

Master thesis

Mindfulness and Emotional Problems

A quantitative research about the relationship between mindfulness and emotional problems among adolescents and the moderating role of sex

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Abstract

Ongeveer 20% van de Nederlandse adolescenten heeft mentale gezondheidsproblemen. Voor een goede mentale gezondheid als volwassene is het belangrijk deze emotionele problemen tijdens de adolescentie op te lossen. Een mogelijke manier om dit te bereiken is via mindfulness. Echter, het is onbekend of en hoe emotionele problemen het beoefenen van mindfulness voorspellen. Dit longitudinale onderzoek bestudeerde daarom de bidirectionele relatie tussen mindfulness en emotionele problemen onder adolescenten en of deze relaties verschilden voor jongens en meisjes. Voor dit onderzoek werd data van de *media multitasking and sleep problems study* gebruikt. Voor deze studie vulden 958 adolescenten (50.4% meisjes) van zeven Nederlandse middelbare scholen een vragenlijst in op drie verschillende momenten. Hiërarchische meervoudige regressieanalyses werden uitgevoerd met emotionele problemen als afhankelijke variabele, mindfulness en geslacht als onafhankelijke variabelen en schoolplezier als controlevariabele. In de tweede analyse werden de variabelen emotionele problemen en mindfulness omgewisseld. In tegenstelling tot de hypothesen bleek mindfulness geen significante voorspeller van emotionele problemen en bleken emotionele problemen geen significante voorspeller van mindfulness. Bovendien verschilden deze relaties niet significant voor jongens en meisjes. Nadat drie multivariate uitschieters werden verwijderd, voorspelden meer emotionele problemen significant minder mindfulness vier maanden later. Op basis van deze bevindingen wordt verder onderzoek aanbevolen.

Sleutelwoorden: Mindfulness, Emotionele Problemen, Mentale Gezondheid, Meditatie

Abstract

Around 20% of Dutch adolescents have mental health problems. To ensure a mentally healthy adulthood, it is essential to resolve these emotional problems during adolescence. One proposed way is by practicing mindfulness. However, it is unknown if and how emotional problems predict mindfulness practice in adolescents. Therefore, this longitudinal study investigated the bidirectional relationship between mindfulness and emotional problems among adolescents and whether these relationships differed for boys and girls. Data of the media multitasking and sleep problems study was used. For this study 958 adolescents (50.4% girls) from seven Dutch secondary schools completed a questionnaire at three different timepoints. Hierarchical multiple regression analyses were conducted with emotional problems as the dependent variable, mindfulness and gender as independent variables and school enjoyment as control variable. In the second analysis the variables emotional problems and mindfulness were interchanged. Contrary to the hypotheses, the results showed that mindfulness did not significantly predict emotional problems and that emotional problems did not significantly predict mindfulness. Moreover, these relationships did not significantly differ for boys and girls. After removal of three multivariate outliers, more emotional problems significantly predicted less mindfulness four months later. Based on these findings, further research is recommended and discussed.

Keywords: Mindfulness, Emotional Problems, Mental Health, Meditation

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Mindfulness and Emotional Problems

It is estimated that 20% of Dutch adolescents have mental health problems (Vollebergh et al., 2006). In addition, in the 21st century there have been reported increases in internalizing problems of adolescents, especially in adolescent girls (Bor et al., 2014). Internalizing problems in adolescents are associated with disruptions in social relationships, family functioning, and school performance (Carpenter et al., 2014). When these problems persist into adulthood, they are associated with increases in medical disorders, suicide attempts and a reduced quality of life (Bayer et al., 2011). To ensure a mentally healthy adolescence and adulthood, it is therefore essential to resolve these emotional problems during adolescence (Pathak et al., 2011).

According to Williams (2010), many emotional problems arise due to a failure to switch off emotional systems once they have been activated. Emotions are automatic processes that activate when the external world demands it, such as when there is a threat, loss of status or success. These emotions deactivate when circumstances in the external world change and no longer require this response. However, humans not only respond to the external world, but also to their internal world; humans can build mental models and think of the past and future. These mental models can elicit a reaction of emotional systems as well, but are not easily switched off. Psychopathology might arise due to the overuse of these emotional processes.

Mindfulness can help detect the overuse of emotional processes in reaction to mental models (Williams, 2010). Mindfulness is defined as “the state of being attentive to and aware of what is taking place in the present” (Brown & Ryan, 2003, p. 822). It is often proposed to help counteract emotional problems, like stress and depression (Zenner et al., 2014). Mindfulness can be cultivated through various techniques, such as meditation, yoga, or tai chi. During these techniques, participants focus their attention on the present moment and gently try to bring their focus back whenever their mind drifts away. The goal is to observe one’s experience of the present moment without judgment.

Thus far, research mostly investigated how mindfulness can lead to less emotional problems. However, a reverse causality could exist; suffering from emotional problems makes it more or less likely to practice mindfulness. Experiencing emotional problems could be a reason to practice mindfulness, as a way to alleviate these problems (Pepping et al., 2016). However, it could also lead to less mindfulness, as feeling emotional or stressed might make it difficult to practice mindfulness (Laurie & Blandford, 2016). Furthermore, in both relationships there may be sex differences because of differences in brain structure and in help-seeking behaviors among boys and girls (Haavik et al., 2017; Koch et al., 2007). This longitudinal study

will therefore investigate the relationship between mindfulness and emotional problems among adolescents and possible sex differences within these relationships.

Mindfulness and Emotional Problems

The current literature provides consistent evidence for mindfulness being beneficial for well-being (Kiken & Shook, 2012). Mindfulness might reduce emotional problems through decreasing rumination and enhancing emotion regulation. Rumination is defined as the repetitive focus on negative emotional states (Ramel et al., 2004) and is associated with depressive symptoms. More specifically, mindfulness may decrease rumination by helping individuals change how to relate to their thoughts, without judging or changing them (Kiken & Shook, 2012). Limiting emotional reactivity to thoughts enhances emotion regulation and in turn reduces emotional lability, which has been linked to emotional problems in children and adolescents (Hill & Updegraff, 2012; Rosen et al., 2015; Silk et al., 2003).

Research supports that mindfulness may foster well-being and reduce emotional problems. A review of cross-sectional, correlational and intervention research concluded that mindfulness can lead to increases in subjective well-being and reductions in psychological symptoms (Keng et al., 2011). Another review reported that mindfulness-based trainings in schools have positive effects on stress, coping and resilience among children and adolescents (Zenner et al., 2014). Hence, theoretical and empirical evidence supports that mindfulness might reduce emotional problems of adolescents.

Emotional Problems and Mindfulness

In addition to mindfulness leading to less emotional problems, the direction could also be reversed: more emotional problems could also influence the amount of mindfulness practice. This relationship could be positive or negative, given that there is theorizing and empirical evidence supporting either direction. It could be that people who experience emotional problems are more open to mindfulness to alleviate these problems. In a qualitative study, adolescents and adults reported starting meditation practice to alleviate emotional distress, reduce anxiety, stress, and depression, and enhance emotion regulation (Pepping et al., 2016). In another qualitative study, adults frequently mentioned their mental health issues as a reason to practice mindfulness (Banerjee et al., 2017).

In contrast, it could also be that people who experience emotional problems are less likely to practice mindfulness (Beattie et al., 2020). Several qualitative and quantitative studies have shown that mental health issues are associated with perceived barriers to mindfulness and mindfulness program attrition (Banerjee et al., 2018; Crane & Williams, 2010; Laurie & Blandford, 2016). For example, college students with high neuroticism scores perceived more

barriers to mindfulness (Whitford & Warren, 2019). The reason why these students perceived more barriers was not discussed. Furthermore, adolescents and adults with high levels of depressive rumination found it difficult to continue meditation (Crane & Williams, 2010). Participants stated that meditating while feeling stressed or emotional was difficult, which resulted in them refraining from mindfulness in stressful situations (Laurie & Blandford, 2016). Consequently, more emotional problems might influence the amount of mindfulness practice of adolescents. Due to theorizing and empirical evidence for both directions, the direction of this relationship remains unclear.

The Moderating Role of Sex

Despite consistent findings that mindfulness may help to reduce emotional problems, not everyone may profit from mindfulness practice to the same extent. Mindfulness could have different effects for boys and girls. Several neuroscientific studies have reported sex differences in brain networks and structure (Koch et al., 2007; McClure et al., 2004; Schulte-Rüther et al., 2008). For example, the insular cortex, a brain structure involved in emotion control and decision-making (Gogolla, 2017), shows sex differences (Macey et al., 2016, Macey et al., 2017). Since insular cortex activity is associated with practicing mindfulness (Young et al., 2018), boys and girls might react differently to mindfulness. Indeed, in a small-scale study, adolescent females were more engaged than males during a mindfulness intervention and reported less stress after (Bluth et al., 2017). Moreover, in a quantitative study, female adolescents who meditated reported increases in positive affect compared to a female control group, whereas this difference was not found in adolescent males (Kang et al., 2018). Hence, girls might benefit more from mindfulness than boys.

Furthermore, the way that emotional problems affect mindfulness practice may also differ for boys and girls. Male adolescents have more negative attitudes toward mental health treatment than females and are less willing to use mental health services (Chandra & Minkovitz, 2006; Wendt & Shafer, 2016). Numerous studies have found that male adolescents are less likely than females to seek help for mental health issues (Addis & Mahalik, 2003; Haavik et al., 2017), especially regarding emotional problems (Möller-Leimkühler, 2002). Moreover, boys often report barriers, like parental disapproval and stigma, to the use of mental health services. Among college students, males are more likely to report privacy and stigma barriers (Horwitz et al., 2020). Female college students more often report finances as a barrier. Since mindfulness often requires no supplies and many free mindfulness apps are offered, this barrier will likely not be influential. This suggests that when adolescents experience emotional problems, boys will be less likely to seek help, more likely to experience barriers and thus might be less likely

to practice mindfulness. In contrast, girls with emotional problems will be more likely to seek help, less likely to experience barriers and thus might be more likely to practice mindfulness

Current Study

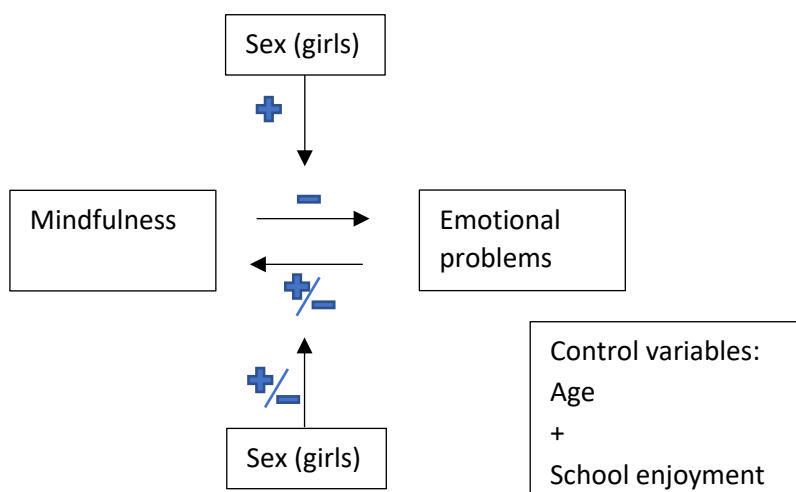
Research to date has mostly focused on the relationship from mindfulness to emotional problems. The reverse relationship, from emotional problems to mindfulness, has been studied less. Moreover, longitudinal studies concerning adolescents are scarce. This study will thus examine the bidirectional relationship between mindfulness and emotional problems among adolescents based on longitudinal data. In this study emotional problems include depression, loneliness, anxiety, low self-esteem, eating disorders and suicidal thoughts (Helsen et al., 2000, Zahn-Waxler et al., 2008).

The following questions are examined: ‘To what extent does mindfulness relate to emotional problems over time?’, ‘To what extent do emotional problems predict mindfulness over time?’, ‘Are these relationships moderated by sex?’. Research has shown that the relationship between present-moment attention and well-being becomes stronger with age (Mahlo & Windsor, 2020). Furthermore, school enjoyment and life satisfaction are related (de Róiste et al., 2012). Therefore, both age and school enjoyment will be controlled for.

First, it is hypothesized that engaging in mindfulness is related to less emotional problems over time (H1). Furthermore, it is hypothesized that this relationship will be stronger for girls (H2). Next, it is hypothesized that emotional problems are related to mindfulness over time (H3). This relationship could either be positive (H3a) or negative (H3b). Lastly, it is expected that, no matter the association between emotional problems and mindfulness, if adolescents experience emotional problems, boys are less likely to practice mindfulness than girls (H4).

Figure 1

Research Model.



Method

Design

Data for this quantitative and longitudinal study was collected from the study media multitasking and sleep problems (MMSP; van der Schuur et al., 2017). Data was collected in three waves (November 2014, March 2015, June 2015). Wave 1 (W1) and wave 2 (W2) were used for this study, since most participants had complete data for these two waves. Participants who had at least one missing value on mindfulness, emotional problems, sex, school enjoyment or age in W1 or W2 were excluded from the dataset. Attrition was mainly due to busy school schedules; at some schools it was not possible to collect data in each wave.

To check whether there was selective dropout, an attrition analysis was conducted. A logistic regression analysis showed that participants who did not join in W2, did not differ from participants in W2. Furthermore, participants who did not join in W1 were significantly less mindful at W2 than participants in W1 (mindfulness at W2 for missing cases W1: $M = 2.57$, $SD = 0.89$, complete W1: $M = 2.72$, $SD = 0.80$, $t(1158) = 2.34$, $p = .020$, two-tailed, $d = 0.17$). In conclusion, for the variable mindfulness there was selective dropout.

Participants

The original sample consisted of 1443 adolescents between 11 and 15 years who filled out the questionnaire in at least one wave. Participants were recruited through seven Dutch secondary schools. In W1, 1231 adolescents participated, in W2 1205 adolescents participated. In total 485 participants (33.6%) were removed from the dataset due to missing data ($N_{W1} = 269$ and $N_{W2} = 295$). The final sample size is $N = 958$ ($M_{age} = 12.62$, $SD_{age} = 0.74$; 50.4% girls) and consisted of adolescents of all seven schools.

Procedure

The MMSP study received ethical approval for their research (van der Schuur et al., 2017). The study involved a three-wave longitudinal design and was conducted among a non-probability sample of adolescents from seven secondary schools in the Netherlands. Schools were invited to participate via email. In consultation with the schools, participating classes were selected. Informed assent of adolescents and passive informed consent of parents was obtained. Before the questionnaires were filled out, the researchers introduced the content of the questionnaire and assured participants that their participation was confidential and voluntary and that they could withdraw at any time. Participants completed the online questionnaire during class and received a small present afterwards. Participation took approximately 30 minutes. The collected data was processed anonymously.

Measuring Instruments

Mindfulness

Mindfulness was measured with the Mindfulness Attention Awareness Scale for Adolescents (MAAS-A; Brown et al., 2011). Five items with the highest factor loadings were selected (examples: “I find myself doing things without paying attention” and “I rush through activities without paying attention to them”). Items were scored on a five-point scale from 0 (*Never*) to 4 (*Very often*). All item responses were reverse coded, such that higher scores indicated more mindfulness. The Dutch MAAS-A has previously been described as a valid measure of mindfulness for adolescents and having high internal consistency, meaning it is a reliable instrument (de Bruin et al., 2011). The Cronbach’s alpha was very good, $\alpha = .84$ (W1) and $\alpha = .86$ (W2).

Emotional Problems

Emotional problems were measured with the emotional symptoms subscale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Participants were asked to what extent they agreed with five statements, such as: “I worry a lot” and “I am often unhappy, depressed or tearful”. Items were scored on a scale which ranged from 0 (*Not true*) to 2 (*Definitely true*). Higher scores indicated more emotional problems. COTAN (2007) judged the reliability and construct validity of the Dutch SDQ to be sufficient. However, there seems to be insufficient research about criterium validity. The Cronbach’s alpha was good, $\alpha = .70$ (W1) and $\alpha = .73$ (W2).

Sex

Participants were asked to indicate their sex (0 = boy and 1 = girl).

Age

Participants were asked their age. The possible answering categories were: 11 years, 12 years, 13 years, 14 years, 15 years, and Else, namely...

School Enjoyment

Researchers of the MMSP study formulated their own questions to measure school experience. These questions were based on the educational goals of the participating schools. One of the components was ‘school enjoyment’. School enjoyment was measured with three items (examples: “I like the school assignments” and “I like the content of the classes”). Items were rated on a five-point scale, ranging from 0 (*Strongly disagree*) to 4 (*Strongly agree*). Higher scores indicated more school enjoyment. The Cronbach’s alpha was very good, $\alpha = .82$ (W1). In a factor analysis only one factor (with an eigenvalue exceeding 1) underlying the

questionnaire items was identified. In total, this factor accounted for around 61% (W1) of variance in questionnaire data.

Data Analysis

Before the analyses were conducted, the correlations between mindfulness, emotional problems, school enjoyment, sex and age were computed with Spearman and point-biserial correlations. Next, the hypotheses were tested with hierarchical multiple regression analyses. First, the dependent variable was emotional problems W2. In model 1 the control variables age, school enjoyment W1 and emotional problems W1 were added. Then, in model 2 the independent variable mindfulness W1 was added and in model 3 the variable sex and interaction term (sex*mindfulness W1) were added. To study the reverse relationship, another analysis was conducted with mindfulness W2 as the dependent variable. In model 1 the control variables age, school enjoyment W1 and mindfulness W1 were added. Next, in model 2 the independent variable emotional problems W1 was added. Subsequent, in model 3 the variable sex and interaction term (sex*emotional problems W1) were added.

Results

Assumptions

Before the analyses, the assumptions were checked. For a reliable regression model N ideally is 50 plus eight times the number of predictors (Allen et al., 2014). With six predictors N has to be at least 98. After deleting participants with missing data, $N = 958$. This is sufficient for a reliable model.

Normality

To check the assumption of normality, Q-Q plots were examined. The residuals of the dependent variables emotional problems W2 and mindfulness W2 all deviated from the straight line, especially at the lower or higher ends and thus violated the assumption of normality. To correct for that, the analyses will be bootstrapped.

Outliers

Next, to check the assumption of outliers, boxplots were examined. All variables had datapoints 1.5 standard deviation from the mean, which are considered outliers. However, because the variables are measured on Likert-scales, answering at the extreme is a real and possible value. Therefore, the outliers were not removed. There was one multivariate outlier detected with a Maximum Mahalanobis Distance above the critical χ^2 value of 22.46 for $df = 6$ (at $\alpha = .001$). This participant answered all questions in the first wave at the extremes. Results for analyses with and without this outlier will be compared.

Multicollinearity

Subsequent, there was checked for multicollinearity. Relatively high tolerances for all variables in the regression model indicated that there is no multicollinearity.

Normality, Linearity and Homoscedasticity of Residuals

Finally, the dependent variables emotional problems W2 and mindfulness W2 were checked for normality, linearity and homoscedasticity of residuals. In the P-P plot for emotional problems W2, the points deviated quite from the diagonal line. For mindfulness W2 the points clustered tightly along the diagonal line. The scatter plot for emotional problems W2 was not completely random. However, for the possible values (0-2) there was no indication of over- or underprediction. The scatter plot for mindfulness W2 showed funneling, with worse predictions for smaller values, indicating heteroscedasticity. Hence, the assumption of normality, linearity and homoscedasticity of residuals seems violated. This will be corrected for by wild bootstrapping the analysis for mindfulness W2.

Descriptive Statistics

The sample consisted of 475 boys (49.6%) and 483 girls (50.4%). Descriptive statistics of the continuous variables are presented in Table 1. For mindfulness, participants reported means above average, considering the potential minimum and maximum score. Furthermore, participants reported very low levels of emotional problems. The mean for school enjoyment W1 is around average.

Table 1

Descriptive Statistics of Mindfulness W1 and W2, Emotional Problems W1 and W2, School Enjoyment W1, and Age

| Variable | <i>M</i> | <i>SD</i> | <i>Min</i> | <i>Max</i> |
|-----------------------|----------|-----------|------------|------------|
| Mindfulness W1 | 2.73 | 0.77 | 0 | 4 |
| Mindfulness W2 | 2.72 | 0.80 | 0 | 4 |
| Emotional problems W1 | 0.54 | 0.45 | 0 | 2 |
| Emotional problems W2 | 0.54 | 0.46 | 0 | 2 |
| School enjoyment W1 | 1.95 | 0.72 | 0 | 4 |
| Age | 12.62 | 0.74 | 11 | 15 |

The correlations between variables are presented in Table 2. For continuous variables the Spearman correlations are calculated, because the assumption of normality was violated. For the variable sex, point-biserial correlations are calculated. More mindfulness at W1

correlates significantly with less emotional problems at W2. Furthermore, more emotional problems at W1 correlate significantly with less mindfulness at W2. Additionally, sex significantly correlates with emotional problems W1 and W2; with girls reporting more emotional problems. Furthermore, school enjoyment W1 significantly correlates with more mindfulness at W2 and less emotional problems at W2. Because age did not significantly correlate with the dependent variables, it is not included as a control variable.

Table 2

Correlations Between Mindfulness W1 and W2, Emotional Problems W1 and W2, School Enjoyment W1, Age, and Sex

| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------------|--------|--------|-------|--------|--------|------|
| 1. Mindfulness W1 | | | | | | |
| 2. Mindfulness W2 | .50** | | | | | |
| 3. Emotional problems W1 | -.32** | -.22** | | | | |
| 4. Emotional problems W2 | -.22** | -.37** | .63** | | | |
| 5. School enjoyment W1 | .27** | .20** | -.07* | -.09** | | |
| 6. Age | -.06 | .02 | .00 | -.03 | -.15** | |
| 7. Sex | .04 | .02 | .20** | .22** | .01 | -.01 |

Note. $N = 958$. Reference group sex 0 = boy. * Correlation is significant at $p < .05$ (two-tailed).

** Correlation is significant at $p < .01$ (two-tailed).

Hierarchical Multiple Regression Analyses

Analysis Mindfulness and Emotional Problems

The relationship between mindfulness and emotional problems and the potential moderation by sex were examined in a hierarchical multiple regression analysis. The interaction term sex (sex*mindfulness W1) was calculated with the centered variable mindfulness W1. The analysis was bootstrapped since the variables showed non-normality. The results are presented in Table 3. Semi-partial correlations were computed with a non-bootstrapped analysis, since point estimates are unaffected by the assumption violations.

In model 1, the control variables account for a significant 39% of variance in emotional problems W2, $R^2 = .39$, $F(2, 955) = 305.23$, $p < .001$. Emotional problems at W1 predict significantly more emotional problems at W2. In model 2, the independent variable mindfulness W1 was added. This model does not seem to explain significantly more variance in emotional

problems W2, $\Delta R^2 < .001$, $\Delta F(1, 954) = 0.16$, $p = .690$. These results indicate that, contrary to the first hypothesis, engaging in mindfulness is not related to significantly less emotional problems over time ($B = -0.01$, $SE = 0.02$).

In model 3, the variable sex and interaction term (sex*mindfulness W1) were added. This model explains an additional significant 1.1% of variance in emotional problems W2, $\Delta R^2 = .01$, $\Delta F(2, 952) = 8.94$, $p < .001$. The interaction term (sex*mindfulness W1) is not significant ($B = -0.04$, $SE = 0.03$). Contrary to the second hypothesis, this suggests that boys and girls do not significantly differ in the relationship between mindfulness and emotional problems. In combination, the five variables explained 40.1% of variance in emotional problems W2, $R^2 = .40$, $F(5, 952) = 127.62$, $p < .001$.

Table 3

Results of the Bootstrapped Hierarchical Multiple Regression Analysis for Emotional Problems W2

| Variable | <i>B</i> [95% BCa CI] | <i>SE</i> | Bias | <i>p</i> | <i>sr</i> ² | <i>R</i> ² | ΔR^2 |
|-----------------------|-----------------------|-----------|--------|----------|------------------------|-----------------------|--------------|
| Model 1 | | | | | | .39 | .39 |
| School enjoyment W1 | -0.01 [-0.05, 0.02] | 0.02 | <.001 | .448 | .00 | | |
| Emotional problems W1 | 0.63 [0.57, 0.69] | 0.03 | <.001 | <.001 | .39 | | |
| Model 2 | | | | | | .39 | <.001 |
| School enjoyment W1 | -0.01 [-0.05, 0.03] | 0.02 | <.001 | .519 | .00 | | |
| Emotional problems W1 | 0.62 [0.57, 0.68] | 0.03 | <.001 | <.001 | .36 | | |
| Mindfulness W1 | -0.01 [-0.04, 0.03] | 0.02 | <.001 | .711 | .00 | | |
| Model 3 | | | | | | .40 | .01 |
| School enjoyment W1 | -0.01 [-0.05, 0.02] | 0.02 | <.001 | .535 | .00 | | |
| Emotional problems W1 | 0.60 [0.54, 0.66] | 0.03 | <.001 | <.001 | .34 | | |
| Mindfulness W1 | 0.01 [-0.04, 0.06] | 0.03 | <-.001 | .824 | .00 | | |
| Sex | 0.09 [0.05, 0.14] | 0.02 | <-.001 | <.001 | .02 | | |
| Sex*mindfulness W1 | -0.04 [-0.11, 0.03] | 0.03 | <.001 | .242 | .00 | | |

Note. $N = 958$. Results are significant with $p < .05$. *B* = unstandardized regression coefficient. BCa CI = bias corrected accelerated confidence interval. *sr*² = semi-partial correlation. Reference group sex 0 = boy. Bootstrap results are based on 5000 bootstrap samples.

Analysis Emotional Problems and Mindfulness

The relationship between emotional problems and mindfulness and the potential moderation by sex were examined in a hierarchical multiple regression analysis. The interaction term sex (sex*emotional problems W1) was calculated with the centered variable emotional problems W1. The analysis was wild bootstrapped, since the variables showed non-normality and the independent variable displayed heteroscedasticity. The results are presented in Table 4. Semi-partial correlations were computed with a non-bootstrapped analysis, since point estimates are unaffected by the assumption violations.

In model 1, the control variables account for a significant 24.1% of variance in mindfulness W2, $R^2 = .24$, $F(2, 955) = 153.21$, $p < .001$. School enjoyment W1 and mindfulness W1 both predict significantly more mindfulness at W2. Model 2, with the independent variable emotional problems W1, explains an additional significant 0.3% of variance in mindfulness W2, $\Delta R^2 = < .01$, $\Delta F(1, 954) = 4.18$, $p = .041$. However, the wild bootstrapped unstandardized regression coefficient for emotional problems W1 is non-significant ($B = -0.11$, $SE = 0.06$). The negative coefficient suggests that more emotional problems are related to less mindfulness. This potentially provides some evidence for hypothesis 3b. Nevertheless, because the effect is not significant, this suggests that, contrary to the third hypothesis, emotional problems are not significantly related to more or less mindfulness over time.

In model 3, the variable sex and interaction term (sex*emotional problems W1) were added. This model explains an additional 0.4% of variance in mindfulness W2, $\Delta R^2 = < .01$, $\Delta F(2, 952) = 2.61$, $p = .074$. The interaction term (sex*emotional problems W1) is not significant ($B = -0.23$, $SE = 0.12$). Contrary to the fourth hypothesis, this suggests that boys and girls do not significantly differ in the relationship between emotional problems and mindfulness. In combination, the five variables explained 25% of variance in mindfulness W2, $R^2 = .25$, $F(5, 952) = 63.58$, $p < .001$.

Table 4

Results of the Wild Bootstrapped Hierarchical Multiple Regression Analysis for Mindfulness W2

| Variable | <i>B</i> [95% BCa CI] | <i>SE</i> | Bias | <i>p</i> | <i>sr</i> ² | <i>R</i> ² | ΔR^2 |
|---------------------------|-----------------------|-----------|-------|----------|------------------------|-----------------------|--------------|
| Model 1 | | | | | | .24 | .24 |
| School enjoyment W1 | 0.08 [0.00, 0.15] | 0.04 | <.001 | .039 | .01 | | |
| Mindfulness W1 | 0.49 [0.42, 0.56] | 0.04 | <.001 | <.001 | .21 | | |
| Model 2 | | | | | | .25 | <.01 |
| School enjoyment W1 | 0.08 [0.00, 0.15] | 0.04 | <.001 | .037 | .01 | | |
| Mindfulness W1 | 0.47 [0.40, 0.54] | 0.04 | <.001 | <.001 | .18 | | |
| Emotional problems W1 | -0.11 [-0.22, 0.01] | 0.06 | <.001 | .062 | .00 | | |
| Model 3 | | | | | | .25 | <.01 |
| School enjoyment W1 | 0.08 [0.00, 0.15] | 0.04 | <.001 | .042 | .00 | | |
| Mindfulness W1 | 0.47 [0.40, 0.54] | 0.04 | <.001 | <.001 | .17 | | |
| Emotional problems W1 | 0.01 [-0.17, 0.19] | 0.09 | <.01 | .880 | .00 | | |
| Sex | 0.02 [-0.06, 0.11] | 0.05 | <-.01 | .626 | .00 | | |
| Sex*emotional problems W1 | -0.23 [-0.45, -0.01] | 0.12 | <-.01 | .053 | .00 | | |

Note. *N* = 958. Results are significant with *p* < .05. *B* = unstandardized regression coefficient. BCa CI = bias corrected accelerated confidence interval. *sr*² = semi-partial correlation. Reference group sex 0 = boy. Bootstrap results are based on 5000 wild bootstrap samples.

Because the control variable age was removed, the Maximum Mahalanobis Distance was recalculated. Three multivariate outliers were detected above the critical χ^2 value of 20.53 for *df* = 5 (at α = .001). Both analyses were rerun without these outliers. Because the data is bootstrapped, the output differs slightly every time the analysis is run. For the first analysis, the output of the data with and without the multivariate outliers barely differed. The second analysis however, demonstrated differences in model 2 (see Table 5). In model 2 of the analysis without outliers, the variable emotional problems W1 is significant; with more emotional problems at W1 leading to less mindfulness at W2 (*B* = -0.13, *SE* = 0.06). In model 3 though, emotional problems W1 is no longer significant (*B* = -0.05, *SE* = 0.08). The effect of emotional problems seems to be small, therefore it becomes not significant when predictors are added. This suggests that, in line with hypothesis 3b, emotional problems may lead to less mindfulness, yet with a small effect.

Table 5

Results of the Wild Bootstrapped Hierarchical Multiple Regression Analysis for Mindfulness W2 Without the Three Multivariate Outliers

| Variable | <i>B</i> [95% BCa CI] | <i>SE</i> | Bias | <i>p</i> | <i>sr</i> ² | <i>R</i> ² | ΔR^2 |
|---------------------------|-----------------------|-----------|-------|----------|------------------------|-----------------------|--------------|
| Model 2 | | | | | | .25 | <.01 |
| School enjoyment W1 | 0.08 [0.01, 0.15] | 0.04 | <.001 | .023 | .01 | | |
| Mindfulness W1 | 0.48 [0.40, 0.55] | 0.04 | <.001 | <.001 | .19 | | |
| Emotional problems W1 | -0.13 [-0.24, -0.02] | 0.06 | <.001 | .021 | .01 | | |
| Model 3 | | | | | | .25 | <.01 |
| School enjoyment W1 | 0.08 [0.01, 0.15] | 0.04 | <.001 | .026 | .01 | | |
| Mindfulness W1 | 0.48 [0.40, 0.55] | 0.04 | <.001 | <.001 | .19 | | |
| Emotional problems W1 | -0.05 [-0.21, 0.11] | 0.08 | <.001 | .562 | .00 | | |
| Sex | 0.03 [-0.05, 0.12] | 0.05 | <-.01 | .457 | .00 | | |
| Sex*emotional problems W1 | -0.16 [-0.37, 0.05] | 0.11 | <.001 | .141 | .00 | | |

Note. *N* = 955. Results are significant with *p* < .05. *B* = unstandardized regression coefficient. BCa CI = bias corrected accelerated confidence interval. *sr*² = semi-partial correlation. Reference group sex 0 = boy. Bootstrap results are based on 5000 wild bootstrap samples.

Discussion and Conclusion

This study investigated the bidirectional relationship between mindfulness and emotional problems among adolescents and whether these relationships differed for boys and girls. Engaging in mindfulness was expected to be related to less emotional problems over time and it was expected that this relationship would be stronger for girls. Next, it was expected that emotional problems would be related to mindfulness over time. The direction of this hypothesis was unclear because of theorizing and empirical evidence for both directions. Furthermore, it was expected that if adolescents experience emotional problems, no matter the association between emotional problems and mindfulness, boys would be less likely to practice mindfulness than girls. Hypotheses were tested with hierarchical multiple regression analyses. Initially neither of the hypotheses were confirmed. However, after removing three multivariate outliers, more emotional problems predicted significantly less mindfulness.

In contrast to the first hypothesis, adolescents who practiced mindfulness did not experience significantly less emotional problems four months later, although they were

negatively associated. Most studies reported a negative relationship between mindfulness and emotional problems (Keng et al., 2011; Zenner et al., 2014). Since literature is quite conclusive about mindfulness being beneficial for well-being among adolescents, it might be possible that this effect was not found due to methodological limitations. For example, measurements in the current study only included self-reports, whereas, for example, Zenner et al. (2014) reviewed studies that used teacher-reports, parent-reports or objective measurements. Self-reports are subject to limitations (Bergomi et al., 2013). Participants might have provided biased answers, influenced by social desirability or personal values.

Contrary to the second hypothesis, the relationship between mindfulness and emotional problems did not significantly differ for boys and girls. Based on sex differences in brain networks and structure (Koch et al., 2007; McClure et al., 2004; Schulte-Rüther et al., 2008), it was expected that girls would react stronger to mindfulness. Kang et al. (2018) have proposed that sex differences are particularly pronounced in certain forms of mindfulness. Active methods, like yoga or Tai Chi, might benefit boys more. By contrast, mindfulness encompassing self-compassion to target self-criticism may benefit the emotional well-being of girls more. In the current study there was no control over the form of mindfulness participants practiced. It might be that if the researchers had offered mindfulness techniques encompassing self-compassion, girls would have reacted stronger to mindfulness.

Due to theorizing and empirical evidence for both directions, the direction of the third hypothesis was not specified. The results showed a non-significant negative relationship between emotional problems and mindfulness. However, when the analysis was rerun without three multivariate outliers, there was a significant negative relationship. That is, students who experienced more emotional problems reported practicing less mindfulness. This is in line with hypothesis 3b and the finding that mental health issues are associated with perceived barriers to mindfulness and mindfulness program attrition (Banerjee et al., 2018; Crane & Williams, 2010; Laurie & Blandford, 2016). Previous studies mostly examined late adolescents and adults. The current study provides evidence that more emotional problems might also lead to less mindfulness among adolescents.

Contrary to the fourth hypothesis, the relationship between emotional problems and mindfulness did not significantly differ for boys and girls. Boys are less willing to use mental health services than girls and more often report barriers, like parental disapproval and stigma (Chandra & Minkovitz, 2006). Therefore, boys with emotional problems were expected to practice mindfulness even less than girls with emotional problems. The results of the current study did not confirm that sex was a moderator of the relationship between emotional problems

and mindfulness. Since the needs and help-seeking behavior of younger people are mostly mediated by their parents, teachers or other caretakers (Roth & Leavey, 2006), it might be that this has a greater influence on adolescents' help-seeking, than the barriers they perceive.

Limitations, Strengths and Future Directions

Multiple strengths in relation to this study should be mentioned. This study is based on longitudinal data, which made it possible to examine relationships over time. Second, a large sample was used, which leads to more reliable results with greater precision (Neuman, 2014). Third, the scales for mindfulness, emotional problems and school enjoyment all had high Cronbach's alphas and therefore are considered reliable. Fourth, to improve reliability of the study, the same questionnaire was filled out, in the classroom, at the three different timepoints.

Despite these strengths, there are several limitations. First, the MMSP study used a non-probability sample. Therefore, the results may not be generalizable to other Dutch adolescents. Second, the attrition analysis showed that participants in W1 were significantly more mindful at W2 than participants who did not participate in W1. Since those participants who did not join at W1 were less mindful, it might be that if they had participated there would have been stronger effects due to more variance on mindfulness. Third, this study included only subjective self-reports to measure mindfulness, emotional problems and school enjoyment. Self-reports are prone to biases (Paulhus & Vazire, 2007). Participants might not be able to report their own behavior accurately or may interpret questions differently than intended by the researchers. Moreover, it can lead to the social desirability bias, where participants distort answers to look good or to conform to the social norm (Neuman, 2014). Participants may have reported lower levels of mindfulness and emotional problems than they actually experience.

Future research should further examine the effect of emotional problems on mindfulness over time among adolescents and should pay attention to different forms of mindfulness that can be practiced. Based on the limitations of this study, future research is recommended to use a probability sample, to be able to generalize the findings to other Dutch adolescents. Furthermore, to improve reliability and validity it is advised to combine multiple subjective measures, like self-report or parent reports, and, if possible, objective measures, such as breath-counting tasks for mindfulness (Wong et al., 2018). Moreover, it is essential that participants complete the questionnaire at every timepoint, to avoid a selection effect.

Conclusions and Implications

In the current study the bidirectional relationship between mindfulness and emotional problems among adolescents was examined and whether these relationships differed for boys and girls. Initially the results showed no bidirectional significant relationship or a moderating

role of sex. After deletion of three multivariate outliers, a small significant effect was found for the relationship between emotional problems and mindfulness; with more emotional problems being related to less mindfulness four months later.

More knowledge about the bidirectional relationship between mindfulness and emotional problems among adolescents is useful in the design of mindfulness-based school interventions. Even though the current study has found no significant effect of mindfulness on emotional problems, others studies have consistently found that mindfulness reduces emotional problems. These mindfulness-based school interventions can be adapted to accommodate the different needs of adolescents. If future studies do find sex differences in the relationship between mindfulness and emotional problems, these interventions could be adapted by using different mindfulness techniques for boys and girls. Moreover, if more emotional problems lead to less mindfulness, mindfulness-based school interventions should be adapted to reach adolescents with emotional problems. Schools could, for instance, provide educational programs about the positive outcomes of mental health services (Vidourek et al., 2014). These interventions can likely be of use for adolescents with emotional problems, to help them respond adaptively to challenges and stressful environments (Kang et al., 2018). Reducing their emotional problems is imperative for them to be able to develop into mentally healthy adults.

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Appendix A

Syntax SPSS

* Encoding: UTF-8.

* computing which set(wave 1 + wave 2 of wave 2 + wave 3) contains more missing data*

```
IF (MISSING(SCHOOL) | MISSING(SEX) | NMISS(AGE) | MISSING(GRADE) | MISSING(EXP1) | MISSING(EXP2) |  
MISSING(EXP3) | MISSING(EMS1) | MISSING(EMS2) | MISSING(EMS3) | MISSING(EMS4) | MISSING(EMS5) |  
MISSING(MFN1) | MISSING(MFN2) | MISSING(MFN3) | MISSING(MFN4) | MISSING(MFN5) |  
MISSING(EXP1_2) |  
MISSING(EXP2_2) | MISSING(EXP3_2) | MISSING(EMS1_2) | MISSING(EMS2_2) | MISSING(EMS3_2) |  
MISSING(EMS4_2) | MISSING(EMS5_2) | MISSING(MFN1_2) | MISSING(MFN2_2) | MISSING(MFN3_2) |  
MISSING(MFN4_2) | MISSING(MFN5_2)) Wave1and2missings=1.  
  
EXECUTE.
```

```
IF (MISSING(SCHOOL) | MISSING(SEX) | NMISS(AGE) | MISSING(GRADE) | MISSING(EXP1_2) |  
MISSING(EXP2_2) | MISSING(EXP3_2) | MISSING(EMS1_2) | MISSING(EMS2_2) | MISSING(EMS3_2) |  
MISSING(EMS4_2) | MISSING(EMS5_2) | MISSING(MFN1_2) | MISSING(MFN2_2) | MISSING(MFN3_2) |  
MISSING(MFN4_2) | MISSING(MFN5_2) | MISSING(EXP1_3) | MISSING(EXP2_3) | MISSING(EXP3_3) |  
MISSING(EMS1_3) | MISSING(EMS2_3) | MISSING(EMS3_3) | MISSING(EMS4_3) | MISSING(EMS5_3) |  
MISSING(MFN1_3) | MISSING(MFN2_3) | MISSING(MFN3_3) | MISSING(MFN4_3) | MISSING(MFN5_3))  
Wave2and3missings=1.  
  
EXECUTE.
```

computing the variables School Experience, Emotional Problems

```
COMPUTE Schoolexperience1=MEAN(EXP1,EXP2,EXP3).  
  
EXECUTE.
```

```
COMPUTE Emotionalproblems1=MEAN(EMS1,EMS2,EMS3,EMS4,EMS5).  
  
EXECUTE.
```

```
COMPUTE Schoolexperience2=MEAN(EXP1_2,EXP2_2,EXP3_2).  
  
EXECUTE.
```

MINDFULNESS AND EMOTIONAL PROBLEMS

```
COMPUTE Emotionalproblems2=MEAN(EMS1_2,EMS2_2,EMS3_2,EMS4_2,EMS5_2).
```

```
EXECUTE.
```

```
COMPUTE Schoolexperience3=MEAN(EXP1_3,EXP2_3,EXP3_3).
```

```
EXECUTE.
```

```
COMPUTE Emotionalproblems3=MEAN(EMS1_3,EMS2_3,EMS3_3,EMS4_3,EMS5_3).
```

```
EXECUTE.
```

* recoding mindfulness such that higher scores indicate more mindfulness*

```
RECODE MFN1 MFN2 MFN3 MFN4 MFN5 MFN1_2 MFN2_2 MFN3_2 MFN4_2 MFN5_2 MFN1_3 MFN2_3  
MFN3_3 MFN4_3
```

```
    MFN5_3 (0=4) (1=3) (2=2) (3=1) (4=0) (999=999) INTO MFN1_O MFN2_O MFN3_O MFN4_O MFN5_O  
MFN1_2_O MFN2_2_O
```

```
    MFN3_2_O MFN4_2_O MFN5_2_O MFN1_3_O MFN2_3_O MFN3_3_O MFN4_3_O MFN5_3_O.
```

```
EXECUTE.
```

```
COMPUTE Mindfulness1_O=MEAN(MFN1_O,MFN2_O,MFN3_O,MFN4_O,MFN5_O).
```

```
EXECUTE.
```

```
COMPUTE Mindfulness2_O=MEAN(MFN1_2_O,MFN2_2_O,MFN3_2_O,MFN4_2_O,MFN5_2_O).
```

```
EXECUTE.
```

```
COMPUTE Mindfulness3_O=MEAN(MFN1_3_O,MFN2_3_O,MFN3_3_O,MFN4_3_O,MFN5_3_O).
```

```
EXECUTE.
```

* variable for missing data on just wave 1 or just wave 2* * i think I also did things manually here in the dataset
- I manually filled in a 0 for every . for the variable missingswave1 and missingswave2*

```
IF (MISSING(SCHOOL) | MISSING(SEX) | NMISS(AGE) | MISSING(GRADE) | MISSING(EXP1) | MISSING(EXP2) |  
    MISSING(EXP3) | MISSING(EMS1) | MISSING(EMS2) | MISSING(EMS3) | MISSING(EMS4) | MISSING(EMS5) |  
    MISSING(MFN1) | MISSING(MFN2) | MISSING(MFN3) | MISSING(MFN4) | MISSING(MFN5))  
Missingswave1=1.
```

MINDFULNESS AND EMOTIONAL PROBLEMS

EXECUTE.

```
IF (MISSING(SCHOOL) | MISSING(SEX) | NMISS(AGE) | MISSING(GRADE) | MISSING(EXP1_2) |  
    MISSING(EXP2_2) | MISSING(EXP3_2) | MISSING(EMS1_2) | MISSING(EMS2_2) | MISSING(EMS3_2) |  
    MISSING(EMS4_2) | MISSING(EMS5_2) | MISSING(MFN1_2) | MISSING(MFN2_2) | MISSING(MFN3_2) |  
    MISSING(MFN4_2) | MISSING(MFN5_2)) Missingswave2=1.
```

EXECUTE.

* for the attrition analysis the continuous predictors - logit linearity assumption testing*

```
COMPUTE Logitlinearity_AGE=LN(AGE).
```

EXECUTE.

```
COMPUTE Logitlinearity_SE1=LN(Schoolexperience1).
```

EXECUTE.

```
COMPUTE Logitlinearity_EP1=LN(Emotionalproblems1).
```

EXECUTE.

```
COMPUTE Logitlinearity_M1=LN(Mindfulness1_O).
```

EXECUTE.

```
COMPUTE Logitlinearity_SE2=LN(Schoolexperience2).
```

EXECUTE.

```
COMPUTE Logitlinearity_EP2=LN(Emotionalproblems2).
```

EXECUTE.

```
COMPUTE Logitlinearity_M2=LN(Mindfulness2_O).
```

EXECUTE.

```
COMPUTE Logitlinearity_SE3=LN(Schoolexperience3).
```

EXECUTE.

MINDFULNESS AND EMOTIONAL PROBLEMS

```
COMPUTE Logitlinearity_M3=LN(Mindfulness3_O).
```

```
EXECUTE.
```

```
COMPUTE Logitlinearity_EP3=LN(Emotionalproblems3).
```

```
EXECUTE.
```

```
LOGISTIC REGRESSION VARIABLES Missingswave1
```

```
/METHOD=ENTER AGE AGE*Logitlinearity_AGE Schoolexperience2 Logitlinearity_SE2*Schoolexperience2  
Emotionalproblems2 Emotionalproblems2*Logitlinearity_EP2 Mindfulness2_O  
Logitlinearity_M2*Mindfulness2_O  
/CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

```
LOGISTIC REGRESSION VARIABLES Missingswave2
```

```
/METHOD=ENTER AGE AGE*Logitlinearity_AGE Schoolexperience1 Logitlinearity_SE1*Schoolexperience1  
Emotionalproblems1 Emotionalproblems1*Logitlinearity_EP1 Mindfulness1_O  
Logitlinearity_M1*Mindfulness1_O  
/CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

logistic regression and outliers

```
LOGISTIC REGRESSION VARIABLES Missingswave1
```

```
/METHOD=ENTER AGE  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

```
LOGISTIC REGRESSION VARIABLES Missingswave1
```

```
/METHOD=ENTER SEX  
/CONTRAST (SEX)=Indicator(1)  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID
```

MINDFULNESS AND EMOTIONAL PROBLEMS

```
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave1

```
/METHOD=ENTER Emotionalproblems2  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave1

```
/METHOD=ENTER Mindfulness2_O  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave1

```
/METHOD=ENTER Schoolexperience2  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave1

```
/METHOD=ENTER AGE SEX Emotionalproblems2 Mindfulness2_O Schoolexperience2  
/CONTRAST (SEX)=Indicator(1)  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID
```

MINDFULNESS AND EMOTIONAL PROBLEMS

```
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER AGE  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER SEX  
/CONTRAST (SEX)=Indicator(1)  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER Emotionalproblems1  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER Mindfulness1_O  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID
```


MINDFULNESS AND EMOTIONAL PROBLEMS

```
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER Schoolexperience1  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

LOGISTIC REGRESSION VARIABLES Missingswave2

```
/METHOD=ENTER AGE SEX Emotionalproblems1 Mindfulness1_O Schoolexperience1  
/CONTRAST (SEX)=Indicator(1)  
/SAVE=PRED PGROUP COOK LEVER DFBETA ZRESID  
/CLASSPLOT  
/CASEWISE OUTLIER(2)  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

* it seems that mindfulness and sex are different in wave 1 for the missings - compare means of mindfulness and age in wave 2 with those missing and not missing in wave 1*

T-TEST GROUPS=Missingswave1(0 1)

```
/MISSING=ANALYSIS  
/VARIABLES=Mindfulness2_O  
/CRITERIA=CI(.95).
```

for sex it was found (by looking myself and calculating manually) that almost 75% of the data for the W1 drop-out was missing, so this seen difference is not reliable

descriptives

MINDFULNESS AND EMOTIONAL PROBLEMS

FREQUENCIES VARIABLES=SEX

/STATISTICS=STDDEV MEAN

/ORDER=ANALYSIS.

DESCRIPTIVES VARIABLES=AGE

/STATISTICS=MEAN STDDEV MIN MAX.

reliability scales

RELIABILITY

/VARIABLES=EXP1 EXP2 EXP3

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=DESCRIPTIVE SCALE CORR

/SUMMARY=TOTAL.

RELIABILITY

/VARIABLES=EXP1_2 EXP2_2 EXP3_2

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=DESCRIPTIVE SCALE CORR

/SUMMARY=TOTAL.

RELIABILITY

/VARIABLES=MFN1 MFN2 MFN3 MFN4 MFN5

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=DESCRIPTIVE SCALE CORR

/SUMMARY=TOTAL.

RELIABILITY

/VARIABLES=MFN1_2 MFN2_2 MFN3_2 MFN4_2 MFN5_2

MINDFULNESS AND EMOTIONAL PROBLEMS

```
/SCALE('ALL VARIABLES') ALL  
/MODEL=ALPHA  
/STATISTICS=DESCRIPTIVE SCALE CORR  
/SUMMARY=TOTAL.
```

RELIABILITY

```
/VARIABLES=EMS1 EMS2 EMS3 EMS4 EMS5  
/SCALE('ALL VARIABLES') ALL  
/MODEL=ALPHA  
/STATISTICS=DESCRIPTIVE SCALE CORR  
/SUMMARY=TOTAL.
```

RELIABILITY

```
/VARIABLES=EMS1_2 EMS2_2 EMS3_2 EMS4_2 EMS5_2  
/SCALE('ALL VARIABLES') ALL  
/MODEL=ALPHA  
/STATISTICS=DESCRIPTIVE SCALE CORR  
/SUMMARY=TOTAL.
```

factor analysis

FACTOR

```
/VARIABLES EXP1 EXP2 EXP3  
/MISSING LISTWISE  
/ANALYSIS EXP1 EXP2 EXP3  
/PRINT INITIAL CORRELATION SIG DET KMO AIC EXTRACTION ROTATION  
/FORMAT SORT BLANK(0.30)  
/PLOT EIGEN ROTATION  
/CRITERIA MINEIGEN(1) ITERATE(25)  
/EXTRACTION PAF  
/CRITERIA ITERATE(25)  
/ROTATION PROMAX(4)  
/METHOD=CORRELATION.
```

MINDFULNESS AND EMOTIONAL PROBLEMS

FACTOR

```
/VARIABLES EXP1_2 EXP2_2 EXP3_2  
/MISSING LISTWISE  
/ANALYSIS EXP1_2 EXP2_2 EXP3_2  
/PRINT INITIAL CORRELATION SIG DET KMO AIC EXTRACTION ROTATION  
/FORMAT SORT BLANK(0.30)  
/PLOT EIGEN ROTATION  
/CRITERIA MINEIGEN(1) ITERATE(25)  
/EXTRACTION PAF  
/CRITERIA ITERATE(25)  
/ROTATION PROMAX(4)  
/METHOD=CORRELATION.
```

deleting all participants with 1 or more missings on the variables: age, mindfulness, emotional problems or school enjoyment

* also deleting wave 3 for 'overzichtelijkheid'*

```
COMPUTE Missingsinwave1=MISSING(EXP1) | MISSING(EXP2) | MISSING(EXP3) | MISSING(EMS1) |  
MISSING(EMS2) | MISSING(EMS3) | MISSING(EMS4) | MISSING(EMS5) | MISSING(MFN1) | MISSING(MFN2) |  
MISSING(MFN3) | MISSING(MFN4) | MISSING(MFN5).  
EXECUTE.
```

```
COMPUTE Missingsinwave2=MISSING(EXP1_2) | MISSING(EXP2_2) | MISSING(EXP3_2) | MISSING(EMS1_2) |  
MISSING(EMS2_2) | MISSING(EMS3_2) | MISSING(EMS4_2) | MISSING(EMS5_2) | MISSING(MFN1_2) |  
MISSING(MFN2_2) | MISSING(MFN3_2) | MISSING(MFN4_2) | MISSING(MFN5_2).  
EXECUTE.
```

* checking the assumptions for the hierarchical multiple regression analysis*

```
EXAMINE VARIABLES=AGE Minfulness1_O Minfulness2_O Schoolexperience1 Schoolexperience2  
Emotionalproblems1 Emotionalproblems2  
/PLOT BOXPLOT STEMLEAF HISTOGRAM NPLOT
```

MINDFULNESS AND EMOTIONAL PROBLEMS

```
/COMPARE VARIABLES  
/STATISTICS DESCRIPTIVES  
/CINTERVAL 95  
/MISSING LISTWISE  
/NOTOTAL.
```

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Emotionalproblems2  
/METHOD=ENTER Minfulness1_O SEX AGE Schoolexperience1 Emotionalproblems1  
/SCATTERPLOT=(*ZRESID ,*ZPRED)  
/RESIDUALS NORMPROB(ZRESID)  
/SAVE MAHAL COOK.
```

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Minfulness2_O  
/METHOD=ENTER Emotionalproblems1 SEX AGE Schoolexperience1 Minfulness1_O  
/SCATTERPLOT=(*ZRESID ,*ZPRED)  
/RESIDUALS NORMPROB(ZRESID)  
/SAVE MAHAL COOK.
```

descriptives

```
DESCRIPTIVES VARIABLES=Minfulness1_O Minfulness2_O Emotionalproblems1 Emotionalproblems2  
Schoolexperience1 AGE  
/STATISTICS=MEAN STDDEV MIN MAX.
```

MINDFULNESS AND EMOTIONAL PROBLEMS

correlations

NONPAR CORR

```
/VARIABLES=Minfulness1_O Minfulness2_O Emotionalproblems1 Emotionalproblems2  
Schoolexperience1 AGE SEX  
/PRINT=SPEARMAN TWOTAIL NOSIG  
/MISSING=PAIRWISE.
```

CORRELATIONS

```
/VARIABLES=Minfulness1_O Minfulness2_O Emotionalproblems1 Emotionalproblems2 Schoolexperience1  
AGE SEX  
/PRINT=TWOTAIL NOSIG  
/MISSING=PAIRWISE.
```

* interaction variables 'sex x mindfulness W1' and 'sex x emotional problems W1' centering variables first and then computing the two interaction variables*

AGGREGATE

```
/OUTFILE=* MODE=ADDVARIABLES  
/BREAK=  
/Minfulness1_O_mean=MEAN(Minfulness1_O)  
/Emotionalproblems1_mean=MEAN(Emotionalproblems1).
```

COMPUTE deviation_mindfulness1_O=Minfulness1_O - Minfulness1_O_mean.

EXECUTE.

COMPUTE deviation_Emotionalproblems1=Emotionalproblems1 - Emotionalproblems1_mean.

EXECUTE.

COMPUTE sex_X_devmindfulness1_O=SEX * deviation_mindfulness1_O.

EXECUTE.

MINDFULNESS AND EMOTIONAL PROBLEMS

```
COMPUTE sex_X_devemotionalproblems1=SEX *deviation_Emotionalproblems1.  
EXECUTE.
```

* regression for emotional problems W2*

BOOTSTRAP

```
/SAMPLING METHOD=SIMPLE  
/VARIABLES TARGET=Emotionalproblems2 INPUT= Schoolexperience1 Emotionalproblems1  
Minfulness1_O SEX sex_X_devmindfulness1_O  
/CRITERIA CILEVEL=95 CITYPE=BCA NSAMPLES=5000  
/MISSING USERMISSING=EXCLUDE.
```

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Emotionalproblems2  
/METHOD=ENTER Schoolexperience1 Emotionalproblems1  
/METHOD=ENTER Minfulness1_O  
/METHOD=ENTER SEX sex_X_devmindfulness1_O.
```

* wild bootstrapping hierarchical multiple regression for mindfulness W2 - computing the residuals for wild bootstrapping*

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Minfulness2_O  
/METHOD=ENTER Schoolexperience1 Minfulness1_O  
/METHOD=ENTER Emotionalproblems1  
/METHOD=ENTER SEX sex_X_devemotionalproblems1
```

MINDFULNESS AND EMOTIONAL PROBLEMS

/SAVE RESID.

BOOTSTRAP

/SAMPLING METHOD=WILD(RESIDUALS=RES_1)

/VARIABLES TARGET=Minfulness2_O INPUT= Schoolexperience1 Minfulness1_O

Emotionalproblems1 SEX sex_X_devemotionalproblems1

/CRITERIA CILEVEL=95 CITYPE=BCA NSAMPLES=5000

/MISSING USERMISSING=EXCLUDE.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT Minfulness2_O

/METHOD=ENTER Schoolexperience1 Minfulness1_O

/METHOD=ENTER Emotionalproblems1

/METHOD=ENTER SEX sex_X_devemotionalproblems1.

analyses again without the three multivariate outliers with a MAH distance above 20.515 - manually removed

BOOTSTRAP

/SAMPLING METHOD=SIMPLE

/VARIABLES TARGET=Emotionalproblems2 INPUT= Schoolexperience1 Emotionalproblems1

Minfulness1_O SEX sex_X_devmindfulness1_O

/CRITERIA CILEVEL=95 CITYPE=BCA NSAMPLES=5000

/MISSING USERMISSING=EXCLUDE.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT Emotionalproblems2

MINDFULNESS AND EMOTIONAL PROBLEMS

```
/METHOD=ENTER Schoolexperience1 Emotionalproblems1  
/METHOD=ENTER Minfulness1_O  
/METHOD=ENTER SEX sex_X_devmindfulness1_O.
```

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Minfulness2_O  
/METHOD=ENTER Schoolexperience1 Minfulness1_O  
/METHOD=ENTER Emotionalproblems1  
/METHOD=ENTER SEX sex_X_devemotionalproblems1  
/SAVE RESID.
```

BOOTSTRAP

```
/SAMPLING METHOD=WILD(RESIDUALS=RES_2)  
/VARIABLES TARGET=Minfulness2_O INPUT= Schoolexperience1 Minfulness1_O  
Emotionalproblems1 SEX sex_X_devemotionalproblems1  
/CRITERIA CILEVEL=95 CITYPE=BCA NSAMPLES=5000  
/MISSING USERMISSING=EXCLUDE.
```

REGRESSION

```
/MISSING LISTWISE  
/STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE ZPP  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT Minfulness2_O  
/METHOD=ENTER Schoolexperience1 Minfulness1_O  
/METHOD=ENTER Emotionalproblems1  
/METHOD=ENTER SEX sex_X_devemotionalproblems1.
```