkboxes on the online platform. These questionnaires did not finish until participants gave answers to all the question items. There were thus no missing data that were excluded from analysis.

### Psychological Scales

#### *Five Facet Mindfulness Questionnaire (FFMQ)*

The FFMQ (Baer et al., 2006) is currently regarded as one of the most comprehensive psychological scales of mindfulness. The scale involves five facets of mindfulness. *Observing* refers to paying attention to or noticing external and internal stimuli, including sounds, smells, one's own thoughts, emotions, and body sensations. *Describing*

denotes verbalizing one's own sensations, emotions, thoughts, etc. *Acting with awareness* refers to attending to one's own behavior at each moment, as opposed to behaving in absent-minded or automatic ways. *Non-judging of inner experience* points to refraining from evaluating one's own thoughts, emotions, sensations, etc. Finally, *non-reactivity to inner experience* refers to allowing thoughts, emotions, images etc. to come and go without attention getting caught up in them. The FFMQ has 39 items in total, with each item being rated on a 5-point scale from 1 (never or very rarely true) to 5 (very often or always true). Sugiura et al. (2012) developed and validated a Japanese version of the FFMQ, which was used in the present study.

### ***Subjective Well-Being Scale (SWBS)***

The SWBS (Ito et al., 2003) is a Japanese scale of psychological well-being developed based on the original Subjective Well-Being Inventory by the World Health Organization (WHO SUBI; Sell & Nagpal, 1992; Tonan et al., 1995). Ito et al. (2003) demonstrated reliability of this scale for both samples of university/college students and their parents. The SWBS involves 15 items, and each item is rated on a 4-point scale from 1 (not at all, never, etc.) to 4 (very much, always, etc.). The scale has five subscales, each of which taps core dimensions of well-being: *general well-being: positive affect* (i.e., generally positive attitudes towards one's life), *confidence in coping* (i.e., confidence to cope with difficult or unexpected situations that may potentially happen in life), *expectation-achievement congruence* (i.e., feeling of success and/or achievement as per one's expectation), *general well-being: negative affect* (i.e., generally depressed or negative views on one's life), and *transcendence* (i.e., experiences that go beyond ordinary existence, such as moments of bliss or sense of belonging to the humanity).

### ***Beck Depression Inventory (BDI)***

The BDI (Beck et al., 1961; 1979) is a widely used scale to measure characteristic attitudes and symptoms of depression. The scale has 21 items, each concerning symptoms of depression including pessimism, sadness, guilty feelings, and suicidal thoughts or wishes, and physical symptoms such as loss of appetite, tiredness or fatigue, and loss of interest in sex. Each item has four self-evaluative statements. Participants endorse most relevant statements to these items, which are scored from 0 to 3. For consistency with the other scales, participants in this study were instructed to report their recent feelings. Answers to each item are summed up to calculate a total score. The established Japanese version of the BDI (Hayashi, 1988; Hayashi & Takimoto, 1991) was used for this survey.

### ***Positive and Negative Affect Schedule (PANAS)***

The PANAS (Watson et al., 1988) measures subjective affective status in two dimensions: positive affect (PA) and negative affect (NA). The PANAS is frequently used as a reliable measurement scale of affective status (Crawford & Henry, 2004). A Japanese version of the PANAS by Sato & Yasuda (2001) was used in this study. This version has 16 items (emotion terms), with each item being rated on a 6-point scale from 1 (not true at all) to 6 (extremely true). Both the PA and NA scores evidenced good reliability (Sato & Yasuda, 2001). In this study, participants were instructed to report perceived daily affective status on average. As is the typical practice of the PANAS, the total PA and NA scores were calculated separately.

### ***Interpersonal Reactivity Index (IRI)***

The IRI (Davis, 1983) is a measure of dispositional empathy that involves four subscales, each of which contains seven items tapping a separate facet of empathy. Among these subscales, *perspective taking* represents a tendency to spontaneously adopt the psychological point of views of others in everyday life. *Empathic concern* refers to a tendency to experience feelings of sympathy and compassion for others who are in trouble or in unfortunate situations. *Fantasy* relates to a tendency to imaginatively transpose oneself into fictional situations, such as those in novels or movies. *Personal distress* refers to a tendency to experience discomfort and distress in response to severe distress in other people. Perspective taking subscale concerns a cognitive dimension of empathy and the other subscales concern emotional dimensions of empathy. Each of the 28 items is rated on a 4-point scale from 1 (not true at all) to 4 (extremely true). Sakurai (1988) validated the Japanese version of the IRI in a college student sam-

Table 1. Alphas, scores, and correlations with the reading measures for the total and subscale scores from each scale.

Scale	$\alpha$	Mean ( <i>SD</i> )	Pearson's correlation coefficients ( <i>r</i> s)		
			Reading time	Self-reported reading speed	Measured reading speed
FFMQ total	0.75	118.56 (11.77)	.153***	.021	.0002
Observing	0.85	21.80 (5.83)	.212***	.020	-.026
Describing	0.80	23.29 (5.07)	.143***	.045	.029
Acting with awareness	0.87	27.63 (5.43)	-.033	-.018	.018
Nonjudging	0.89	26.56 (5.72)	-.085*	.008	.034
Nonreactivity	0.81	19.28 (4.55)	.112***	-.008	-.065
SWBS total	0.91	40.14 (8.33)	.181***	.026	-.016
General well-being: Positive affect	0.89	8.50 (2.15)	.148***	.019	-.014
Confidence in coping	0.87	8.73 (2.12)	.184***	.027	-.042
Expectation-achievement congruence	0.83	7.95 (2.19)	.144***	.011	.009
General well-being: Negative affect	0.76	7.38 (2.10)	.069*	.009	-.037
Transcendence	0.77	7.57 (2.09)	.162***	.038	.020
BDI total	0.93	12.28 (10.67)	-.097**	.022	.087*
PANAS: PA	0.91	26.22 (7.11)	.127***	.095**	-.071*
PANAS: NA	0.89	23.08 (6.93)	-.023	.006	-.018
IRI total	0.79	71.33 (8.31)	.075*	-.021	-.066
Perspective taking	0.70	18.11 (3.11)	.097**	-.059	-.050
Empathic concern	0.62	18.71 (2.87)	.050	-.007	-.062
Fantasy	0.68	17.81 (3.22)	.113***	.010	-.028
Personal distress	0.71	16.70 (3.28)	-.057	-.001	-.039

Mean scores and their standard deviations are shown for each scale and subscale. For the general well-being: negative affect subscale of the SWBS, higher scores correspond to less self-reported negative affect. \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

ple, which was used for the present survey.

## Results

### Reliability, Scores, and Correlations between Reading Measures and Scores

All statistical tests were conducted by using a download-free software HAD 16 (Shimizu, 2016). Internal consistency coefficients (Cronbach's alphas) for all the total ( $\alpha$  values = 0.75–0.93) and subscale ( $\alpha$ s = 0.62–0.89) scores from the five psychological scales overall evidenced good to acceptable reliability (**Table 1**), although for some cases reliability was relatively low (e.g.,  $\alpha = 0.62$  for the empathic concern subscale of the IRI). **Table 1** also shows mean scores and their standard deviations (*SD*s) for the total scores and subscale scores where available (i.e., the FFMQ, the SWBS, and the IRI). Regarding measures of reading, mean reading time was 43.4 ( $SD = 51.8$ ) minutes per day, mean self-reported reading speed was 1002.5 ( $SD = 4564.8$ ) characters per minute, and mean measured reading speed was 1786.2 ( $SD = 3580.5$ ) characters per minute. These descriptive data are those previously reported in Miyata (2016), and all the further results described below are those re-analyzed for the present paper.

Zero-order correlations between the three reading measures and the scores from the psychological scales are further summarized in **Table 1**. Numbers of participants who did not report these reading measures were 0 (0.0 %) for reading time, 107 (12.1 %) for self-reported reading speed, and 10 (1.1 %) for measured reading speed, whose data were not included in these analyses. Reading time was significantly positively correlated with the total scores of the FFMQ and its observing, describing, and nonreactivity facets, although correlations were significantly negative for the nonjudging facet. Reading time was also significantly positively correlated with the total and all subscale

scores of the SWBS, the PA of the PANAS, and with the total and two subscale (i.e., perspective taking and fantasy) scores of the IRI, and was significantly negatively correlated with the total score of the BDI. Both self-reported and measured reading speed showed less apparent correlations with the psychological scales. Self-reported reading speed was significantly positively correlated with the PA of the PANAS. Measured reading speed was significantly positively correlated with the BDI scores, and was significantly negatively correlated with the PA of the PANAS. For the remaining comparisons, the two reading speed measures failed to show statistically significant correlations with the scales/subscales (**Table 1**).

### Correlations between Scores from the Psychological Scales

Correlations were further analyzed between the total scores from each psychological scale, which are summarized in **Table 2**. Scores of the FFMQ were significantly positively correlated with those of the SWBS and the PA of the PANAS, and significantly negatively correlated with the scores of the BDI and the NA of the PANAS. Scores of the SWBS showed a significant positive correlation with those of the PA, and significant negative correlations with the scores of the BDI and the NA. Scores of the BDI were also significantly negatively correlated with those of the PA, and significantly positively correlated with the scores of the NA. Scores of the IRI showed significant positive correlations with both those of the PA and the NA (**Table 2**). These data generally show that desirable and non-desirable psychological constructs were significantly associated with each other, whereas empathy was positively associated with both positive and negative affect.

Table 2. Pearson's correlation coefficients (*rs*) between the total scores from each psychological scale.

	FFMQ	SWBS	BDI	PANAS: PA	PANAS: NA
SWBS	.417***	—			
BDI	-.307***	-.690***	—		
PANAS: PA	.438***	.505***	-.283***	—	
PANAS: NA	-.403***	-.361***	.391***	.057	—
IRI	.058	.040	.042	.274***	.271***

\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

### Multiple Regression Analyses

Because multiple measures of reading showed statistically significant correlations with scores from the psychological scales, multiple regression analyses were further conducted by involving each total score as a dependent variable. The NA of the PANAS was not included in these analyses, because the NA failed to show statistically significant correlations with any measures of reading (**Table 1**). These analyses intended to control for the potential effects of demographic variables on the psychological outcomes. These variables were: sex (1 = male, 2 = female), age (years), marital status (1 = married, 2 = unmarried), and household income (1 = below 2,000,000 Japanese yen, 2 = 2,000,000–4,990,000 yen, 3 = 5,000,000–8,990,000 yen, 4 = above 9,000,000 yen). Correlations between the three reading measures, i.e., reading time and self-reported reading speed ( $r = .056$ ,  $p = .125$ ), reading time and measured reading speed ( $r = .026$ ,  $p = .437$ ), and self-reported reading speed and measured reading speed ( $r = .041$ ,  $p = .260$ ), all failed to be statistically significant. All these measures of reading and demographic variables were thus included in the models by using a forced entry method.

**Table 3** shows the results of these multiple regression analyses. Results of all the five models were statistically significant. For these models, Variance Inflation Factor (VIF; a measure of multi-collinearity) was 1.038 for sex, 1.259 for age, 1.376 for marital status, 1.150 for household income, 1.017 for reading time, 1.006 for self-reported reading speed, and 1.010 for measured reading speed, respectively. As in **Table 3**, reading time significantly positively predicted the scores of the FFMQ, the SWBS, and the PA of the PANAS. Self-reported reading speed also positively predicted the scores of the PA. By contrast, measured reading speed was significantly positively associated with the scores of the BDI, and negatively with those of the PA and the IRI. Each of the demographic variables

Table 3. Results of multiple regression analyses for the total scores of each psychological scale.

Independent variable	FFMQ		SWBS		BDI		PANAS: PA		IRI	
	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$
(Constant)	101.221	—	33.296	—	18.352	—	20.422	—	65.956	—
Demographic variables										
Sex	1.930	.072*	.869	.046	.835	.035	.862	.053	4.163	.221***
Age	.140	.158***	.050	.081*	-.066	-.084*	.041	.078*	.007	.012
Marital status	1.509	.062	-2.626	-.154***	1.681	.078	-.657	-.045	-.117	-.007
Household income	1.952	.153***	2.237	.252***	-2.396	-.214***	1.255	.165***	.023	.003
Measures of reading										
Reading time	.023	.103**	.022	.139***	-.010	-.051	.011	.080*	.010	.066
Self-reported reading speed	.000	.011	.000	.007	.000	.031	.000	.088*	.000	-.019
Measured reading speed	.000	-.013	.000	-.024	.000	.102**	.000	-.089*	.000	-.076*
<i>R</i> <sup>2</sup>	.056		.160		.098		.072		.057	
Adjusted <i>R</i> <sup>2</sup>	.047		.152		.090		.063		.048	
<i>F</i>	6.333***		20.261***		11.572***		8.252***		6.444***	

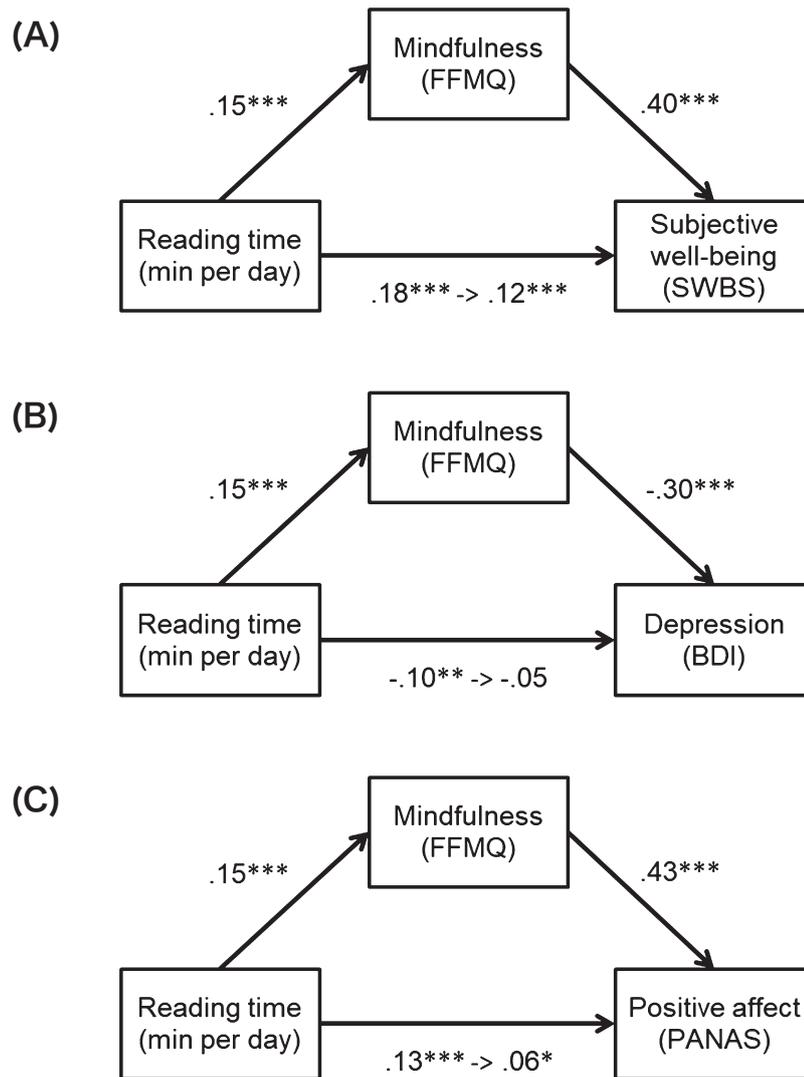
\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

also influenced the psychological outcomes. Scores of the FFMQ and the IRI were significantly higher in females than in males. Age significantly predicted higher scores of the FFMQ, the SWBS, and the PA, and lower scores of the BDI. The state of being married was significantly associated with higher scores of the SWBS. Also, higher household income significantly predicted higher scores of the FFMQ, the SWBS, and the PA, and lower scores of the BDI (Table 3). Thus, reading time and/or speed as well as demographic variables significantly influenced mindfulness and psychological outcomes. Reading speed, however, appeared to have less influence on the psychological outcomes than reading time and to have an opposite impact whether the measure was self-estimated or measured during the survey.

### Mediating Effects of Mindfulness

A further interest concerned whether and how dispositional mindfulness may mediate the relationships between reading and psychological outcomes. In the correlation analyses described above, total scores of the FFMQ were significantly correlated with reading time, but not with the reading speed measures. Reading time was also significantly correlated with the total scores of the SWBS, the BDI, the PA, and the IRI (Table 1). Total scores of the FFMQ were significantly correlated with the total scores of the SWBS, the BDI, and the PA, but not with those of the IRI (Table 2). Based on these correlations, three mediation analyses were conducted by using the methods described by Baron and Kenny (1986). In each case, the independent variable was the daily reading time in minutes per day. The proposed mediating variable was the total scores of the FFMQ. The dependent variable for each mediation analysis was the total scores of the SWBS, the BDI, and the PA of the PANAS, respectively. The independent variable, the mediator, and the dependent variable were all significantly inter-correlated in all these models.

Results of the three mediation analyses are shown in Figure 1. In the first analyses in which the total SWBS score was a dependent variable (Figure 1[A]), reading time significantly predicted larger scores of the SWBS ( $\beta = .181, p < .001$ ) and the FFMQ ( $\beta = .153, p < .001$ ), and the FFMQ scores also significantly predicted larger scores of the SWBS ( $\beta = .399, p < .001$ ). When reading time and the scores of the FFMQ were simultaneously included as a predictor of the SWBS, the regression coefficient for reading time dropped, although the effect still remained significant ( $\beta = .120, p < .001$ ). Results of a non-parametric, bias-corrected bootstrap analysis (bootstrap resamples = 2,000) testing the scores of the FFMQ as a mediator suggested that the indirect effect was estimated to lie between .005 and .016 with 99 % confidence (i.e., the 99 % confidence interval [CI] does not contain zero), which indicates a significant mediating effect of mindfulness. The Sobel's test (Sobel, 1982) also proved that the indirect effect was significant ( $Z = 4.333, p < .001$ ). These results suggest that dispositional mindfulness partially mediates the effect of



**Figure 1.** Mediation of the relationships between daily reading time and the psychological outcomes, i.e., total scores of the SWBS (A), the BDI (B), and the PA of the PANAS (C). In each case, the mediating variable is the total scores of the FFMQ. All the values are  $\beta$  coefficients. For each effect from reading time to the psychological outcome, the value on the right-hand side shows the  $\beta$  coefficient when the mediating variable was included in the model. \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

reading time on larger scores on subjective well-being.

A second mediation analysis was conducted by involving the scores of the BDI as a dependent variable (Figure 1[B]). Reading time significantly predicted smaller scores of the BDI ( $\beta = -.097, p = .004$ ) and larger scores of the FFMQ ( $\beta = .153, p < .001$ ), and scores of the FFMQ significantly predicted smaller scores of the BDI ( $\beta = -.299, p < .001$ ). When reading time and the FFMQ were simultaneously involved as a predictor of the BDI, the regression coefficient for reading time was non-significant ( $\beta = -.051, p = .118$ ). A bootstrap analysis conducted in a consistent way as above showed that the indirect effect was significant (99 % bootstrap CI of  $-.016 - -.004$ ). The Sobel's test also indicated a significant indirect effect ( $Z = -4.114, p < .001$ ). These results indicate that the effect of reading time on smaller scores of depression is completely mediated by dispositional mindfulness.

Finally, a third mediation analysis involved the scores of the PA of the PANAS as a dependent variable (Figure 1[C]). Reading time significantly predicted larger scores of the PA ( $\beta = .127, p < .001$ ) and the FFMQ ( $\beta = .153, p < .001$ ), and scores of the FFMQ also significantly predicted larger scores of the PA ( $\beta = .429, p < .001$ ). When reading time and the FFMQ were simultaneously included as a predictor of the PA, the regression coefficient for reading time dropped, although the effect was still significant ( $\beta = .061, p = .046$ ). A bootstrap analysis conducted in the

same way as above showed that the indirect effect was significant (99 % bootstrap CI of .004 – .015). A significant indirect effect was also proven by the Sobel's test ( $Z = 4.368, p < .001$ ). These results suggest that the effect of reading time on larger scores of positive affect is partially mediated by dispositional mindfulness.

## Discussion

The present study aimed to clarify the associations between reading habits and psychological status and the mediating role of dispositional mindfulness in these relationships, in a population of Japanese participants naïve to mindfulness-based practice or meditation. The data used in a preliminary report (Miyata, 2016) were further analyzed for these purposes. Daily reading time showed significant correlations with higher scores on mindfulness, subjective well-being, positive affect, and empathy, and lower scores on depression, although correlations were less apparent for the reading speed measures (**Table 1**). Multiple regression analyses further revealed that reading time predicted higher scores on mindfulness, subjective well-being, and positive affect. Reading speed also predicted higher scores on positive affect when the measure was self-estimated, although reading speed measured during the survey predicted lower scores on positive affect and empathy and higher scores on depression (**Table 3**). Also, mediation analyses indicated that dispositional mindfulness completely mediates the relationships between reading time and lower depression, and partially mediates those between reading time and higher subjective well-being and positive affect (**Figure 1**). These results are overall supportive of the hypotheses proposed above, and suggest that daily time spent reading, rather than reading speed, is a significant predictor of desirable psychological outcomes, with dispositional mindfulness mediating these relationships.

The present study using a cross-sectional design seems the first to model the relationships between daily reading habits, mindfulness, and psychological outcomes, further to a preceding study suggesting an association between a specific training in reading and mindfulness (Miyata & Sasaki, 2019). That is, findings from the present study indicate that time being spent reading in daily life may, to a greater or lesser extent, have psychological effects parallel to mindfulness-based interventions (e.g., the MBSR and MBCT programs) and contemplative practices, even in the absence of these practices. As suggested by Miyata (2016), reading may originally have similar correlates to mindfulness (Baer et al., 2006; Sugiura et al., 2012) and meditation (Lutz et al., 2008), because reading should involve mental constructs such as maintaining moment-to-moment attention on a particular text and monitoring of one's own comprehension by self-observation. This may explain why mediating roles of mindfulness similar to those in studies on mindfulness-based interventions and meditation (Campos et al., 2016; Carmody & Baer, 2008; de la Fuente-Anuncibay et al., 2019) were observed in the present study by involving reading time as an independent variable. These views also seem consistent with the long-term effects of bibliotherapy in the treatment of depression (Gualano et al., 2017; Smith et al., 1997), as well as with the stress relief effect of a reading intervention (Rizzolo et al., 2009).

There are also important limitations in the present study that require detailed considerations or further investigations. The first concerns the nature of reading time reported by the participants. In the present survey, participants were instructed to report mean reading time per day with no further specifications. That is, there were no clear distinctions between reading on different platforms, i.e., paper-based or online, or reading on different genres, i.e., novels, critical essays, articles, etc. This means that each participant might have defined *reading* in somewhat different ways. While some participants may have limited the definition of reading to novels, others may have included reading texts on other genres or even articles on social media. In recent years, it seems increasingly important to differentiate reading paper books and online reading activities including social media, given the fact that use of social media is considered to substantially influence psychological health (Guntuku et al., 2017; Keles et al., 2019). These issues should require not only better distinctions but also longitudinal investigations over years. These points may also be related to the fact that scores on empathy, compared with the other scales, showed less apparent associations with the reading measures or with the other scales. As opposed to de la Fuente-Anuncibay et al. (2019), scores of empathy were not included in the mediation analyses in the present study. More apparent associations between reading and empathy and mediating roles of mindfulness in these relationships may be observed if the content of reading is restricted to novels or narrative fictions (see also Mar et al., 2006).

The second to note concerns reading speed. Compared with the reading time measure, the reading speed measures overall revealed less apparent associations with the scores from the psychological scales, whether the measure was self-reported or measured during the survey. This may in part reflect the fact that whether an individual is a fast or a slow reader has relatively little to do with mindfulness and psychological status, unless the individual is engaged in a specific training in reading such as speed-reading (Miyata & Sasaki, 2019; see also Miyata et al., 2012). However, results also indicated that self-reported and measured reading speeds have opposite effects on the psychological status. That is, self-reported reading speed predicted higher positive affect, whereas measured reading speed predicted higher depression and lower positive affect and empathy (**Table 3**). One possible explanation for these trends would be that reading speed measured during the survey does not precisely reflect the participants' reading behavior in daily life. In fact, measured reading speed was 1.78 times as high as self-reported reading speed on average. Participants may have intended to complete the survey quickly, regardless of the instruction to read at their normal speeds with comprehension. These tendencies may have been apparent in individuals with relatively depressed and less positive psychological status. To better estimate the participants' daily reading speeds, it would be a better way forward to instruct participants to report titles of all the books that they recently read, as well as time required to read each of those books.

Finally, limitations of a cross-sectional approach used in the present study need to be addressed. Unlike the intervention studies on mindfulness (e.g., Carmody & Baer, 2008; de la Fuente-Anuncibay et al., 2019; Kabat-Zinn et al., 1985), cross-sectional studies fail to demonstrate changes in mindfulness and psychological outcomes as a result of a particular practice. This inevitably makes arguments regarding the *effects* of the practice relatively weak, although cross-sectional studies are effective in modeling the everyday behavior, dispositional mindfulness, and/or psychological dispositions in a large sample of participants (e.g., Campos et al., 2016; Takahashi et al., 2019). In other words, with the present dataset collected at one time point, it is difficult to make a clear claim about the causal relationships between daily reading habits and higher dispositional mindfulness or desirable psychological status. To overcome these limitations, it should be one way forward to introduce an intervention design in the context of the present study. For example, participants with a relatively small amount of daily reading may engage in reading particular books or texts each day for over weeks or months, to examine whether such practice result in desirable changes in psychological status that are mediated by increase in mindfulness. Also, a promising alternative would be to collect longitudinal data from the same population at different time points and to examine a cross-lagged panel model (Finkel, 1995). This approach should help to uncover how reading habits, mindfulness, and psychological outcomes as well as their relationships may change over time. These enquiries should further help to shed light on how everyday intellectual activities such as reading are associated with mindfulness and psychological functions, in a way that is potentially applicable to clinical, educational, and other practical contexts.

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