Expressive writing in school children: Effects on well-being and working memory

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Abstract: This study examines the benefits of an expressive writing intervention in 5th graders on well-being – anxiety and depression symptoms – and on working memory capacity. A classical paradigm of expressive writing was used in school children during their classroom time: half of the participants had to write about stressful and negative events of their own lives, whereas the other half had to write about a normal school day. Children were asked to write four times in two weeks, resulting in four days of writing. Each group completed questionnaires yielding measures of depression, anxiety, and working memory 3 times: before the intervention, just after the writing sessions and two months after following the intervention. The narratives were analyzed using Emotaix-Tropes software. The results revealed that all the children showed a decrease in depression and anxiety symptoms. By contrast, only children in the expressive writing group showed working memory improvement. The potential benefits of emotional disclosure in school children are discussed. While there are several possible explanations for these findings, the results of this study indicate, first, that expressive writing seems to be both feasible and potentially valuable for school children, and second, that some cognitive changes occur in terms of cognitive functioning.

Keywords: expressive writing, written emotional disclosure, children, working memory

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1. Introduction

The benefits, both psychological and physical, of emotional content writing have been widely studied through the paradigm of expressive writing in adults (Frattaroli, 2006; Pennebaker, 1997; Salesse, Saucier, & Mavrikakis, 2015; Smyth, 1998; Toepfer & Walker, 2009; Travagin, Margola, & Revenson, 2015). Classically, participants are invited to write about negative or stressful events or thoughts, describing as much as possible their deep emotions and their feelings related to these events (for example, mourning, a bad work experience, a breakup, or depressive disorders).

Although there are divergent results about the positive effects of this type of writing, most studies have shown a beneficial or even therapeutic effect of this paradigm. Indeed, in her meta-analysis that gathers the results of 146 studies, Frattaroli (2006) shows that the results of random effects analyses indicate that experimental disclosure is significant (*r*-effect size of .075), and has beneficial effects for participants in terms of psychological health (improvement in depressive symptoms, anxiety or post-traumatic stress) and physical health (decreased medical consultations, better functioning of the immune system and reduction of somatic disorders). Depending on the studies considered, these benefits were evaluated through various tests (General Health Questionnaire, Beck Depression Inventory, Beck Anxiety Inventory, Perceived Stress Scale, Stress-Related Growth Scale…) held before, just after and several months after the writing sessions.

There is considerable discussion about how writing might achieve such benefits in adults. Some explanations focus on the cognitive changes (e.g., decrease in intrusive thoughts, switching on new perspectives…) produced by expressive writing (EW; Pennebaker, 1997). These cognitive changes are regularly inferred from the analysis of the linguistic characteristics of writers' essays. It seems that across writing episodes, essays written by participants who experienced the greatest health and behavioral benefits contained more emotional (which express feelings, emotions, such as *sadness, sorrow*…) and insight words (which express a certain awareness, such as the verbs *to consider* or *to know*; Pennebaker & Francis, 1996; Pennebaker, Mayne, & Francis, 1997). Pennebaker et al. (1997; Pennebaker & Seagal, 1999) believe that these linguistic changes reflect the cognitive processes associated with encoding and storing features of the experience, resulting in a more organized, coherent, and simplified manner that could reduce the associated emotional arousal. In other words, EW may initiate cognitive processing in terms of searching for a coherent meaning for the traumatic or stressful event and allow reappraisal of the situation. Indeed, several studies have shown that written emotional disclosure elicits meaning-making processes such as searching for causal explanations and interpretation of the events (Boals, 2012; Klein & Boals, 2010; Pennebaker, Colder, & Sharp, 1990; Pennebaker & Seagal, 1999; Suedfeld & Pennebaker, 1997).

At the same time, authors have focused more precisely on the relationship between working memory (WM) capacity and EW in adults (Klein & Boals, 2001; Yogo & Fujihara, 2008). WM is described as a flexible system constrained by limited resources that can be allocated to either the storage or the processing of information. According to Baddeley (2000), WM consists of four main components: three slave systems (phonological loop, visuospatial sketchpad and episodic buffer) managed by a central executive. The latter forms the heart of the system, allowing for the coordination of different kinds of information, the inhibition of information that is irrelevant to the task, and the modification or adaptation of ongoing strategies, with the help of the three slave systems. In addition, it oversees, regulates and controls complex cognitive processes, such as writing processes (Hayes, 1996; 2012; Kellogg, Turner, Whiteford, & Mertens, 2016). Thus, in such a limited capacity system, irrelevant distractors compete with task-relevant demands for attentional resources. Inhibiting responses to off-task demands leaves fewer resources for the task at hand (Stoltzfus, Hasher, & Zacks, 1996).

According to Klein and Boals (2001), among the irrelevant demands that compete for resources are cognitions about ongoing stressful events, and thus, writing about these experiences reduces their draw on resources. Their results showed that participants who wrote about their deepest feelings and deepest thoughts benefited from an increase in their WM capacity (assessed by a test at three different times). Similar results were obtained by Yogo and Fujihara (2008), demonstrating that EW can improve WM capacities many weeks after writing. This type of writing would therefore provide benefits not only in terms of health (psychological and physiological) but also through the release of cognitive resources occupied by negative and intrusive thoughts (Frattaroli, 2006; Lepore, 1997). Because of expressive writing, better exploitation of working memory resources would be possible (Klein & Boals, 2001; Yogo & Fujihara, 2008).

The effect of expressive writing on working memory has never been explored in children. However, WM development in children has been extensively studied (for a review, see Hitch, 2006). According to Gathercole, Pickering, Ambridge, and Wearing (2004), WM capacity undergoes steady development between the ages of 4 and 15 years. The increase in performance is almost linear, and the WM components are in place by 6 years of age. The capacity of each component (phonological loop, visuospatial sketchpad and central executive) changes over time, and the relationship between them gradually strengthens. Thus, the similarity in WM structure between adults and children raises questions about the possible effects of expressive writing on WM capacity in children. To date, very few studies have investigated the possible gains and benefits that this paradigm could bring to children (for a review, see Travagin, Margola, & Revenson, 2015), and to our knowledge, no study has explored the field of expressive writing in relation to the WM capacity in school-age children. The rare studies conducted on the theme of EW with children reveal mixed results (Fivush, Marin, Crawford, Reynolds, & Brewin, 2007; Giannotta, Settanni, Kliewer, & Ciairano, 2009; Reynolds, Brewin & Saxton, 2000).

Reynolds et al. (2000) evaluated the effect of the paradigm of EW on one hundred ninety-two children (aged 9 to 13) attending two different types of schools (urban schools and suburban schools). Children in the EW group were given the task of keeping a diary in which they had to express their deepest thoughts and feelings about events in their lives that were very stressful, very sad, or emotionally disruptive to them for three consecutive days. Children in the control group had to keep a journal of their daily activities (how they spend their time) at school, at home or in other activities. Children in the non-writing control group had to talk about the types of things children find stressful. At the same time, questionnaires of depression, anxiety, somatization and feelings of difficulty were proposed to the children just before starting the three days of writing and two months after the end. Their texts were analyzed in terms of content. The results showed that the writing content of children in the EW group conformed to the instructions given (topics were about friendships, family, school, teachers, unfair situations, illness, exams, school work, or falling out with friends) and that children in this group used many more emotional terms in their writings. However, measurements collected two months after the intervention showed improved scores in all questionnaires for all participants (all groups improved over time in the symptom measures).

According to the authors, at least two explanations are possible. The simplest is that the improvement was due to a practice effect, with greater familiarity leading to a change in the pattern of questionnaire responses. The other explanation could be that the measures were detecting a genuine improvement in symptoms that came about because the children benefited from some general aspect of the study (recognition of sources of stress and feelings just through the use of the specific questionnaires). Thus, this research shows that simply participating in a study and answering questionnaires about "health" seem to be beneficial to children. Subsequently, Fivush et al. (2007) analyzed in Reynolds et al.'s (2000) study each text produced by children in the two writing groups. They examined the differences in how children narrate their life events and how these differences impact outcomes. Their results highlighted that children in the emotional writing group wrote more about negative evaluations, problems, emotions, explanations and coping than children in the non-emotional writing group. However, the children who wrote more about negative evaluations, problems and explanations subsequently showed higher levels of anxiety, depression and difficulties. They conclude that using EW with children could harm or even disrupt them due to their limited narrative and emotional regulation skills. In fact, according to the authors, the more the children revealed themselves in their writings and the more they talked about their personal problems, the less positive their answers to the different psychological health questionnaires. The authors note that for children of this age, more guided EW might help them create a more explanatory framework for understanding stressful events.

In a similar study, Soliday, Garofalo and Rogers (2004) asked one hundred and six teenagers (mean age of 13-years-old) to write twenty minutes a day for three days about

either "your very deepest thoughts and feelings about an extremely important emotional or stressful issue that has affected you and your life", or "their plans for the weekend" (Day 1), "the description of the school building" (Day 2), and "the description of a recent class project" (Day 3). The text contents were analyzed to determine the degree to which students wrote scripts with emotional content consistent with the instructions in each condition. In addition to the writing sessions, children had to answer questionnaires (somatic symptoms, depression and emotional state) four times: before the experiment (pretest questionnaire completion), just after the last writing session, two weeks after the last writing session, and six weeks after the last writing sessions. The results showed that after the intervention, scores on psychological distress decreased, and positive disposition scores increased for adolescents in the EW group compared to the scores of the adolescents writing about neutral topics. The text contents analyzed revealed first that written essays were in accordance with the instructions of the study (participants wrote about a wide range of emotional topics, including school-related problems, peer concerns, and family issues), and second, that the disclosure participants' use of positive-emotion words increased from the first to the third day of writing session compared to the neutral writing group. The authors noted a decrease in the depression score for students writing about emotional topics in the tests two and six weeks after the intervention. This is in contradiction with the results of Reynolds et al. (2000) but consistent with previous research conducted with adults (Frattaroli, 2006). The benefits of the EW paradigm on psychological health are efficient or not according to the experimental procedure (number of writing sessions, instructions, type of questionnaire…), regardless participant's age (Fivush et al., 2007; Reynolds et al., 2000; Soliday et al., 2004).

Recently, Travagin, Margola, and Revenson (2015) conducted a meta-analysis on the effects of EW on adolescent populations. They counted seven studies on this theme with children or adolescents aged 10 to 13. First, they examined whether EW had positive effects on well-being and physical health. Second, they investigated whether the beneficial effects of EW are stronger for particular subgroups of adolescents. Additionally, they paid attention to the gender because previous studies showed that EW may lead to different effects among girls and boys (Range & Jenkins, 2010; Smyth, 1998). Indeed, in general, adolescent boys are not really encouraged to express emotions such as sadness and anxiety, which may indicate dependency and weakness (Wong, Pituch, & Rochlen, 2006). As a result, boys might display more constrained emotional experience and expression (Twenge, 1999). Thus, Travagin et al. (2015) examined the variability in effect size across studies as a function of specific characteristics of the participants (age, gender, and risk status) and of the intervention (focus of the writing instructions and dosage of the writing task). They also investigated whether effect size was related to elements of the research design (type of control condition, timing of follow-up assessments, and attrition rates). At the end of their analysis, the authors conclude that the paradigm of EW has not yet been proven its efficiency with the child and adolescent population. The effect size was weak but

significant. The effects of the individual domains of problem behavior, internalizing problems, social adjustment, and school participation were also significant but small. Additionally, with regard to participant characteristics, gender did not moderate the effects of EW.

According to the authors, the effects of EW on the domains of school performance, somatic complaints, and medical visits were heterogeneous, probably influenced by other variables. They concluded that the overall effect and the effects for half of the outcome domains showed a significant benefit of EW, although the effect sizes were small. One of the reasons that could explain these results is that children were assigned to very brief writing interventions (less than fifteen minutes and/or fewer than three sessions), which would be unhelpful or even detrimental for them as they had no time to regulate their emotions. In addition, Travagin et al. (2015) proposed some research directions to enhance EW effects in children and adolescents, such as increasing the time interval between sessions, which would provide participants with more time to gain insight and reduce fatigue arising from the intensive emotional and cognitive energy spent in writing. Moreover, they specified that although some cognitive abilities (perspective taking, summarizing disparate information into coherent abstractions…) emerge in late childhood and adolescence, the ability to create a coherent text about personal events may appear earlier (Habermas & Bluck, 2000; McLean, Breen, & Fournier, 2010). However, the intensive self-immersion in the narrative of stressful memories during writing may interfere with an adaptive self-distancing mechanism (Kross, Duckworth, Ayduk, Tsukayama, & Mischel, 2011), resulting in a seeming detrimental effect of EW. Finally, in accordance with Fivush et al. (2007), Travagin et al. (2015) argued for a more focused writing assignment (instead of a general emotional disclosure task) and a greater dosage (in terms of number, length, and spacing of sessions), which could yield greater benefits by reducing cognitive burden and providing youth with sufficient time to elaborate their experiences and still achieve a psychological distance from them.

2. The present study

The present study examined whether writing about stressful and negative events vs. trivial topics should influence internalizing symptoms and/or WM capacity with the intention not only to explore EW's potential for improving cognitive functioning but also to explore the beneficial effects of EW on ten-years-old children. More precisely, to address issues raised in previous research and to add to the literature on the effects of emotional disclosure data with young populations, the value of a written emotional disclosure intervention for reducing depressive and anxiety symptoms and improving cognitive functioning (i.e., WM) in a sample of fifth-grade children was evaluated. Thus, we assessed the effect of writing on internalizing symptoms, namely, depression and anxiety, as they have been used in evaluations of EW trials (Frattaroli, 2006; Travagin et al., 2015). Based on previous research with adults and adolescents, we

expected that children assigned to the written emotional disclosure condition would report (1) reduced depressive and anxiety symptoms (Frattaroli, 2006; Pennebaker, 1997; Reynolds et al., 2000; Smyth, 1998) and (2) increased WM capacity (Klein & Boals, 2001; Lepore, 1997; Yogo & Fujihara, 2008) compared to children writing about neutral topics. In addition, we expected that the narrative texts of children in the emotional disclosure condition would contain more content related to emotions than those of the control group (Pennebaker & Francis, 1996; Pennebaker et al., 1997). Finally, as there is no clear evidence that gender should moderate the effect of the intervention (Frattaroli, 2006; Travagin et al., 2015), and as Frattaroli (2006), recommended it, it was hypothesized in an exploratory way that the gender factor (girls vs. boys) should have an effect on anxiety, depression and working memory measures.

3. Method

3.1 Participants

Thirty-five 5th graders from two classes (19 girls; mean age: 10; 9 years, range: 9; 3-11; 6 years) without any learning disabilities were recruited from a primary school in Southeast France and were randomly assigned to two writing groups within each class: An Emotional Writing Group (EWG; 9 girls and 8 boys, mean age: 10; 9 years, range: 9; 3-11; 3 years) and a Non-emotional Writing Group (NWG; 10 girls and 8 boys, mean age: 10; 10 years, range: 10; 4-11; 5 years). Parents gave their consent for their children to participate in the study. Youth also provided their consent to participate.

3.2 Material and measures

The French version of the *Multiscore Depression Inventory for Children* (MDI-C, Berndt & Kaiser, 1999) was used. The MDI-C is a self-report measure of depression and features related to depression, standardized for children (from 8 to 17 years). It consists of 79 items in the form of brief sentences with a true/false response format. The total score measures the general severity of depression. The maximum score possible is 79, and the higher the score is, the more severe the symptoms are.

The French version of the *Revised Children's Manifest Anxiety Scale* (R-CMAS, Reynolds & Richmond, 1999) was also used. The R-CMAS is a self-report inventory that measures the level and nature of anxiety in children and adolescents (from 6 to 19 years). The R-CMAS consists of 37 items in the form of brief sentences with a yes/no response format. A total anxiety score is computed based on 28 items. The remaining 9 items on the R-CMAS constitute the lie subscale (that is used to detect those who wish to hide the truth about their mental health). Scores are derived from affirmative responses, and a high score indicates a high level of anxiety or lie on that subscale (Reynolds & Richmond, 1999).

The Working Memory Index from the French version of the *Wechsler Intelligence Scale for Children* (WISC-IV; Wechsler, 2005) was used to assess WM capacity. It consists of two subtests, namely, digit span (forward and backward) and letter-number sequencing, which are summed and converted into a standard score to represent the Working Memory Index (WMI).

The digit span subtest comprises two sets (forward and backward) of 16 trials, each featuring numbers (2-8 items). For the digit span forward, at the end of each trial, participants have to recall the numbers in the same order as presented aloud by the experimenter. For the digit span backward, at the end of each trial, participants have to repeat numbers in the reverse order of that presented aloud by the examiner. The score is determined by the number of correctly recalled trials. To score one point, children had to recall (same order or reverse) all the dictated numbers in the trial without making any mistakes. The maximum possible score is 32 points. The letter-number sequencing subtest comprises 10 sets of 3 trials, each featuring letters and numbers (2-8 items). At the end of each trial, participants had to recall first the numbers (in ascending order), then the letters (in alphabetic order). The score is determined by the number of correctly recalled trials (i.e., all the numbers and letters recalled in the correct order). To score one point, children had to recall all the dictated numbers in ascending order, then all the dictated letters in alphabetic order, in the trial without making any mistakes. The maximum possible score was 30 points. The Working Memory Index is calculated by summing the two subtests scores and referring to a conversion table.

Finally, written essay content was analyzed to determine the degree to which children wrote scripts with emotional content consistent with the instructions in each condition. The Emotaix-Tropes software, a tool built by Piolat and Bannour (2009) for analyzing the French emotional and affective lexicon, was used. This software can also identify different grammatical categories that complement the emotional and affective lexicon, such as verbs and subjective adjectives. Outcome variables chosen for analyses corresponded to quantitative variable measures that were previously found to correspond to changes in physical and psychological well-being (Frattaroli, 2006; Pennebaker & King, 1999): Emotional lexicon (positive vs. negative), presence of two types of verbs – factive (which express actions, e.g., *to do*) and stative (which express states, e.g., *to be*) – and subjective adjectives, which are usually used to express feelings and sensations such as *happy, sad*, or *funny*. More precisely, we hypothesized that texts written in the EWG should contain more emotional lexicon, more stative verbs, and more subjective adjectives, whereas texts written in the NWG should contain less emotional lexicon, more factive verbs and fewer subjective adjectives. Indeed, as shown by Fartoukh, Chanquoy and Piolat (2012), writing about an emotional event should be more personal and more compelling. For all the types of words, the mean percentage of words falling within each category was calculated (it was calculated on the total number of words in the text).

3.3 Procedure

Children completed the two measures assessing anxiety and depression collectively (approximately 15 minutes) and the two subtests of the WMI (Wechsler, 2005) assessing their WM capacity individually (approximately 10 minutes). All the children completed the questionnaires at the beginning (one week before writing; pretest), one week after the fourth writing session (posttest), and finally two months after the fourth writing session (two months follow-up).

Based on suggestions by Fivush et al. (2007), four sessions of writing were used to provide the children with more time for disclosure. Children were randomly allocated to the two writing groups. The instructions about the topic (emotional vs. non-emotional) were written on the sheet of paper distributed to children. In both groups they were asked to write quietly for 20 minutes for four days (2 per week) in their own classroom. Children in the EWG were instructed to write about their "deepest thoughts and feelings concerning one or some negative and stressful events. The important thing is that you let go and get in contact with your deepest emotions and reflections. Write about this or these events, how you experienced it. Don't worry about grammar or spelling", whereas children in the NWG were instructed to write in details about how they spend "a typical school day, from when you got up, until you went to bed. The most important thing is to describe everything you did in as much detail as possible. Don't worry about grammar or spelling". For all children, each writing session was followed by a post-experiment procedure in which the experimenter proposed children to tell jokes.

4. Results

4.1 Thematic content of essays

A text scrutiny was conducted to verify the adherence of the essay contents to the instructions. All the texts were read by the experimenter and were classified according to their content. First, the analysis of each text revealed that participants from both groups respected the instructions and that the essay contents were in accordance with the writing groups. Secondly, the qualitative analysis showed that in the four writing sessions, children in the EWG wrote about their "deepest thoughts and feelings concerning one or some negative and stressful events" such as the death of a grandparent, the death of an animal, an injury (to oneself or a parent), a divorce, a big verbal fight or an aggressive act. Conversely, analyses of the control group essays showed that children wrote about a normal school day with many details, as requested.

4.2 Preliminary analyses

To determine whether between-group differences existed before the experiment, the effectiveness of randomization was assessed by examining mean differences between the control and intervention groups at pretest. Preliminary analysis of variance

(ANOVA) was conducted and showed that there was no difference between the EWG and the NWG in depression scores, $F(1, 33) = 0.11$, $MSE = 102.68$, $p = .74$, $d = 0.11$; anxiety scores, $F(1, 33) = 0.63$, $MSE = 132.96$, $p = .43$, $d = 0.27$; and WMI, $F(1, 33) = 2.07$, $MSE = 207.8$, $p = .16$, $d = 0.50$.

4.3 Effect of EW on depression and anxiety

To test the effect of the intervention on depression and anxiety levels, two 2 (Writing Condition) X 2 (Gender) X 3 (Time) ANOVAs with repeated measures on the last factor were performed on the standardized scores of depression and anxiety (see Table 1 for results).

Table 1. Mean scores (and standard deviations) on depression, anxiety and working memory index measures at pretest, posttest and 2 months follow-up

Measure and Group	Pretest	Posttest	2 months follow-up
Depression (MDI-C)			
EWG	47.53 (7.64)	47.41 (9.18)	44.06 (9.28)
NWG	46.38 (12.01)	47.11 (11.81)	45.02 (9.21)
Anxiety (R-CMAS)			
EWG	52.71 (12.31)	49.29 (12.91)	47.35 (11.01)
NWG	49.61 (10.74)	47.72 (11.26)	44.61 (9.60)
WM index			
EWG	93.06 (12.77)	102.64 (17.26)	108.47 (13.17)
NWG	98.77 (15.80)	103.22 (16.07)	100.50 (16.94)

Note. Expressive writing group (EWG), Non-emotional Writing Group (NWG), Working Memory (WM)

Concerning depression level, there was no effect of Writing Condition, $F(1, 31) = 0.01$, $MSE = 263.10$, $p = .94$, $d = 0.03$, and no effect of Gender, $F(1, 31) = 0.19$, $MSE = 263.10$, $p = .66$, $d = 0.15$. Conversely, there was a significant effect of Time, $F(2, 62) = 4.07$, $MSE = 24.40$, $p < .05$, $d = 0.70$. More precisely, planned comparisons revealed no change between pretest and posttest, $F(1, 31) = 0.01$, $MSE = 13.78$, $p = .96$, $d = 0.03$, but a significant decrease between posttest and two months follow-up, $F(1, 31) = 3.99$, $MSE = 29.19$, $p = .05$, $d = 0.69$. None of the interactions were significant.

Concerning anxiety level, there was no effect of Writing Condition, $F(1, 31) = 0.40$, $MSE = 317.20$, $p = .53$, $d = 0.22$, and no effect of Gender, $F(1, 31) = 0.68$, $MSE = 317.20$, $p = .42$, $d = 0.28$. There was a significant effect of Time, $F(2, 62) = 6.97$, $MSE = 35.20$, $p < .01$, $d = 0.92$. Planned comparisons revealed a significant difference between pretest and posttest, $F(1, 31) = 5.24$ $MSE = 24.11$, $p < .05$, $d = 0.79$, but no difference between posttest and two months follow-up, $F(1, 31) = 2.52$, $MSE = 47.07$, p

= .12, d = 0.55. None of the interactions were significant. In sum, depression and anxiety symptoms decreased for the all the participants after the intervention but not at the same time.

4.4 Effects of EW on WM capacity

To test the effect of the intervention on WM capacity, a 2 (Writing Condition) X 2 (Gender) X 3 (Time) ANOVA with repeated measures on the last factor was performed on the WMI scores (see Table 1).

There was no effect of Writing Condition, $F(1, 31) = 0.01$, $MSE = 604$, $p = .98$, $d = 0.03$, and no effect of Gender, $F(1, 31) = 1.19$, $MSE = 604$, $p = .30$, $d = 0.38$. Conversely, there was a significant effect of Time, $F(2, 62) = 10.13$, $MSE = 66$, $p < .001$, $d = 1.10$, which is specified by the significant interaction between Writing Condition and Time, $F(2, 62) = 7.09$, $MSE = 66$, $p < .01$, $d = 0.93$ (see Figure 1). The mean score of the EWG significantly increased from pretest to posttest, $F(1, 31) = 14.85$, $MSE = 54.22$, $p < .001$, $d = 1.34$; significantly increased from posttest to 2 months follow-up, $F(1, 31) = 4.03$, $MSE = 69.43$, $p = .05$, $d = 0.70$; and finally, the mean score significantly increased from pretest to 2 months follow-up, $F(1, 31) = 27.71$, $MSE = 73.43$, $p < .001$, $d = 1.83$. In contrast, the mean score of the NWG did not significantly differ from pretest to posttest, $F(1, 31) = 2.31$, $MSE = 54.22$, $p = .14$, $d = 0.53$; did not significantly vary from posttest to 2 months follow-up, $F(1, 31) = 1.02$,

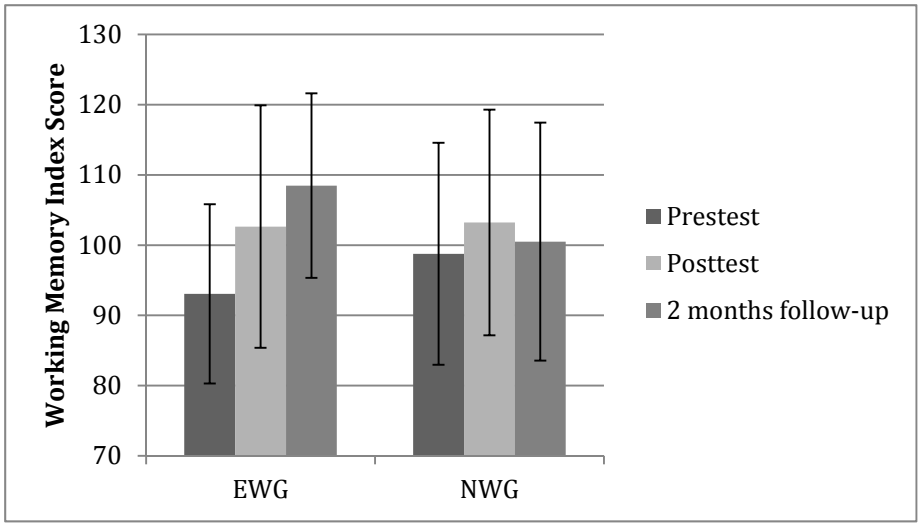

Figure 1. Mean WM Index scores (and standard deviations represented by error bars) as a function of Writing Condition and Time.

MSE = 69.43, $p = .31$, $d = 0.35$; and finally, did not significantly differ from pretest to 2 months follow-up, $F(1, 31) = 0.10$, *MSE* = 73.43, $p = .75$, $d = 0.11$. None of the other interactions were significant. Analyses were also carried out to test group differences for each moment. There was no significant difference between EWG and NWG at pretest, $F(1, 31) = 1.91$, *MSE* = 207.05, $p = .17$, $d = 0.48$, between EWG and NWG at posttest, $F(1, 31) = 0.01$, *MSE* = 285.28, $p = .89$, $d = 0.03$, and between EWG and NWG at 2 months follow-up, $F(1, 31) = 2.18$, *MSE* = 242.81, $p = .14$, $d = 0.51$.

4.5 Analysis of essay content

Several analyses were conducted to examine the essay content using the Emotaix-Tropes software (Piolat & Bannour, 2009). First, the analysis concerned the mean number of words. Second, the evolution of the use of emotional words (positive *vs*. negative) and other words categories related to consciousness, self-implication and emotional states, such as types of verbs (factive *vs*. stative) and subjective adjectives, was examined.

To test the effect of the intervention on the written outcomes (see Table 2), a 2 (Writing Condition) X 2 (Gender) X 4 (Writing session) ANOVA with repeated measures on the last factor was performed on the different linguistic characteristics mentioned above. For the mean number of words, there was no effect of Writing Condition, $F(1, 31) = 2.58$, *MSE* = 6714, $p = .12$, $d = 0.56$, and no effect of Gender, $F(1, 31) = 0.01$, *MSE* = 6714, $p = .98$, $d = 0.03$. Conversely, there was a significant effect of Writing session, $F(3, 93) = 26.68$, *MSE* = 942, $p < .001$, $d = 1.80$. The mean number of words decreased with successive writing sessions. Only the interaction between Writing Condition and Gender was significant, $F(1, 31) = 5.73$, *MSE* = 6714, $p < .05$, $d = 0.83$. More precisely, the mean number of words in the girls' texts was significantly lower in the EWG compared to that in the NWG, $F(1, 31) = 8.20$, *MSE* = 6714, $p < .01$, $d = 0.99$, whereas there was no such significant difference for boys, $F(1, 31) = 0.20$, *MSE* = 6714, $p = .66$, $d = 0.15$. For the positive emotional words, there was neither a significant effect nor a significant interaction. There were very few positive emotional words in all the essays (see Table 2). Conversely, for the negative emotional words, there was a significant effect of Writing Condition, $F(1, 31) = 108.13$, *MSE* = 12.99, $p < .001$, $d = 3.62$. Children in the EWG used more negative emotional words than those in the NWG. There was no effect of Gender, $F(1, 31) = 3.71$, *MSE* = 12.99, $p = .06$, $d = 0.67$. There was a significant effect of Writing Session, $F(3, 93) = 3.99$, *MSE* = 2.55, $p < .05$, $d = 0.69$, which is specified by the interaction between Writing Condition and Writing Session, $F(3, 93) = 4.97$, *MSE* = 2.55, $p < .01$, $d = 0.77$. Indeed, while for the NWG, the use of negative emotional words did not change across the sessions, for the EWG, negative emotional words use increased from writing session 1 to writing session 2, $F(1, 31) = 35.72$, *MSE* = 1,44, $p < .001$, $d = 2.08$, and remained constant from writing session 2 to writing session 3, $F(1, 31) = 0.09$, *MSE* = 2,72, $p = .76$, $d = 0.10$,

and from writing session 3 to writing session 4, $F(1, 31) = 0.18$, $MSE = 2{,}23$, $p = .67$, $d = 0.15$. No other interaction was significant.

Table 2. Mean ratings of essay characteristics and mean number and percentage of words in each linguistic category by writing session

		Writing sessions			
	Writing condition	Essay 1	Essay 2	Essay 3	Essay 4
Mean number of words	EWG	157.18 (28.47)	108.64 (48.62)	93.29 (43.10)	91.17 (17.65)
	NWG	168.66 (54.34)	138.11 (52.54)	129.27 (50.58)	114.39 (51.94)
Emotional words					
Positive emotion (%)	EWG	0.81 (1.04)	1.16 (1.04)	0.33 (0.49)	0.79 (0.97)
	NWG	0.77 (0.76)	0.80 (0.64)	0.78 (0.98)	0.99 (1.44)
Negative emotion (%)	EWG	4.78 (1.93)	7.23 (2.88)	7.14 (4.66)	6.90 (3.78)
	NWG	0.16 (0.31)	0.01 (0.01)	0.06 (0.19)	0.05 (0.25)
Verbs					
Stative (%)	EWG	9.15 (3.52)	11.30 (6.52)	9.51 (9.13)	9.95 (6.09)
	NWG	0.32 (1.40)	0 (0)	0.49 (2.10)	0 (0)
Factive (%)	EWG	1.25 (3.54)	3.29 (4.94)	3.39 (5.71)	2.82 (5.32)
	NWG	13.94 (3.12)	15.60 (3.54)	15.29 (3.89)	16.52 (3.98)
Subjective adjectives(%)	EWG	1.90 (1.67)	2.49 (2.42)	2.49 (3.99)	2.26 (3.34)
	NWG	0.11 0.49)	0 (0)	0.19 (0.81)	0 (0)

Concerning the stative verbs, as predicted, there was a significant effect of the Writing Condition, $F(1, 31) = 73.68$, $MSE = 45.57$, $p < .001$, $d = 2.99$. Stative verbs were mainly used by children in the EWG. There was no effect of Gender, $F(1, 31) = 3.04$, $MSE = 43.57$, $p = .09$, $d = 0.60$, or Writing Session, $F(3, 93) = 0.36$, $MSE = 12.51$, $p = .77$, $d = 0.20$. Only the interaction between Writing Condition and Gender was significant, $F(1,$

31) = 4.66, *MSE* = 45.57, $p < .05$, $d = 0.75$. More precisely, in the EWG, girls used more stative verbs than boys, $F(1, 31) = 7.43$, *MSE* = 43,57, $p < .05$, $d = 0.95$, whereas there was no difference between girls and boys in the NWG, $F(1, 31) = 0.09$, *MSE* = 43,57, $p = .77$, $d = 0.10$. Factive verbs showed the opposite pattern, with a significant effect of the Writing Condition, $F(1, 31) = 119.95$, *MSE* = 44.81, $p < .001$, $d = 3.81$, in which factive verbs were mainly used by the children in the NWG. There was no effect of Gender, $F(1, 31) = 0.01$, *MSE* = 44.81, $p = .94$, $d = 0.03$, but there was an effect of the Writing session, $F(3, 93) = 4.13$, *MSE* = 8.58, $p < .01$, $d = 0.70$. The use of factive verbs increased from session 1 to session 2, $F(1, 31) = 9.55$, *MSE* = 7.07, $p < .01$, $d = 1.07$, but remained stable from session 2 to session 4. No other interaction was significant.

Finally, for subjective adjectives, there was only a significant effect of the Writing Condition, $F(1, 31) = 24.77$, *MSE* = 6.59, $p < .001$, $d = 1.73$. Children in the EWG used more subjective adjectives than children in the NWG.

5. Discussion

This study assessed the relations between children's narratives about stressful and negative events in their everyday lives and their anxiety, depression and WM capacity measures. Accordingly, the effectiveness of an EW intervention in decreasing the depressive and anxiety symptoms and improving the cognitive functioning (WM) in a sample of French fifth graders was tested.

The first hypothesis, based on previous research with adults and adolescents (Frattaroli, 2006; Pennebaker, 1997; Reynolds et al., 2000; Smyth, 1998), expected that children assigned to the EWG would report reduced depressive and anxiety symptoms compared to NWG. In this study, the intervention (e.g., the written emotional disclosure) had no effect on symptoms of anxiety and depression. The results obtained on these symptoms showed no specific decrease through the EW intervention. This is consistent with previous research carried out with young adolescents (Reynolds et al., 2000; Solyday et al., 2004; Travagin et al., 2015). However, also consistent with Reynolds and colleagues' (2000) results, there was an overall reduction in symptom levels across the entire sample. The symptoms reported were reduced for all the groups just after the writing sessions for anxiety and two months after for depression. There are several possible explanations for this result. First, it is possible that decreasing in anxiety and depression measures was due to a practice effect (i.e., test and retest using the same tool), with greater familiarity with the measures leading to a change in the pattern of responses. This phenomenon has long been well known (Spence, 1998; Windle, 1954) and could be responsible for the change in scores (decrease) over time. Another explanation could be that the measures revealed a real improvement in the symptoms that came about because the children were questioned many times about their feelings. An awareness about these problematics could have taken place (Reynolds et al., 2000). The tests used in this study (MDI-C and R-CMAS) could also be questioned, as they

may have been too long or not discriminating enough for a non-clinical sample. There are many shorter questionnaires, and their use could be a solution for distinguishing a practical effect or a real effect of the paradigm. Also, there could be a problem of sample size, which affects the significance level. Insufficient sample sizes can hide small intervention effects (Giannotta et al., 2009). Indeed, according to Frattaroli (2006), in the case of EW intervention, the average effect sizes for depression and anxiety are quite small. More participants may be needed in this study to detect such small effects. Nevertheless, there was a general reduction in symptom measures, indicating that all the children benefited from their involvement in the study. Finally, these results are in the same line that previous findings. According to Travagin et al. (2015), the paradigm of EW has not yet proven its efficiency with child and adolescent population. Thus, EW may not be as effective in children as in adults to decrease anxiety and depression symptoms.

The second hypothesis predicted an improvement in children's WM capacity in the EWG, as already shown in adults (Klein & Boals, 2001; Lepore, 1997; Yogo & Fujihara, 2008). The results supported this hypothesis, as children in the EWG showed an improvement in WM capacity just after the writing sessions and another improvement two months later. In other words, children who wrote about their deepest thoughts and feelings about negative and stressful events exhibited WM improvements compared with children in the control group who wrote about a normal school day. It is possible to conclude that writing a narrative text about a stressful and negative experience could free WM resources. Unfortunately, for the moment, it is not possible to explain the reason for this effect. Indeed, usually, the most important reason proposed is that the WM improvements enjoyed by expressive writers may be mediated by a decline in intrusive thoughts and avoidant thinking about negative stressful experiences. According to Klein and Boals (2001), participants who reported lower levels of unwanted cognitions (intrusive thoughts) had higher final WM scores and showed the greatest improvement in WM scores. However, in this study, it was not possible to use a questionnaire about intrusive thoughts because, to our knowledge, there was no such questionnaire adapted to French pupils. Consequently, our findings demonstrate that EW can improve WM capacity after the writing sessions and that writing about trivial topics had no effect. These results are consistent with Klein and Boals's (2001) and Yogo and Fujihara's (2008) findings and extend them to a sample of French-speaking children. It is also important to note that the issue about the effect persistence and its impact on academic performance was not addressed here. This should be explored in further research by conducting a longitudinal study during which precise measures of school achievement would be provided.

In parallel, the analysis of the texts written by the children clearly showed that they wrote about stressful and negative aspects of their lives. The Emotaix-Tropes software (Piolat & Bannour, 2009) data confirmed the hypothesis. There were highly significant differences between the EWG and the NWG groups in their use of emotional words, stative and factive verbs, and subjective adjectives. More precisely, children in the

EWG used more negative emotional words, more stative verbs and more subjective adjectives throughout the sessions than did children in the NWG. Consistent with previous research (Frattaroli, 2006; Travagin et al., 2015), this analysis showed that the intervention achieved the desired effect of facilitating children's focus on emotional vs. neutral topics. However, these results did not reveal what exactly occurs in the EWG because the differences were the same in all writing sessions. Indeed, previous research has showed that writing essays containing increases in words reflecting insight (Pennebaker & Francis, 1996; Pennebaker et al., 1997) and positive-emotion words (Soliday, et al., 2004) led to the greatest health and behavioral benefits. The same pattern was found in the case of improvement in WM capacity in adults. This lack of increase in such words could explain the absence of significant results in terms of well-being improvement but not the WM results. Thus, the reason why WM capacity increased remains difficult to explain and needs more investigation. For instance, the use of questionnaire about intrusive thoughts should be useful to verify if a decrease in the amount of these thoughts could explain the increase in WM capacity. Furthermore, to explain the lack of effect on well-being, it could be argued that the mean number of words in the scripts was low and that the average word count was between 100-150 words each day. It was previously shown (Reynolds et al., 2000) that this written exercise could not elicit enough detailed processing to result in the change in meaning that is believed to underlie the positive health changes in adults. In this study, this may have been because of writing development. More specifically, since children are still learning how to write and their writing processes are not enough stabilized or mature (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994), their writing skills do not allow them to perform parallel cognitive processing and to on-line modify their thoughts while they are writing (e.g., Galbraith, 2009). As children are not able, because their writing processes are yet not automatized, to disengage themselves from the act of writing, the well-being processes cannot be involved. Finally, concerning the exploratory hypothesis about gender, there was a trend in the data suggesting no evidence of a gender effect on well-being or WM capacity release. Only a few differences appear in the content of the written texts; for example, girls wrote fewer words in the EWG than in the NWG, and girls used more stative verbs than boys in the EWG, but these differences are marginal.

Although there are several explanations for our findings, they indicate that it is both feasible and potentially valuable to give children opportunities to engage in writing about sources of stress and their reactions to them. Because this study appears to be the first in French school children, a replication will be necessary. This study strongly suggests that primary school children were receptive to the EW paradigm. No problem was observed in any of the sessions. Despite some limitations, the results of this study reveal a promising avenue of research for emotional disclosure as a tool for improving well-being or WM among school children. Indeed, it must be noted that the school, parents and children willingly participated in the study and that the children voluntarily participated in all the sessions. Further research is needed to test this paradigm with

nonclinical and clinical populations of children (e.g., children with learning disabilities, ADHD, or generalized anxiety disorder) to know how effective this intervention could be with different children in terms of well-being and WM capacity. Determining how and why EW does and does not work for children of different ages will help researchers create more developmentally appropriate EW interventions and, from a practical point of view, help psychologists design new tools for enhancing well-being.

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