



Comprehension of One's Life as a Possible Target for Reducing PTSD Symptoms

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Abstract

Post-Traumatic Stress Disorder (PTSD) is one of the most prevalent mental disorders in the Netherlands, affecting an estimated 7.4% of the Dutch population at some point in their life (De Vries & Olf, 2009). As a proportion of PTSD-patients drops out or does not respond to psychotherapy (Najavits, 2015; Goetter et al., 2015; Hembree et al., 2003) and there seems to be an association between the discontinuation of pharmacotherapy and relapse (Davidson et al., 2001; Davis et al., 2006), the development of new treatments for PTSD is important. This thesis studied the meaning in life subconstruct of comprehension, being “the degree to which individuals perceive a sense of coherence and understanding regarding their lives” (George & Park, 2016, p. 206), as a possible target for reducing PTSD symptom severity. This study used an experimental design to study the relation between comprehension and PTSD symptom severity and whether an intervention designed to increase comprehension leads to a decrease in PTSD symptom severity in a non-clinical sample ($N = 101$). Results showed significant and moderately strong inverse relations between comprehension and PTSD, but did not show the comprehension intervention being effective in either increasing participants' sense of comprehension or decreasing participants' PTSD scores at a one week follow-up. As such, it remains unclear whether comprehension is a useful target for reducing PTSD symptom severity. Further research and development of a comprehension intervention is needed to fully examine the influence of comprehension on PTSD symptom severity.

Keywords: comprehension, intervention, meaning in life, PTSD

Comprehension of One's Life as a Possible Target for Reducing PTSD Symptoms

Post-Traumatic Stress Disorder (PTSD) is one of the most prevalent mental disorders in the Netherlands. It's estimated that between 52% and 81% of the Dutch population will experience a traumatic event in their lifetime and that 7.4%, at some point in their life, will develop PTSD (De Vries & Olf, 2009). Symptoms of PTSD include repetitive and intrusive memories of the traumatic experience, avoidance of stimuli associated with the traumatic event, negative changes in cognition and mood, and changes in arousal, vigilance and reactivity (American Psychiatric Association, 2013). These symptoms can cause significant distress and impairments in daily functioning. About a third to half of individuals with PTSD have also been diagnosed with a depressive disorder (Keane, Marshall, & Taft, 2006) and/or a substance abuse disorder (Debell et al., 2014; Schäfer & Langeland, 2015).

Although there are several forms of treatment available for PTSD, a proportion of PTSD-patients drops out or does not respond to psychotherapy (Najavits, 2015; Goetter et al., 2015; Hembree et al., 2003) with rates of 10% to 38% in Prolonged Exposure (McLean, Asnaani, & Foa, 2015) and approximately 20% in Cognitive Processing Therapy (Monson et al., 2006). Additionally, there seems to be an association between the discontinuation of pharmacotherapy and relapse (Davidson et al., 2001; Davis et al., 2006). As such, the development of new treatments or additions to available treatments of PTSD is important.

Meaning in Life

A possible addition to the available treatments of PTSD may be found within the theoretical framework of meaning in life (MIL), which has been identified as an indicator of well-being and optimal functioning (Ryff, 1989; Seligman, 2011; Steger et al., 2006) and less severe PTSD (Bryan et al., 2020; Blackburn & Owens 2015; Bryan et al. 2013; Currier et al. 2015; Grossman et al. 1999; Owens et al. 2009; Zhang et al. 2015). Recent years have seen the development and increasing support of a tripartite model of MIL in which MIL is

proposed to consist of three components (Martela & Steger, 2016; George & Park, 2016; King & Hicks, 2020; Heintzelman & King, 2014): comprehension, being “the degree to which individuals perceive a sense of coherence and understanding regarding their lives” (George & Park, 2016, p. 206), purpose, being “the extent to which individuals experience life as being directed and motivated by valued life goals” (George & Park, 2016, p. 206), and mattering, being “the degree to which individuals feel that their existence is of significance, importance, and value in the world” (George & Park, 2016, p. 206).

A related concept is that of meaning frameworks, which have been conceptualized as the complex networks of propositions we have about how the world works and how it will work in the future (Heine, Proulx, & Vohs, 2006). According to the theory of meaning frameworks it is through our experiences that we learn to form mental representations of expected relationships among objects, places, people and ideas which would help us make sense of the world. It is suggested that meaning frameworks may contribute to a sense of MIL and that meaning frameworks that are consistent, coherent and have the explanatory power to make sense of one’s life and life experiences, may primarily provide a sense of comprehension (e.g. George & Park, 2016). Those with an increased sense of comprehension therefore could possibly experience less uncertainty (Hirsh, Mar, & Peterson, 2012; Van den Bos, 2009). Uncertainty can be understood as experiencing conflicting ways of perceiving and acting on ambiguous situations, which can be subjectively experienced as anxiety. These individuals could also experience a greater sense of clarity which enables one to make better choices as they are better able to discern what the best action to take is (Gawronski & Strack, 2012; Proulx & Inzlicht, 2012). They could also be better able to make sense of stressful life events (Park, 2010). Here, making sense can be understood in multiple terms, such as acceptance, causal understanding, integrating the event into one’s identity and changing one’s beliefs and goals.

The Connection Between MIL and Traumatic Experiences

It is suggested that traumatic experiences can violate one's meaning frameworks and disrupt one's sense of comprehension as one's views and expectations of the world become inconsistent with one's lived experiences (Janoff-Bulman, 1992; Thompson & Janigian, 1988; Park, 2010). According to Janoff-Bulman and Frieze (1983), there seem to be three types of assumptions that are especially affected by traumatic experiences. The first is thought to be the assumption of invulnerability, our tendency of being aware of bad things happening but simultaneously believing they won't happen to us. Once this sense of invulnerability is shattered by experiencing a traumatic event, becoming a victim (once again) feels like a very real possibility (Kahneman & Tversky, 1973). The second assumption is thought to be the view of the world as meaningful and comprehensible. If we view the world as operating according to a predictable ruleset we can enact control over what happens to us. The world is meaningful because we know what to expect and why negative events happen. The third assumption is thought to consist of positive self-perceptions. People tend to view themselves as worthy and decent individuals. When one becomes victimized, these self-perceptions are questioned and negative self-perceptions become activated (Horowitz et al., 1980). One can view themselves as weak, helpless, needy, frightened, out of control (Krupnick, 1980), and lacking autonomy (Bard & Sangrey, 1979). It is thought that the inability to come to terms with these shattered assumptions and to restore meaning plays a causal role in the development of PTSD (Janoff-Bulman, 1992; Dalgleish, 2004; Park et al., 2012). Studies have shown that having more shattered assumptions is related to greater PTSD severity in victims of trauma (Dunmore, Clark, & Ehlers, 2001; Foa et al., 1999; Mitchell-Gibbs & Joseph, 1996; Owens & Chard, 2001; Solomon et al., 1997; Wenninger & Ehlers, 1998). The symptoms of intrusive and repetitive thoughts about the traumatic event can be viewed as

attempts to incorporate new information into new assumptions and models of the world (e.g. Horowitz, 1982).

Coping with Traumatic Experiences

Coping with traumatic experiences is thought to involve the re-establishing of coherent world views (Janoff-Bulman & Frieze, 1983). Both the violation of assumptions as well as the re-establishing of world views could be interpreted from a MIL perspective (George & Park, 2016) as decreasing and increasing sense of comprehension respectively. A treatment for PTSD that explicitly addresses the violation of one's beliefs is Cognitive Processing Therapy, which involves processing the traumatic experience and targeting maladaptive thoughts that maintain PTSD (Lancaster et al., 2016). Patients write and talk about the ways the trauma has affected their beliefs about self, others, and the world. Throughout the therapy, unhelpful and over-generalized thoughts brought on by the trauma are identified and more helpful and accurate thoughts are generated. This too could be interpreted from a MIL perspective as a way of increasing comprehension, specifically regarding the traumatic experience.

A concept that has similarities with the MIL construct of comprehension is Sense of Coherence (SOC; Antonovsky, 1979), which is defined as one's confidence in the predictability of their external and internal environments and one's ability to manage difficult life experiences. With regards to stressors, individuals with a high SOC are thought to have greater clarity, more resources and greater motivation to cope with these stressors (Cederblad et al., 1994). While research has found SOC to be negatively correlated with PTSD symptoms (e.g. Kazlauskas et al., 2017; Veronese & Pepe, 2014), the causal influence of SOC on PTSD symptoms remains unclear. With the similarities of the concepts in mind, it seems plausible that the MIL construct of comprehension will show similar correlations with PTSD.

Aims of the Current Study

As traumatic experiences can disrupt such a broad array of someone's assumptions, beliefs and worldviews that are not limited to the traumatic experience itself (Janoff-Bulman & Frieze, 1983), comprehension of one's life as a whole could possibly be a useful target for treatment of PTSD. The aim of the current study is to examine whether an intervention targeting comprehension as defined by the tripartite model (George & Park, 2016) will affect PTSD symptoms and whether comprehension shows associations with PTSD symptoms. This could possibly lead to a new intervention for the treatment of PTSD. Hypothesis 1: A comprehension intervention will lead to a significantly larger decrease in PTSD symptom severity at a follow-up assessment a week after the intervention compared to a control condition. Hypothesis 2: Decreases in PTSD symptom severity are associated with increases in comprehension.

Methods

Participants

The participants were first year psychology students recruited through the SONA system of the University of Groningen. A total of 202 participants completed the first assessment and answered all relevant questionnaires. Between the first and second assessment 39 participants dropped out. Thirteen participants did not finish the second assessment or did not answer all relevant questionnaires and were excluded. Out of the remaining 150 participants, 49 were part of the purpose condition and thus not relevant for this thesis, resulting in the final sample of 101 participants, with 54 participants in the control group and 47 participants in the comprehension group. This final sample had a mean age of 19.92 ($SD = 1.79$), ranging from 17 to 27 years old, and consisted of 30 men (29.7%), 70 women (69.3%) and 1 individual identifying as non-binary (1%).

Materials

Comprehension Questionnaire

The questionnaire used to measure comprehension consisted of five items of the Multidimensional Existential Meaning Scale (MEMS; George & Park, 2017) and included items such as, “My life makes sense” and “I know what my life is about”. Participants rated each item on a 7-point Likert scale, ranging from 1, *Very strongly disagree*, to 7, *Very strongly agree*. Internal consistency was high across assessments ($\alpha = .848$; $\alpha = .904$).

PTSD Questionnaire

PTSD symptoms were measured with the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). This questionnaire consists of 20 items each listing a problem that people sometimes have in response to a very stressful experience. Prior to the PCL-5, participants were asked to choose the stressful experience that is currently most distressing to them from a list. Participants were asked to keep this event in mind while filling out the PCL-5 and to rate on a 5-point Likert scale, ranging from 0, “*Not at all*”, to 4, “*Extremely*”, how much they were bothered by that event in the past month. It included items such as “*Repeated, disturbing, and unwanted memories of the stressful experience?*” and “*Trouble remembering important parts of the stressful experience?*”. Internal consistency was high across assessments ($\alpha = .940$; $\alpha = .963$).

Additional questionnaires were included in the study which were not relevant to this thesis.

Intervention

The comprehension intervention used in the current study consisted of several exercises that were inspired by the theoretical literature on MIL (e.g. Shin & Steger, 2014), as well as existing interventions which include exercises that aim to increase the sense of order by narrating and ordering one’s life experiences. These interventions aim to alleviate the distress of patients diagnosed with cancer. Two examples of such interventions are the Meaning-Making Intervention (MMI; Lee, 2004) which includes the development of a

lifeline, intended to help clients identify their strengths and to come to terms with their illness, and the Individual Meaning-Centered Psychotherapy (IMCP; Breitbart & Poppito, 2014), which includes an exercise in which clients look back on their life, reflect on who they are today and look towards the future. Randomized controlled studies have shown significant treatment effects on self-esteem, optimism, self-efficacy (MMI; Lee et al., 2006), quality of life, sense of meaning, spiritual well-being, anxiety, and desire for hastened death (IMCP; Breitbart et al., 2012; Breitbart et al., 2018) in patients diagnosed with cancer. PTSD was not measured in these studies. See appendix A for the content of the intervention used in the current study.

Procedure

The study was executed online through Qualtrics from May to June of 2021. Participants were randomly assigned to either one of two experimental groups (one targeting comprehension, the other targeting purpose) or to the control group. Information was provided about the research, describing its aim to study changes in mental well-being over an interval of approximately a week. Participants were informed that participation is voluntary and that they may terminate their participation at any time without any negative consequences. The possibility of some questions being experienced as personal or distressing was mentioned, in which case the participants were given the option of skipping these questions and participants were encouraged to contact the researcher. Finally, participants were informed that their responses and personal data would be pseudonymized and that after integration of the collected data, email addresses and SONA numbers will be deleted. Participants were then asked to fill out the informed consent if they agreed to participate in the research. All continuing participants were presented with questionnaires about MIL and mental health.

After filling out the questionnaires the experimental groups underwent an intervention aimed at either increasing the sense of comprehension or the sense of purpose. Following the intervention, participants filled out demographic information (age, gender, nationality and fluency in English), MIL was measured again as well as state affect (e.g., *Right now, I feel upset*) and participants were asked to summarize what they have been doing for the past 15 minutes. Participants were then asked how engaged they were with thinking about who they are and how their lives fit together (comprehension) and how engaged they were with their values and goals (purpose). Finally, participants were asked how depressed, anxious and distressed (regarding an earlier reported aversive life event) they were expecting to feel over the next week. On average, the first session took the control condition approximately 22 minutes and the comprehension group approximately 45 minutes to complete. A week after taking part in the first assessment, participants were invited for the second online assessment, in which they again filled out the questionnaires regarding MIL and mental health.

Statistical Analyses

All analyses of the data were conducted with SPSS version 26.

Preparation of the Data

Sum scores for comprehension and PTSD at pre- and post- intervention were computed resulting in sum scores of comprehension with a possible range from 5 to 35 and sum scores of PTSD with a possible range from 0 to 80. Difference scores for comprehension and PTSD were computed by subtracting the post-intervention sum scores from the pre-intervention sum scores of each variable. To make the use of a mixed model ANOVA and Pearson's correlation coefficient appropriate, the data should come from a population that is assumed to be distributed normally. This is reflected in small samples by residuals that are at least approximately normally distributed (Aron, Coups, & Aron, 2013). This was checked for by looking at histograms and QQ-plots of the sum and difference scores of comprehension

and PTSD. Where necessary, square root transformations were performed to adjust distributions to be approximately normal. Homoscedasticity was checked by conducting Levene's test. Checking for outliers was done by looking at histograms, boxplots and scatterplots.

Analysis of Dropout

The 39 participants that had dropped out between the first and second assessment were analyzed and compared to the continuing participants in order to study whether these groups showed any significant differences which may have influenced the decision to discontinue participation in this study. Chi-square tests were performed on gender and English fluency, and t-tests were performed on age and pre-intervention scores of comprehension and PTSD.

Correlational Analyses

To study the association between comprehension and PTSD symptoms, and whether changes in one are associated with changes in the other (hypothesis 2), Pearson's correlation coefficients were computed between comprehension and PTSD sum scores (pre- and post-intervention separately) and difference scores respectively.

Mixed Model ANOVA

Mixed model ANOVAs were conducted to study whether the intervention succeeded in increasing the sense of comprehension (manipulation check) and to study whether this intervention leads to significantly larger decreases in PTSD scores at a one week follow-up in the comprehension group compared to the control group (hypothesis 1). A mixed model ANOVA is suitable for conducting analyses involving both between-group and within-group variables, in this case the different groups and time (pre- and post-intervention assessments) respectively (Murrar & Brauer, 2018). This analysis allows for comparisons even in the event of the groups showing differences at pre-intervention. This analysis compared the control and

comprehension groups on comprehension scores (manipulation check) and PTSD scores (hypothesis 1).

Post-Hoc Analyses

The analyses which study the influence of the intervention on PTSD scores (hypothesis 1) and whether changes in comprehension scores correlate with changes in PTSD scores (hypothesis 2) were rerun twice on two different subsets of participants. First, with a subset of participants that showed an increase in comprehension at the second assessment ($n = 41$) to further study the effect of the comprehension intervention on PTSD symptoms. And second, with participants that showed pre-intervention PTSD scores above 30 ($n = 17$), which research suggests to be indicative of probable PTSD (Weathers et al., 2013), to study whether the intervention shows different effects on people with greater PTSD symptom severity.

Results

Data Management Issues

Histograms and QQ-plots showed pre- and post-intervention sum scores of PTSD and its residuals to be distributed non-normally and to be strongly skewed to the right in both the control and comprehension groups (as shown in appendix B). Square root transformations were conducted on this data in order to comply with the assumption of normality. See appendix C for the distribution of the transformed data and its residuals, and appendix D for the means and standard deviations of this data. Histograms, boxplots and scatterplots of the difference scores of comprehension and PTSD showed the presence of two strong outliers in the comprehension group with extremely large increases in PTSD from pre- to post-intervention (as shown in appendix E). These scores were more than three standard deviations ($SD = 12.85$) away from the mean ($M = -0.19$). As Pearson's correlation coefficient is sensitive to outliers (Aron, Coups, & Aron, 2013), this analysis was performed twice (with and without outliers) to control for the influence of the outliers.

Dropout of Participants

A chi-square test on age showed the participants that had dropped out ($n = 39$, $M = 20.76$, $SD = 1.88$) to be slightly older ($t(197) = -2.03$, $p = .043$, $d = 0.38$) than the continuing participants ($n = 163$, $M = 20.04$, $SD = 1.94$). A t-test on pre-intervention PTSD showed that the participants that had dropped out ($M = 19.56$, $Mdn = 11$, $SD = 17.92$) scored significantly higher ($t(200) = -2.23$, $p = .027$, $d = 0.36$) than the continuing participants ($M = 13.86$, $Mdn = 15$, $SD = 13.38$). No statistically significant differences were found on gender, English fluency and pre-intervention scores of comprehension, p 's $> .137$.

Manipulation Check

A mixed model ANOVA was conducted on the comprehension sum scores at pre- and post-intervention by the control and comprehension groups. Table 1 shows the means and standard deviations of these sum scores. There was no significant main effect of time on comprehension scores $F(1, 99) = 0.015$, $p = .901$, $\eta_p^2 = .000$. There was no significant main effect of condition on comprehension scores $F(1, 99) = 0.530$, $p = .468$, $\eta_p^2 = .005$. There was no significant time by condition interaction effect on comprehension scores $F(1, 99) = 0.113$, $p = .738$, $\eta_p^2 = .001$. These findings show that the intervention failed to significantly influence the comprehension scores.

Correlations Between Comprehension and PTSD

Pearson's correlation coefficient was computed for the comprehension sum scores and

Table 1

Descriptive Statistics of Comprehension Sum Scores

Comprehension Scores	Condition				Marginal <i>M</i>
	Control ($n = 54$)		Comprehension ($n = 47$)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	23.24	4.83	22.45	4.35	22.84
Post-Intervention	23.06	4.67	22.53	5.93	22.79
Marginal	23.15		22.49		

Table 2*Pearson's Correlation Coefficients for Comprehension and Transformed PTSD Sum Scores*

Time	Condition					
	Complete Sample ($N = 101$)		Control ($n = 54$)		Comprehension ($n = 47$)	
	r	p	r	p	r	p
Pre-Intervention	-.454	< .001	-.501	< .001	-.427	.003
Post-Intervention	-.425	< .001	-.422	.001	-.437	.002

the transformed PTSD sum scores by the complete sample, as well as the control and comprehension groups separately. As shown in table 2, the findings show that comprehension and PTSD have a moderately strong inverse relation (Dancey & Reidy, 2007), across all participants and within the groups.

Hypothesis One: Influence of a Comprehension Intervention on PTSD

A mixed model ANOVA was conducted on the transformed PTSD sum scores at pre- and post-intervention by the control and comprehension groups. Table 3 shows the means and standard deviations of the raw PTSD sum scores. PTSD symptoms significantly decreased over time, $F(1, 99) = 5.910, p = .017, \eta_p^2 = .056$. There was no significant main effect of condition on PTSD scores, $F(1, 99) = 0.269, p = .605, \eta_p^2 = .003$. There was no significant time by condition interaction effect on PTSD scores, $F(1, 99) = 3.350, p = .070, \eta_p^2 = .033$. These findings show that the comprehension intervention did not significantly influence the PTSD scores.

Table 3*Descriptive Statistics of PTSD Sum Scores*

PTSD Scores	Condition				Marginal M
	Control ($n = 54$)		Comprehension ($n = 47$)		
	M	SD	M	SD	
Pre-Intervention	16.94	15.05	13.26	13.10	15.23
Post-Intervention	13.41	15.79	13.45	15.15	13.43
Marginal	15.18		13.35		

Table 4*Descriptive Statistics and Correlations of Comprehension and PTSD Difference Scores*

Condition	Difference Scores				Correlation	
	Comprehension		PTSD		<i>r</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Control (<i>n</i> = 54)	0.19	3.77	3.54	9.12	-.084	.545
Comprehension (<i>n</i> = 47)	-0.09	4.31	-0.19	12.85	-.245	.096
Comprehension Without Outliers (<i>n</i> = 45)	-0.18	4.34	1.76	8.99	-.267	.076

Note. The difference scores were computed by subtracting post-intervention scores from pre-intervention scores, which makes positive values indicative of decreases in scores and negative values indicative of increases in scores.

Hypothesis Two: Correlation Between Difference Scores of Comprehension and PTSD

Pearson's correlation coefficient was computed for the difference scores of comprehension and PTSD. This was done a second time for the comprehension group with the two outliers excluded. As shown in table 4, the findings show that there were no significant correlations between the difference scores of comprehension and PTSD.

Post-Hoc Analyses

As the intervention did not influence comprehension and PTSD scores, the main analyses were rerun twice to further examine the comprehension intervention's influence on PTSD scores. First, with a subset of participants that showed an increase in comprehension at the second assessment (*n* = 41) to further study the effect of the comprehension intervention on PTSD symptoms. And second, with participants that showed pre-intervention PTSD scores above 30 (*n* = 17), which research suggests to be indicative of probable PTSD (Weathers et al., 2013), to study whether the intervention shows different effects on people with greater PTSD symptom severity.

Analyzing Participants That Showed Increases in Comprehension

A mixed model ANOVA was conducted on the transformed PTSD sum scores at pre- and post-intervention by the control and comprehension groups. Table 5 shows the means and

Table 5*Descriptive Statistics of PTSD Sum Scores by Subset One*

PTSD Scores	Condition				Marginal <i>M</i>
	Control (<i>n</i> = 20)		Comprehension (<i>n</i> = 21)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	19.55	13.90	12.00	11.86	15.68
Post-Intervention	13.60	15.99	11.05	11.60	12.29
Marginal	16.58		11.52		

standard deviations of the raw PTSD sum scores. PTSD symptoms significantly decreased over time, $F(1, 39) = 6.003, p = .019, \eta_p^2 = .133$. There was no significant main effect of condition on PTSD scores, $F(1, 39) = 0.858, p = .360, \eta_p^2 = .022$. There was a significant time by condition interaction effect on PTSD scores, $F(1, 39) = 5.692, p = .022, \eta_p^2 = .127$. These findings show that when specifically looking at participants that showed increases in comprehension the control group showed significantly larger decreases in PTSD over time compared to the comprehension group.

Pearson's correlation coefficient was computed for the difference scores of comprehension and PTSD by the control and comprehension groups. There was no significant correlation between the difference scores of comprehension and PTSD within the control group ($r = -.372, p = .106$) as well as the comprehension group ($r = -.321, p = .156$).

Analyzing Participants with Pre-Intervention PTSD Scores Above 30

A mixed model ANOVA was conducted on the transformed PTSD sum scores at pre- and post-intervention by the control and comprehension groups. Table 6 shows the means and standard deviations of the raw PTSD sum scores. There was no significant main effect of time on PTSD scores, $F(1, 15) = 1.527, p = .236, \eta_p^2 = .092$. There was no significant main effect of condition on PTSD scores, $F(1, 15) = 0.543, p = .473, \eta_p^2 = .035$. There was no significant time by condition interaction effect on PTSD scores, $F(1, 15) = 0.681, p = .422, \eta_p^2 = .043$. These findings show that the comprehension intervention did not have a significant effect on

Table 6*Descriptive Statistics of PTSD Sum Scores by Subset Two*

PTSD Scores	Condition				Marginal <i>M</i>
	Control (<i>n</i> = 12)		Comprehension (<i>n</i> = 5)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	40.58	7.08	41.20	6.61	40.76
Post-Intervention	33.92	16.11	39.80	11.54	35.65
Marginal	37.25		40.50		

the difference scores of PTSD among a subset of participants with pre-intervention PTSD scores above 30.

Pearson's correlation coefficient was computed for the difference scores of comprehension and PTSD by the control and comprehension groups. There was no significant correlation between the difference scores of comprehension and PTSD within the control group ($r = -.081, p = .803$) as well as the comprehension group ($r = -.719, p = .171$).

Discussion

With PTSD being one of the most prevalent mental disorders in the Netherlands (De Vries & Olf, 2009) and a proportion of patients with PTSD dropping out or not responding to psychotherapy (Najavits, 2015; Goetter et al., 2015; Hembree et al., 2003), the development of new treatments or additions to available treatments of PTSD is important. This thesis studied whether the MIL construct of comprehension (George & Park, 2016) is a useful target for the reduction of PTSD symptoms. This thesis studied associations between comprehension and PTSD, and the effect of an intervention designed to increase comprehension on PTSD symptoms.

Summary of Results

Although the findings of the current study showed significant and moderately strong inverse relations between comprehension and PTSD at both pre- and post-intervention, they did not show the comprehension intervention being effective in either increasing participants'

sense of comprehension or decreasing participants' PTSD scores at a one week follow-up. These findings will be discussed more in depth in the coming paragraphs, followed by a comparison to previous empirical literature.

Manipulation Check

The intervention failed to influence participants' sense of comprehension. This could mean that the intervention did not successfully line up with the comprehension items of the MEMS (George & Park, 2017). Other potential reasons are the intervention not leaving a lasting impression or participants not adhering to the homework, resulting in possible effects dissipating over the week between the assessments. Another potential reason may be that the intervention does not raise comprehension above a certain level, in which case such an exercise may still be useful for individuals with a low sense of comprehension.

Hypothesis One: Influence of a Comprehension Intervention on PTSD

PTSD scores significantly decreased over time across all participants. Comparable research on an intervention for PTSD, which also included a non-active control condition, also found a main effect of time on two trauma-related measures at a one week follow-up assessment (Matthijssen et al., 2021). As there seems to be a lack of studies on PTSD interventions with comparable control conditions and timeframes, it is difficult to determine whether this decrease in PTSD symptoms over one week was to be expected.

The interaction effect is worth mentioning as it was approaching significance, yet the effect was in the opposite direction as expected. The control group showed larger decreases in PTSD scores than the comprehension group. Both of these effects were also observed in the subset of participants that increased in comprehension, with both reaching significance. This seems to indicate that if the intervention had any effect at all, it actually reduced the main effect of time and prevented improvements in PTSD symptoms. Studies have shown that PTSD symptoms can be exacerbated during trauma-focused therapy, while still showing

significant improvements by the end of the treatment (Larsen et al., 2016; Foa et al., 2002; Lancaster et al., 2020). It could be possible that the intervention in this study failed to show improvements in PTSD symptoms at a one week follow-up, while a longer version would have led to significant reductions.

In the subset of participants that showed pre-intervention PTSD scores above 30, no significant effects were seen. As the sample size was rather small and thus underpowered, only large effects would be able to be observed (as significant), which was not the case in this study.

Hypothesis Two: Correlation Between Difference Scores of Comprehension and PTSD

Although no significant correlations were found between changes in comprehension and PTSD, the comprehension group showed weak negative correlations (Dancey & Reidy, 2007) that were approaching significance (regardless of in- or exclusion of the outliers). This prompted the post-hoc analyses which studied the subset of participants that increased in comprehension. While this subset also did not show any significant correlations, with slightly higher p-values than in the complete sample (as is to be expected from a smaller sample), it's interesting that this subset showed moderately strong negative correlations. This stronger correlation possibly indicates that increases in comprehension relate differently to changes in PTSD symptoms compared to decreases in comprehension.

The analysis of the subset of participants with pre-intervention PTSD scores above 30 was interesting as well, even though these findings were non-significant as well. Although this even smaller group was even more underpowered, the comprehension group in this subset showed a strong negative correlation with only a slightly higher p-value compared to the prior subset. This finding possibly indicates that comprehension and PTSD relate differently in individuals with greater PTSD symptom severity compared to individuals with lower PTSD

symptom severity. Consequently, the comprehension intervention possibly affected these individuals differently, but the lack of power in this sample hindered detection of this effect.

Comparing Results with Previous Empirical Literature

The findings of the current study provide evidence for an inverse relation between the MIL construct of comprehension and PTSD. This finding fits within the broader theory of meaning frameworks (e.g. Heine, Proulx, & Vohs, 2006), which suggests that traumatic experiences can disrupt one's sense of comprehension as one's views and expectations of the world become inconsistent with one's lived experiences (Janoff-Bulman, 1992; Thompson & Janigian, 1988; Park, 2010), which in turn is thought to contribute to the development of PTSD (Janoff-Bulman, 1992; Dalgleish, 2004; Park et al., 2012). As, to our knowledge, there have been no studies that looked at the relation between the specific MIL construct of comprehension and PTSD, no direct comparisons can be made. It is however possible to compare the findings of the current study with studies on similar or related concepts.

The closest research comparatively found that general MIL was inversely associated with subjective distress and repetitive thinking related to aversive events in undergraduate students (Ostafin & Proulx, 2020). As both of these are symptoms of PTSD and are covered by the PCL-5 (Weathers et al., 2013), there is considerable overlap with the correlational findings of the current study. Other research has found that having a greater sense of MIL was related to less severe PTSD symptoms in samples of military personnel (Bryan et al., 2020; Blackburn & Owens 2015; Bryan et al. 2013; Currier et al. 2015; Grossman et al. 1999; Owens et al. 2009; Zhang et al. 2015). Although comparisons between undergraduate students and military personnel should be made with caution (due to different life experiences), the correlation between MIL and PTSD seems to be consistent across these populations. There has been a lack of longitudinal studies that investigate causal relations between MIL and PTSD.

The correlational findings of the current study are similar to the inverse relations found between SOC (Antonovsky, 1979) and PTSD symptoms (e.g. Kazlauskas et al., 2017; Veronese & Pepe, 2014), and between shattered assumptions (Janoff-Bulman, 1989) and PTSD symptoms (Dunmore, Clark, & Ehlers, 2001; Foa et al., 1999; Mitchell-Gibbs & Joseph, 1996; Owens & Chard, 2001; Solomon et al., 1997; Wenninger & Ehlers, 1998). This possibly indicates that these concepts are theoretically related to each other and that shattered assumptions can indeed be interpreted from a MIL perspective as a low sense of comprehension.

The MIL interventions which include exercises similar to the one used in this study were aimed at alleviating the mental suffering of and coming to terms with a cancer diagnosis. Sadly, almost none of them actually measured MIL (Guerrero-Torrelles et al., 2017) and none measured PTSD symptoms. As such, although the current study did not find the comprehension intervention to be successful, it did conduct the appropriate measurements to be able to conclude this.

In sum, when looking at research on similar or related concepts and how they relate to PTSD, the inverse relation between comprehension and PTSD symptoms seems to be consistent with the literature. The possible causal relationship between comprehension and PTSD is still mostly unclear however. The literature does not provide evidence for the influence of MIL, SOC or shattered assumptions on PTSD, or whether changes in these measures correlate with changes in PTSD.

Strengths and Limitations

The use of an experimental design made it possible to study the influence of comprehension on PTSD symptoms. As there seems to be a lack of studies on interventions for PTSD that target a specific MIL construct, the current study may be one of the first to do so.

The efficacy of the intervention in decreasing PTSD scores was difficult to assess as the majority of participants had very low PTSD scores at the pre-intervention assessment, which left them little opportunity for improvement at the post-intervention assessment. To address this, post-hoc analyses made use of a subset of participants with pre-intervention PTSD scores above 30, which research suggests as being indicative of probable PTSD (Weathers et al., 2013). This resulted in a small and underpowered sample, which makes drawing conclusions difficult.

The dropout of participants between the first and second assessment contributed to skewed distribution of PTSD scores. These participants showed significantly higher pre-intervention PTSD scores compared to the participants that continued. It may be that these participants experienced the assessment as distressing and did not want to go through this distress for a second time. Inclusion of these participants would have resulted in a sample with higher PTSD scores with more opportunity to show decreases at the post-intervention assessment. Additionally, the assessment being experienced as distressing runs counter to the aim of studying the reduction of PTSD symptoms and may have influenced scoring on this measure.

Another limitation of the study has to do with the nature of the intervention. As this is the first iteration of an intervention that specifically aims to increase the sense of comprehension it still requires validation. This study has shown that a single online session was not able to significantly increase comprehension or decrease PTSD scores. Interventions that have shown to influence different measures of psychological wellbeing (e.g. MMI; Lee, 2004; IMCP; Breitbart & Poppito, 2014) are larger in scope and include more themes, but also spend more time (sessions and time per session) and make use of a therapeutic setting. As such, the short duration, limited scope and online nature of the intervention used in this study

may have prevented the intervention of being effective in increasing comprehension and decreasing PTSD scores.

Future Directions

Future research could make use of a screener which selects participants based on a PTSD cut-off score. This could facilitate a larger sample that has more room for improvement, making smaller changes in PTSD scores more detectable.

Regarding the nature of the intervention, future research could make several adjustments. As the online nature of the intervention fits with the increased use of e-health, it would be interesting to study whether a longer intervention (e.g. weekly sessions across a few months) would lead to greater efficacy in influencing comprehension and PTSD symptoms. This would also address the possibility of a temporary exacerbation of PTSD symptoms early in treatment (Larsen et al., 2016; Foa et al., 2002; Lancaster et al., 2020) and allow for more opportunity to show improvements at later timepoints of the treatment. Other adjustments could include the use of an in-person intervention within a more therapeutic setting. This would allow the participant, together with a guide or therapist, to deeper explore the subjects of MIL, their life story and identity. This would be more in line with existing MIL interventions (Lee, 2004; Breitbart & Poppito, 2014). The trade-off between the ease of use, accessibility and privacy of the online intervention and the greater scope, deeper exploration and guidance of a more “therapeutic” intervention should be considered, as both modalities have their uses.

Conclusion

In sum, this thesis found support for the inverse relation between the MIL construct of comprehension and PTSD symptom severity. As the intervention failed to increase comprehension it was difficult to study comprehension’s influence on PTSD symptom severity. Analyses of the intervention’s influence on PTSD either indicated the intervention to

lead to less improvements compared to the control condition, or to have no significant effect at all. As such, it remains unclear whether comprehension is a useful target for the reduction of PTSD symptom severity. Further validation and development of a comprehension intervention is needed to fully examine the influence of comprehension on PTSD symptom severity.

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Appendix A

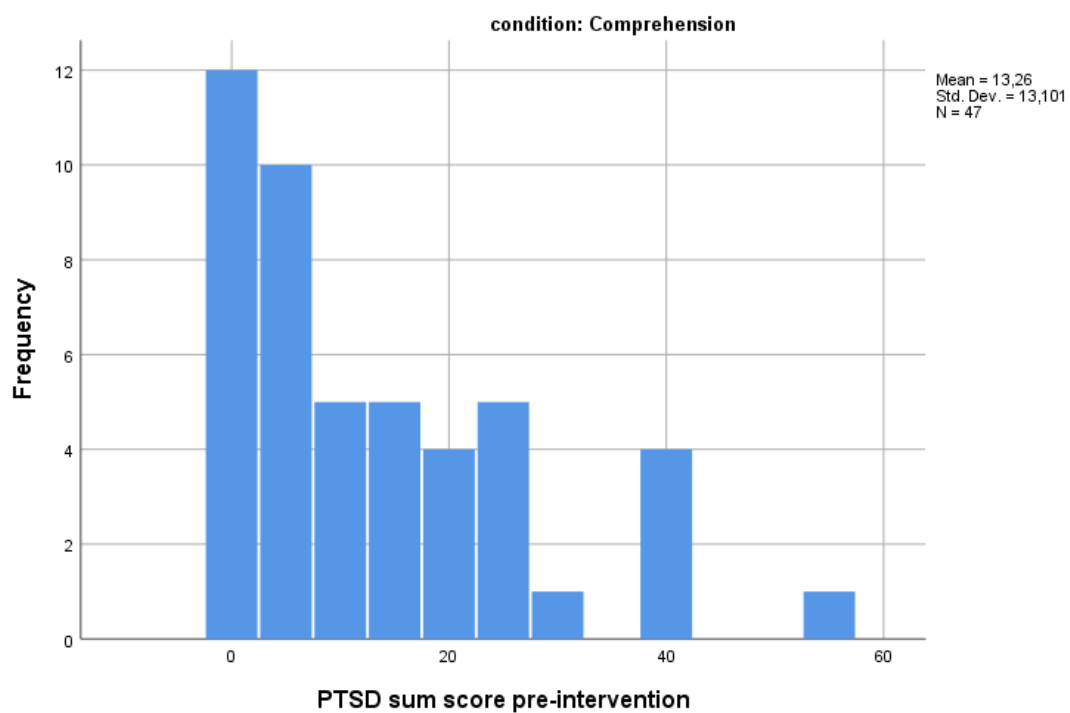
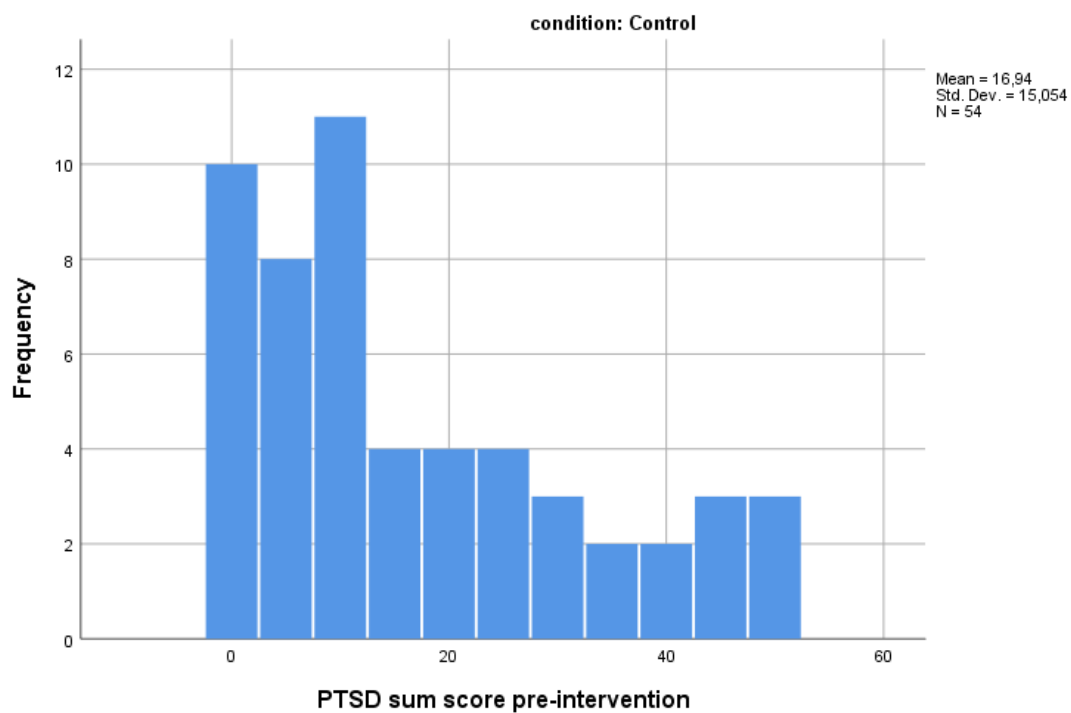
Intervention Used in the Current Study

The participants were asked to think about the life they have lived and to write down their life story in three chapters. They were free to structure their story anyway they found suitable. They were given 10 to 15 minutes to write the three chapters, if necessary they could extend this time with three minutes. Participants were instructed to write down the names and main components of each chapter onto a piece of paper for them to review later. For the next exercise participants were instructed to write down at least four (and up to six) answers to the question “Who am I?”. Subsequently they were asked to think about how their life has made them the person they are today and to write down at least three (and up to five) connections between the life they have lived until now and the person they are today onto the piece of paper. The participants were asked to keep this piece of paper, to read through it again over the next week and to add a connection between who they are today and their life story every evening of the next week.

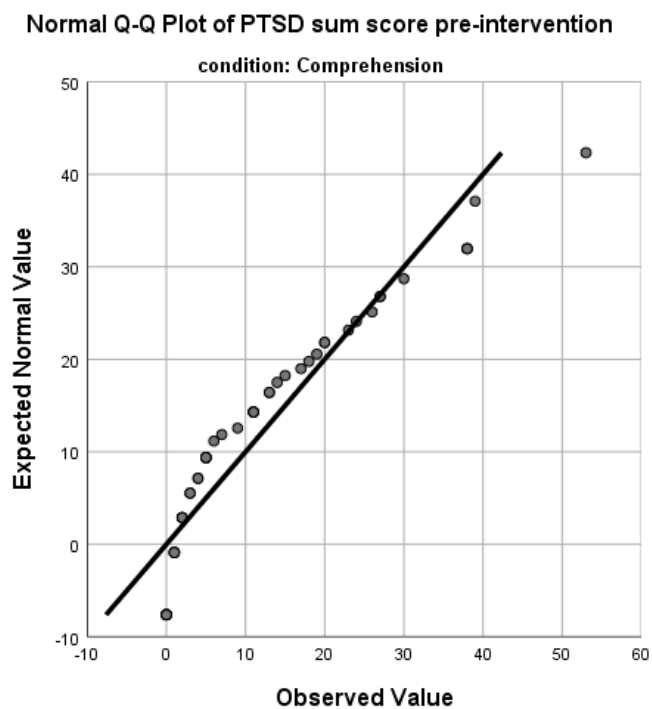
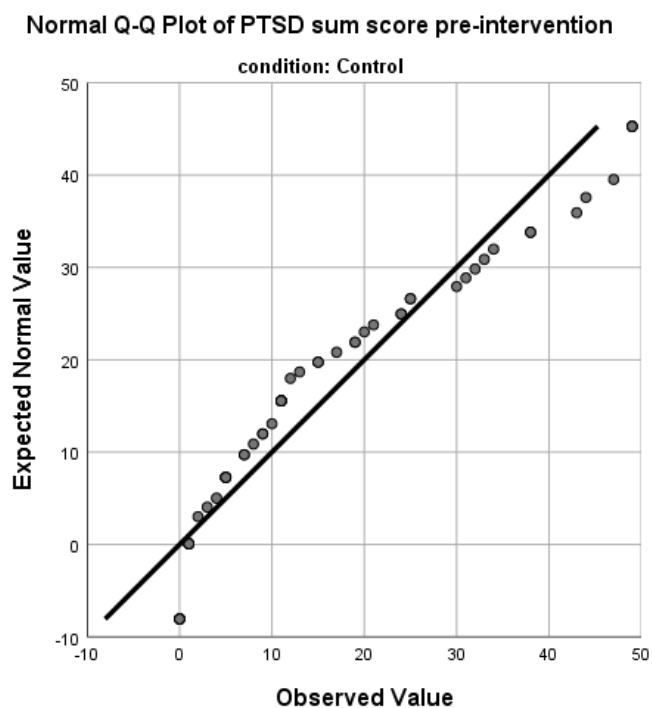
Appendix B

Histograms and QQ-plots of PTSD Sum Scores

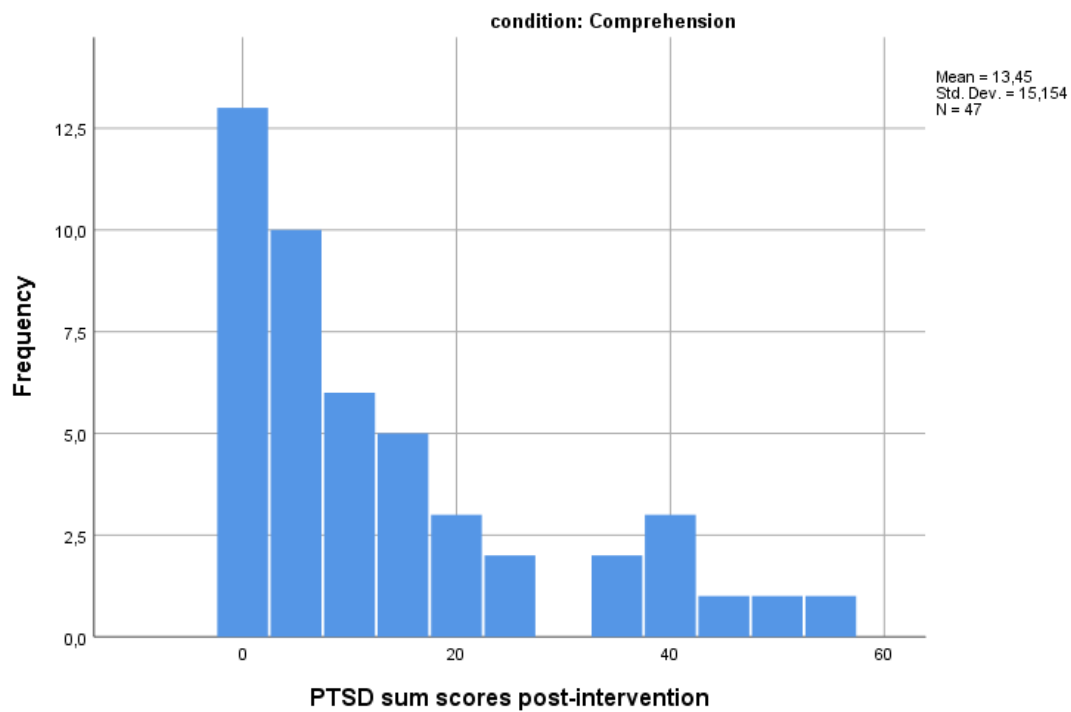
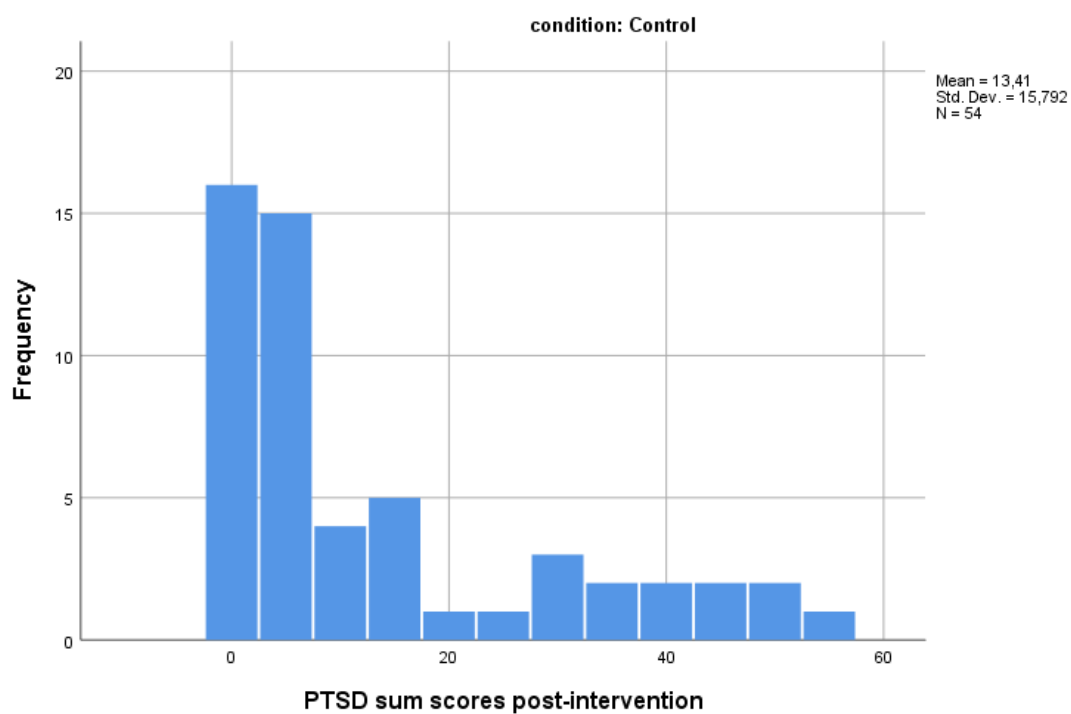
Histograms of pre-intervention scores of PTSD by control and comprehension groups.



QQ-plots of the residuals of the pre-intervention scores of PTSD by control and comprehension groups.

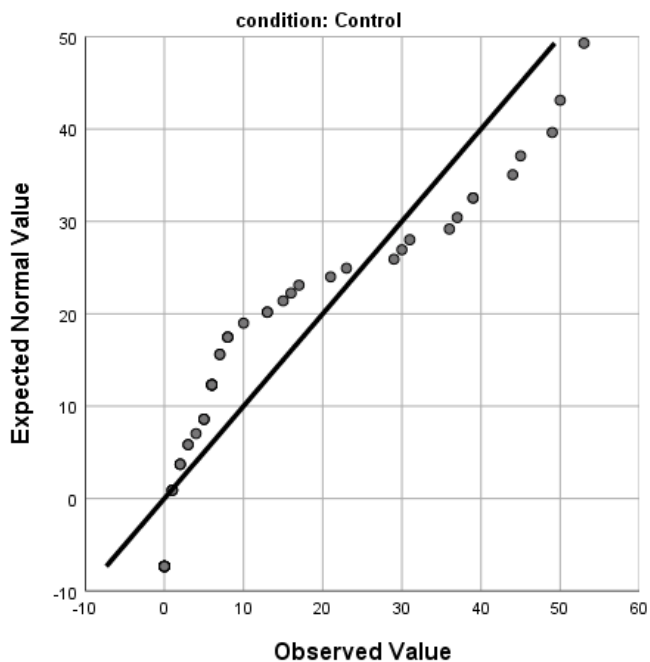


Histograms of post-intervention scores of PTSD by control and comprehension groups.

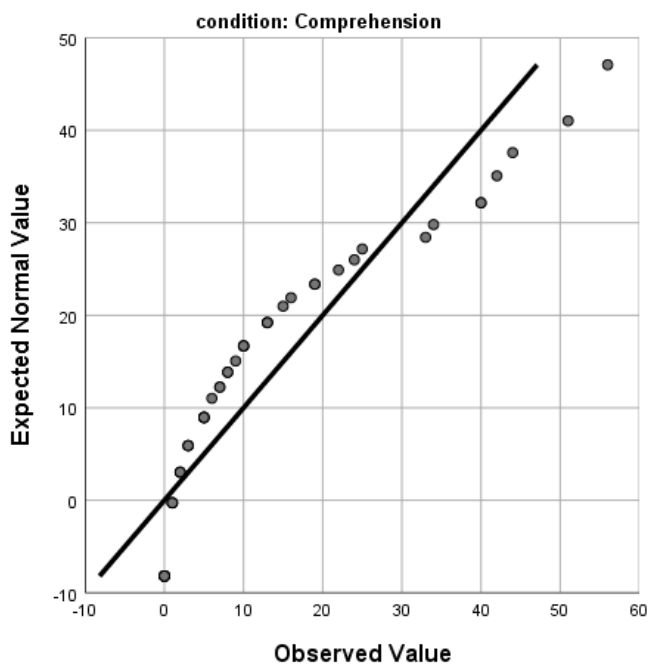


QQ-plots of the residuals of the post-intervention scores of PTSD by control and comprehension groups.

Normal Q-Q Plot of PTSD sum scores post-intervention



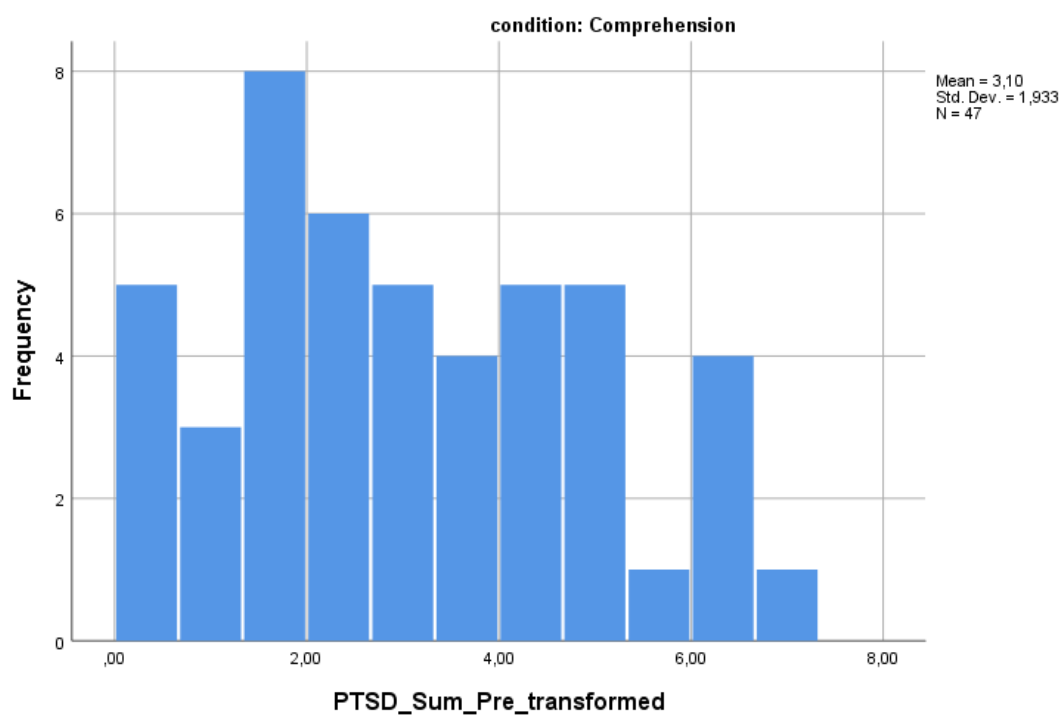
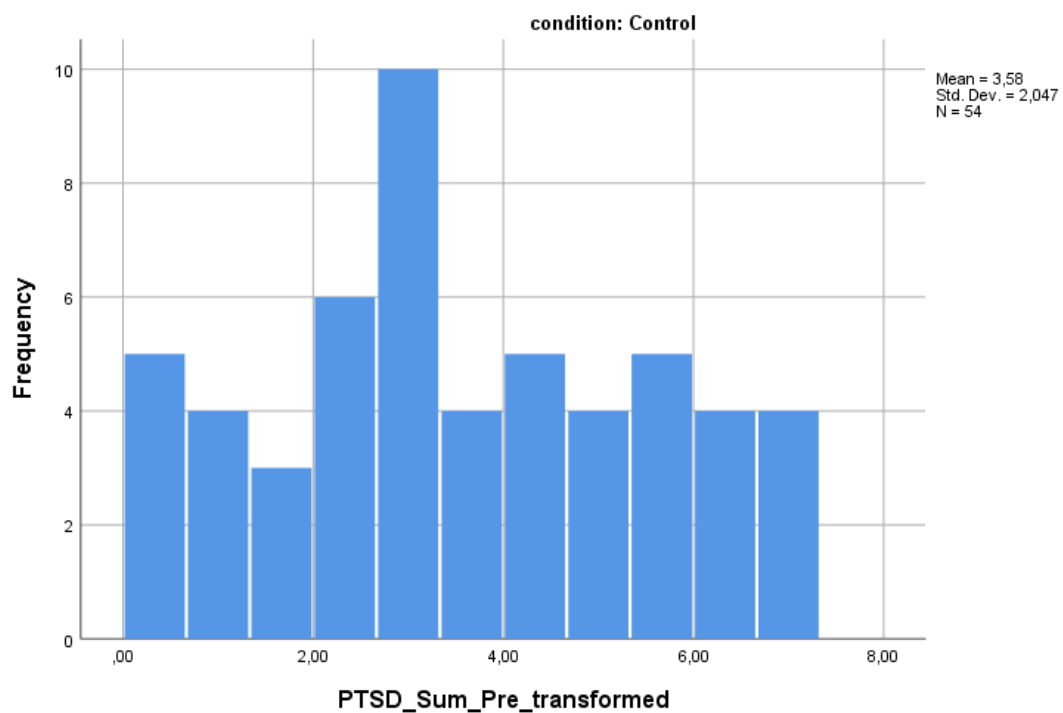
Normal Q-Q Plot of PTSD sum scores post-intervention



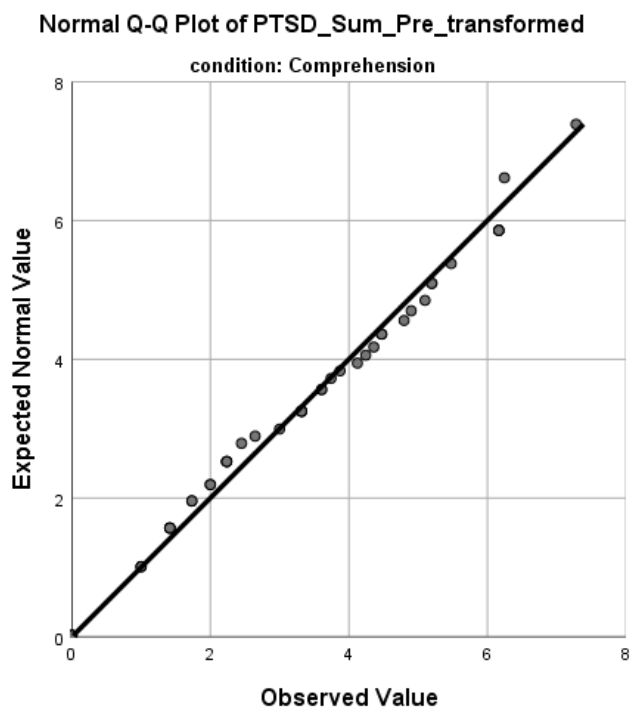
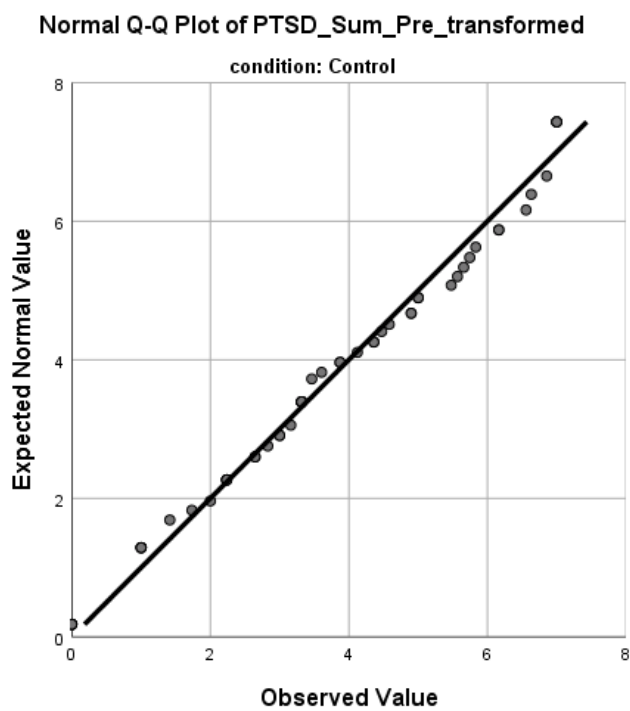
Appendix C

Histograms and QQ-plots of Transformed PTSD Sum Scores

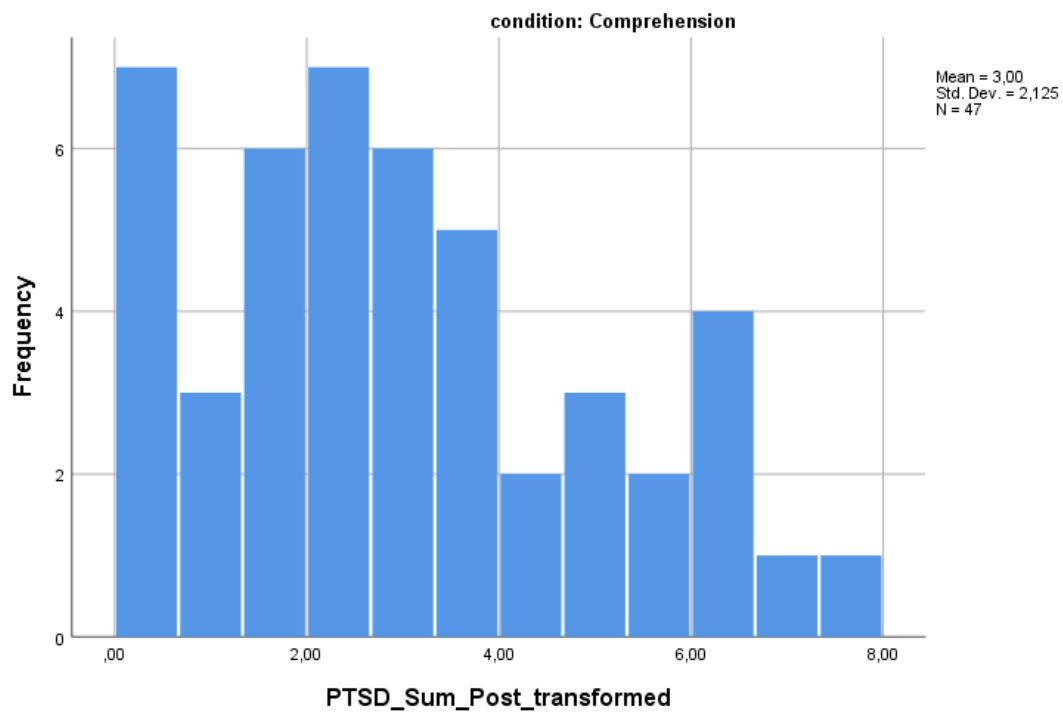
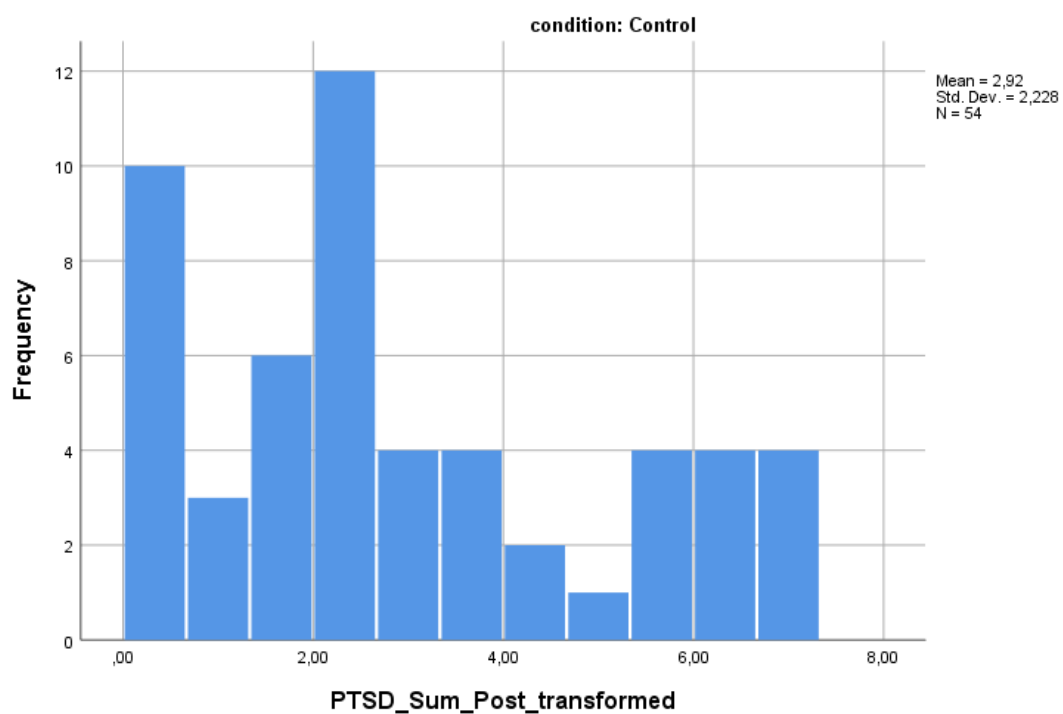
Histograms of transformed pre-intervention scores of PTSD by control and comprehension groups.



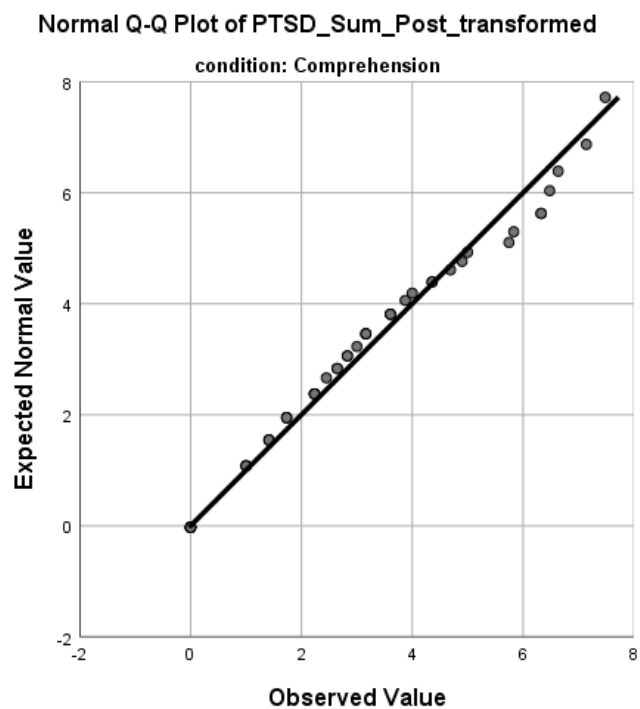
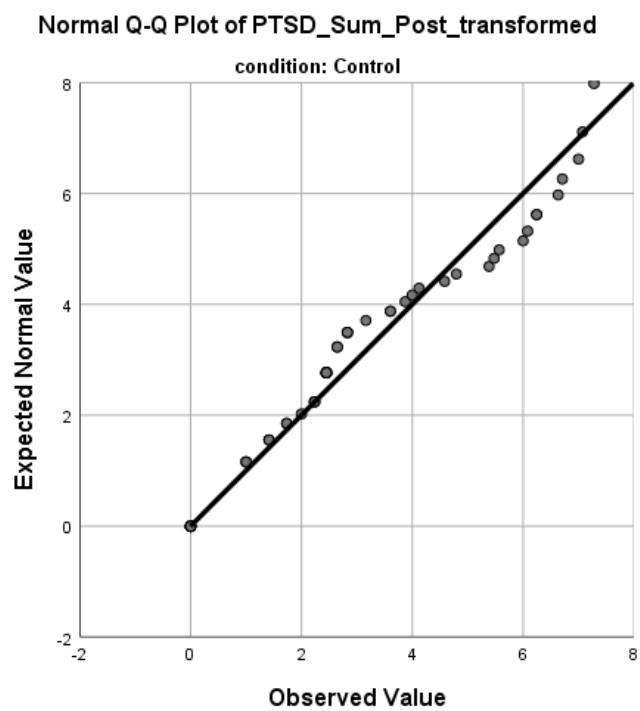
QQ-plots of the residuals of the transformed pre-intervention scores of PTSD by control and comprehension groups.



Histograms of transformed post-intervention scores of PTSD by control and comprehension groups.



QQ-plots of the residuals of the transformed post-intervention scores of PTSD by control and comprehension groups.



Appendix D

Descriptive Statistics of Transformed PTSD Sum Scores

Below are tables showing descriptive statistics of the transformed PTSD sum scores by the complete sample (table C1), by the subset of participants that showed an increase in comprehension at the second assessment (table C2) and by the subset of participants that had pre-intervention PTSD scores above 30 (table C3).

Table D1

Descriptive Statistics of Transformed PTSD Sum Scores of the Complete Sample

PTSD Scores	Condition				Marginal <i>M</i>
	Control (<i>n</i> = 54)		Comprehension (<i>n</i> = 47)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	3.58	2.05	3.10	1.93	3.34
Post-Intervention	2.92	2.23	3.00	2.12	2.96
Marginal	3.25		3.05		

Table D2

Descriptive Statistics of Transformed PTSD Sum Scores by Subset One

PTSD Scores	Condition				Marginal <i>M</i>
	Control (<i>n</i> = 20)		Comprehension (<i>n</i> = 21)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	4.01	1.91	2.94	1.88	3.46
Post-Intervention	2.90	2.34	2.92	1.62	2.91
Marginal	3.45		2.93		

Table D3

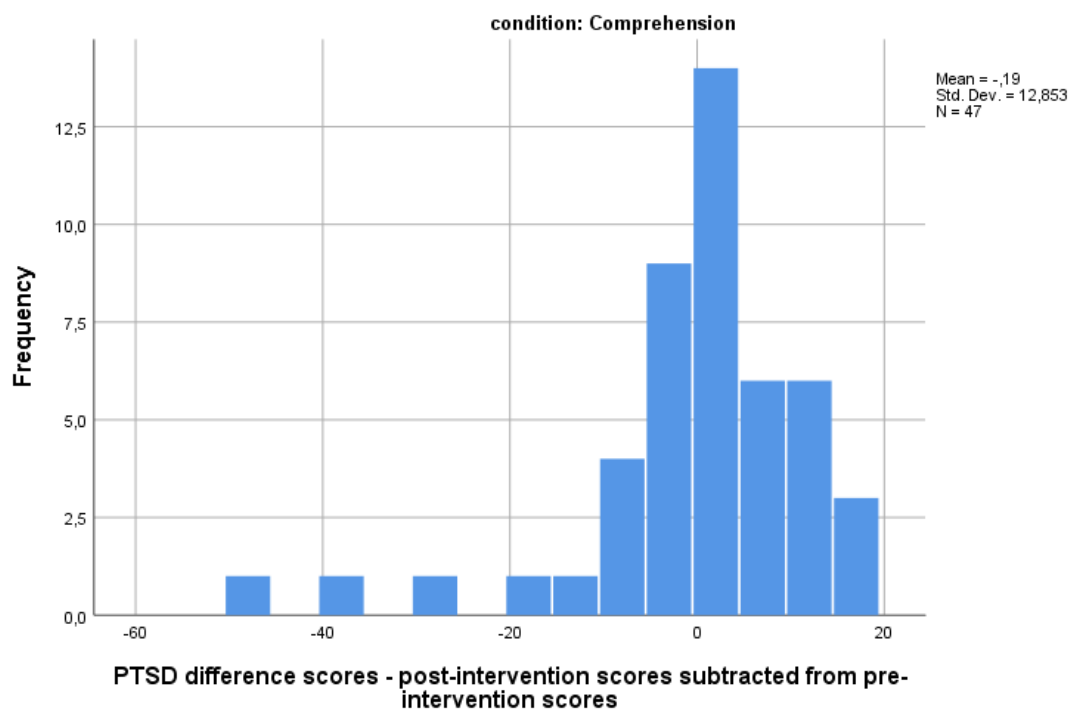
Descriptive Statistics of Transformed PTSD Sum Scores by Subset Two

PTSD Scores	Condition				Marginal <i>M</i>
	Control (<i>n</i> = 12)		Comprehension (<i>n</i> = 5)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Pre-Intervention	6.35	0.56	6.40	0.49	6.36
Post-Intervention	5.60	1.67	6.25	0.92	5.79
Marginal	5.97		6.33		

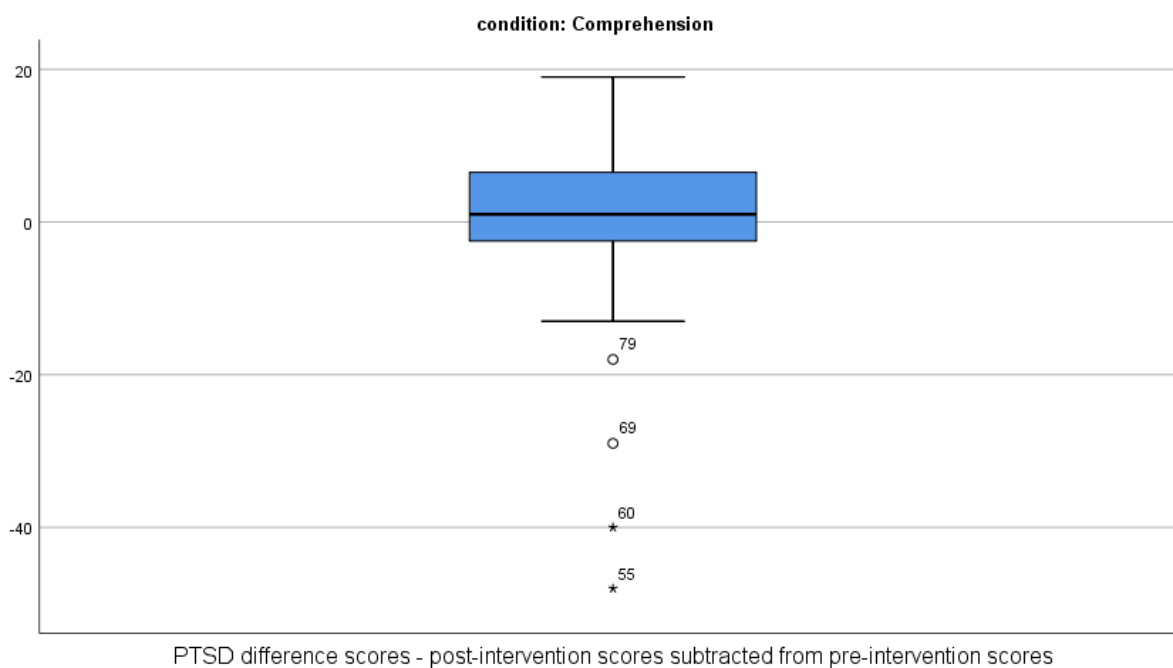
Appendix E

Graphs of PTSD Difference Scores by the Comprehension Group

Histogram of PTSD difference scores by the comprehension group.



Boxplot of PTSD difference scores by the comprehension group.



Scatterplot of PTSD difference scores and comprehension difference scores by the comprehension group.

