ROCZNIKI PSYCHOLOGICZNE / ANNALS OF PSYCHOLOGY
2015, XVIII, 4, 567-578

ALEKSANDRA JASIELSKA
LECH KACZMAREK
ALEKSANDRA BROŃSKA
MARIA DOMINIAK
KAROLINA NIEMIER
DARIA PATALAS
ANDRZEJ SOKOŁOWSKI
MARTYNA TOMCZAK
Adam Mickiewicz University
Institute of Psychology in Poznań

THE RELATIONSHIP BETWEEN WORKING MEMORY AND EMOTION REGULATION STRATEGIES

The article focuses on the results of a study on the relationship between working memory and emotion regulation. The relationship between working memory and emotion regulation is expected to manifest itself especially in situations of applying emotion regulation strategies that engage cognitive resources, such as cognitive reappraisal and positive reappraisal. We assumed that, compared to participants low in working memory capacity, participants high in working memory capacity would report using the above strategies more frequently. In our study (N = 65), the participants completed two questionnaires: the Emotion Regulation Questionnaire and the Cognitive Emotion Regulation Questionnaire, as well as a well-validated measure of working memory capacity known as the Operation Span Task. Our hypotheses were confirmed. The results were interpreted in relation to such constructs as temporal organization of emotion regulation strategies, affective flexibility, or forms of reappraisal.

Keywords: working memory, emotion regulation strategies, cognitive reappraisal, positive reappraisal.

Corresponding address: ALEKSANDRA JASIELSKA – Institute of Psychology, Adam Mickiewicz University in Poznań, ul. Szamarzewskiego 89, 60-568 Poznań; e-mail: aleksandra.jasielska@amu.edu.pl

The study is part of the research project “Emotion Regulation and Working Memory,” financed by the program for the financial support of young researchers and doctoral students at the Institute of Psychology, Adam Mickiewicz University.

INTRODUCTION

Working memory (WM) is a processual psychological construct responsible for storing and processing information. In WM models, the active aspect of information processing has been emphasized. It has also been assumed that, apart from information storage, the main function of WM is actively manipulating data through monitoring and integrating. Baddeley (1999) listed the following WM functions: focusing on the source of information, blocking secondary information, accessing and manipulating information from the long-term memory, planning, applying a reaction strategy together with switching between the strategies available. On the other hand, Miyake and colleagues (2000) distinguished the following functions: monitoring accessible information, integrating it into WM, inhibiting the reactions that impose themselves, and switching between tasks and current operations.

To sum up, the functions of WM consist in the dynamic control and regulation of information processing as well as temporary information storage during the performance of complex cognitive tasks. The data processed and stored can have a visual, auditory, or emotional form. Since WM is able to receive information from various sensory channels and sustain it for the time necessary for the processing of data in a particular subsystem, WM is also responsible for current processing and for the supervision of other mental operations. Another task that WM needs to perform is preventing routine behaviors, which lead to errors. If errors occur while processing data, WM executes corrective processes. Thanks to cooperation with the long-term memory, WM is capable of acquiring data necessary for current processing. Information is temporarily stored in order to be utilized in complex cognitive processes such as inference, understanding, or learning (Ericsson & Delaney, 1999). Coordinating the course of separate operations, WM integrates them (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000), which enables performing two different tasks simultaneously.

WM is also responsible for processing emotional data. Scientists are highly interested in the possible consequences of the influence that emotions have on WM functioning (Brzezicka-Rotkiewicz & Sędek, 2005; Piotrowski & Wierzchoń, 2009; Unsworth, Heitzand, & Engle, 2006).

Using emotions as a source of information involves mainly processes such as decision making and social cognition. The analysis of emotional information can have an impact on the processing of cognitive data – for example, drawing attention to an emotional stimulus and decreasing the level of cognitive task performance (Kesinger & Corkin, 2003). The existence of a two-way relationship between WM and emotion regulation (ER) is currently stressed in research. On the one hand, WM influences the experience of emotion and the choice of ER strategy as well as the course and efficiency of ER. On the other hand, ER modifies the functioning of memory. For instance, positive mood can disturb the processes of planning, refreshing, and switching between tasks (Philips, Bull, Adams, & Fraser, 2002), whereas negative mood disturbs performing tasks that involve WM and selective attention (Cheng, Holyoak, Nisbett, & Oliver 1986). Additionally, the type of emotional stimulus influences attentional processes – negative information has a tendency to draw attention faster and more easily (Williams, Mathews, & MacLeod, 1996). It has also been proven that WM training on affective material significantly affects the level of ER and increases the level of control over affective information. Interestingly, smaller active interference effect in the Stroop task was observed in those people who had undergone training (Schweizer, Hampshire, & Dalgleish, 2011). In another study, it was noted that people high in WM capacity inhibited emotional expression significantly better for both negative and positive emotions; however, WM had no influence on the general level of emotions experienced (Schmeichel, Volokhov, & Demaree, 2008). Moreover, people high in WM capacity using cognitive reappraisal as an ER strategy (which consists in changing the emotional meaning of an emotion-eliciting situation) experience less negative emotions in comparison to people low in WM capacity using the same ER strategy. Applying cognitive reappraisal, people not only experience less negative emotions but also cope better with inhibiting the expression of those emotions (Schmeichel et al., 2008).

Schmeichel and colleagues (2008) concluded that WM participates in volitional ER. The authors suggest that the better WM functions (in terms of storage and processing), the more effective ER is likely to be. This refers to both positive and negative emotions. It was shown that the more efficient WM was, the easier it became to suppress emotional expression (only when participants were instructed to suppress it). This does not necessarily mean that people with better WM express emotions less in general, but that they are able to do it more effectively under situational pressure. Similar results were obtained when analyzing the cognitive reappraisal strategy.

Questions and hypotheses

Having analyzed the literature and research results, we posed the following question: Is there any relationship between WM and ER strategies? It was hypothesized that the relationship between WM capacity and ER strategies should manifest itself especially in situations of using ER strategies that engage cognitive resources. According to Gross (1998), one of such strategies is cognitive reappraisal. Another ER strategy mentioned in the literature, namely positive reappraisal involved in regulating emotions during difficult situations, can be considered a strategy similar to cognitive reappraisal (Granefski, Kraaij, & Spinhoven, 2002). Therefore, it was expected that people higher in WM capacity would report applying cognitively active ER strategies more often. That would mean a relationship between the scales measuring Reappraisal and Positive Reappraisal and the results of the task that measures the functioning of WM.

METHOD

Materials

We used the following research instruments in the study:

(1) Emotion Regulation Questionnaire (ERQ; Gross & John, 2003; Polish adaptation by Kobylińska, 2015; Śmieja, Morozowicz, & Kobylińska, 2011; cf. Szczygieł, 2014). The instrument consists of 10 items that measure Suppression (4 items) and Reappraisal (6 items). Participants respond to items on a 7-point scale with responses ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The individual's score is the sum of scores for each scale. An example item is: "When I want to feel more positive emotions (such as joy or amusement), I change what I'm thinking about."

(2) Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaji, & Spinhoven, 2002; Polish adaptation by Marszał-Wiśniewska & Fajkowska, 2010). The questionnaire was designed to identify the cognitive ER strategies one can apply when experiencing negative or traumatic life events. The CERQ is a 36-item instrument consisting of the following nine conceptually distinct subscales: Self-blame, Other-blame, Rumination, Catastrophizing, Putting into Perspective, Positive Refocusing, Positive Reappraisal, Acceptance, and Refocus on Planning. Cognitive emotion regulation strategies are measured on a 5-point scale ranging from 1 (*almost never*) to 5 (*almost always*). Individual score is obtained by summing the scores for particular subscales. An example item of Positive Reappraisal is: "I think that the situation also has its positive sides."

(3) Operation Span Task (OSPAN; Turner & Engle, 1989) is an automated computer task for measuring working memory capacity as described in Unsworth, Heitz, Schrock, and Engle (2005). It measures the capacity to store information while performing additional mathematical cognitive tasks. Participants are supposed to memorize the letters they see on the screen (a sequence of 3 to 7 randomly selected letters) while solving simple math problems (e.g., 1 x 2 + 2 = 4) and deciding whether the solution they see is correct or not. The tasks are presented alternately. First, one letter is presented, then a math problem pops up and the answer to that problem emerges, then the next letter, etc. At the end of each set of letters and math problems, a recall screen appears and participants are asked to select the letters they saw in their exact order. The math problems are presented in order to prevent mental repetitions of letters, which increase the amount of information one can store in WM (Daneman & Merikle, 1996). The result of OSPAN is the total number of letters in the sets that were correctly recalled in their entirety. For instance – if a participant recalled three letters from a set of three letters, five letters from a set of five letters, and four letters from a set of seven letters – their score is 8 (3 + 5 + 0).

In the automated OSPAN, participants are given a chance to practice all the elements of the procedure before the main part of the task begins. First, participants are given simple math problems to solve. Then, they also receive sets of letters that they are supposed to memorize. Only after solving both parts separately are they asked to perform them simultaneously. During the trial test, the average time of solving the math problems is measured. In the main test, participants are supposed to solve the math problems within the time that is their average time plus 2.5 standard deviations of that time. After exceeding the time limit, the math problem disappears and the task is considered to be a math speed error. The accuracy of solving the math problems is also registered. As a general rule, results with an accuracy rate below 80% are rejected. Participants are informed about their current accuracy rate after solving each math task. The accuracy rate is visible as a percentage in the upper right corner.

In our study we used the automated version of OSPAN. The study was conducted using the *Inquisit* package created by Millisecond Software.[1] One test took approximately 20 minutes, depending on an individual's pace of solving the tasks. The participants gave their responses by moving and clicking the mouse. The following indicators were measured:

[1] DEMO version in English is available at: http://www.millisecond.com/download/library/OSPAN/

– OSPAN scores (values OSPAN) – the total number of letters in completely recalled sets;
– total recalled sets;
– math speed errors;
– math accuracy errors;
– math total errors.

As in the original OSPAN task, the OSPAN score was regarded as the final result of an individual's OSPAN performance and as the indicator of WM functioning.

Participants

The participants in the study were 77 people; the results of 65 individuals were analyzed. Researchers had two main reasons for rejecting 12 participants. The foremost reason for rejection was incomplete questionnaires. Secondly, the results of participants with more than 10 errors in the OSPAN task were not taken into account. Both may have been caused by misunderstanding the instructions or low motivation, resulting in lower scores in WM tests. The analyzed sample included 46 women and 18 men aged from 20 to 32 (M = 23.78, SD = = 3.1). A majority of the participants were secondary school graduates – university students (63.1%); people with higher education constituted 35.4% of the sample. One participant did not reveal his/her education.

Procedure

The participants were run in groups of up to five individuals. Each person was assigned to a separate station, restraining contact with other participants. Each station had a computer, with 55 cm distance between the 15-inch monitor and the person. The room in which the study was conducted had artificial lighting. In the first part of the study, the participants completed the questionnaires (ERQ and CERQ). The next part of the study was the OSPAN task, testing WM capacity. The study took roughly 40 minutes to complete. The order of the methods used is presented in Figure 1.

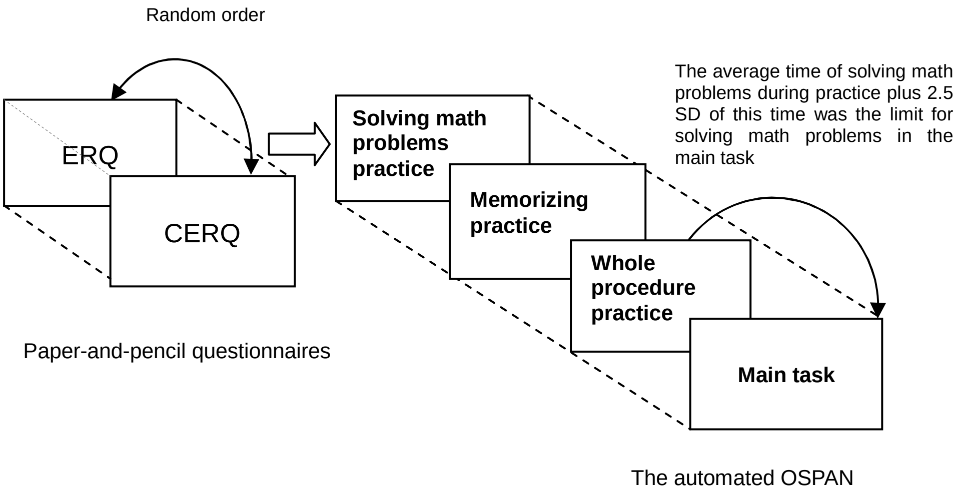

Figure 1. The scheme of the study. Source: authors' own description.

RESULTS

First, in order to verify the correspondence of Reappraisal and Positive Reappraisal, the respective scales of ERQ and CERQ were correlated. The correlation between them turned out to be statistically significant ($r = .39$, $p < .01$). As expected, a moderate positive relationship was found between Reappraisal (ERQ) and Positive Reappraisal (CERQ), which indicates that both ER strategies are similar in terms of content.

For the sole purpose of verifying the main hypothesis, the OSPAN results were analyzed. The mean result equaled $M = 34.9$ (minimum score – 6; maximum score – 75) and the standard deviation was $SD = 16.7$. The participants were divided into two groups based on their OSPAN scores (one group with high scores and the other with low scores). Scores higher than the mean by at least 1 *SD* (> 52) were considered high, and scores below this point were considered low. This resulted in two groups with a total of 22 people. The group of participants with low scores consisted of 12 people (9 women and 3 men) while the other group consisted of 10 people (7 women and 3 men).

The next step was conducting one-way ANOVA. Belonging to a specific group (with high or low OSPAN scores) was considered the grouping factor and interpreted as indicating higher and lower WM capacity, respectively. Scores on the Reappraisal scale of ERQ and on the Positive Reappraisal scale of CERQ were treated as dependent variables. ANOVA results indicate a statistically significant difference in scores on the Reappraisal scale of ERQ between participants with high and low WM capacity according to the OSPAN procedure, $F(1, 21) = 4.42$, $p < .05$. Participants high in WM capacity differed significantly from those with low WM capacity in their scores on the Positive Reappraisal scale of CERQ, $F(1, 21) = 5.78$, $p < .05$). The results for particular ER strategies scored by both groups of participants (low and high in WM capacity) are shown in Figure 2. There were no noticeable differences between these two groups in scores on other scales of CERQ and ERQ.

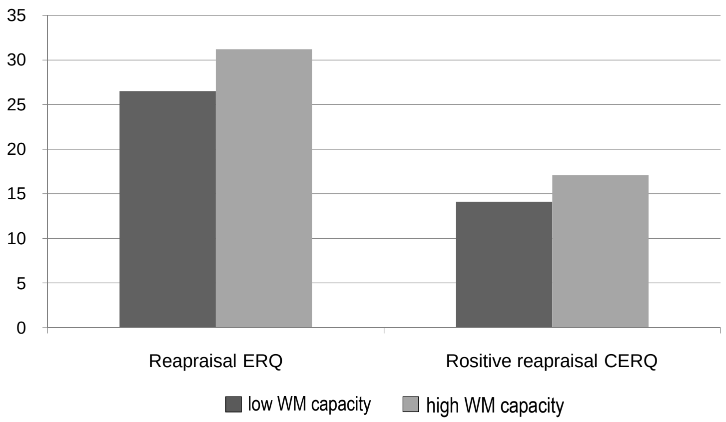

Figure 2. A comparison of mean CERQ and ERQ scores between groups with high and low WM capacity. Source: authors' own research.

DISCUSSION

The obtained results show that people whose WM functions better report more frequent use of strategies that consist in changing the way of thinking about the emotion-eliciting situation. The importance of this discovery is shown by the fact that, even though ER strategies such as cognitive reappraisal or positive reappraisal have similar mechanisms (the moderate positive correlation between these strategies suggests that both involve interpreting the emotion-eliciting situation and the experienced emotions in an alternative way), from a theoretical point of view they have complementary characteristics. In the processual model of ER, two types of strategies have been distinguished – response-focused and antecedent-focus (Gross, 1998; cf. Szczygieł, 2014). Response-focus strategies involve actions that one takes after the emotion-eliciting situation has occurred, such as suppression. Antecedent-focused strategies, by contrast, are employed before an emotion is aroused. It is this type that cognitive reappraisal (which involves individual cognitive transformation or reassessment an emotional situation by changing one's way of thinking about it) is considered to represent. The concept of conscious cognitive emotion regulation encompasses those ER strategies that include cognitive processing and occur after a negative event (Garnefski et al., 2002, pp. 5-6). Positive reappraisal is one of the adaptive cognitive ER strategies (as opposed to catastrophism, for instance) and refers to giving a positive meaning to the event in terms of personal growth. To be precise, positive reappraisal involves assuring oneself that a negative emotional experience will make one stronger and focusing only on the positive aspects of the event (Garnefski et al., 2002, p. 33). Putting those strategies in a proper temporal order makes it visible that they tend to vary as to the moment of being applied by an individual. Cognitive reappraisal is used before the occurrence of an emotional experience, while positive reappraisal is used after an emotion. However, the mechanism of both ER strategies is similar. Both consist in mentally processing and interpreting emotional content – for example by giving new meaning to the event. Transforming emotions in this way is related to deeper levels of information processing (cf. deep emotional labor; Szczygieł, Bazińska, Kadzikowska-Wrzosek, & Retowski, 2009), which consumes more of the individual's cognitive resources, which in turn can lead to a disturbance in the efficiency of the ER process. There is a possibility that the factor counteracting this disturbance is precisely the higher WM capacity observed in the study (thanks to which the costs of the ER system are reduced).

The functions of WM are usually analyzed in terms of capacity and processing. It is postulated that the functions of storing and processing are in conflict with each other, and that, consequently, one of them can be weakened (Kossowska, 2005, pp. 156-157). In the present study, the researchers arranged a situation that demanded engaging both WM functions at the same time. The function of storing and cognitively processing emotionally neutral content (numbers, letters), referred to in this study as working capacity, was measured using the OSPAN task. By contrast, the cognitive processing of emotional content was not included in the OSPAN task; it was postponed, and its measure was the ER strategies reported by the participants. It can be assumed that ER using cognitive transformations is more effective when WM capacity is higher because the conflict between operational capacity and processing decreases. Naturally, this explanation is purely speculative, because the study was based on the participants' declarations concerning the use particular ER strategies, which does not necessarily mean that under circumstances of emotional arousal the participants actually apply the ER strategies they reported, even if the characteristics of their cognitive system (high WM capacity) promote them.

What is more certain is that the intellectual process that underlies the declared ER strategies (cognitive reappraisal, positive reappraisal) is similar to the affective flexibility phenomenon described in the literature (Genet & Siemer, 2011). Affective flexibility is the equivalent of cognitive flexibility in the emotional domain. It is defined as a specific ability of processing material (e.g., images, words), in which switching takes place between the affective and nonaffective aspects of stimulation and between its positive and negative aspects (cf. dialectics of emotional complexity; Jasielska, 2013). A similar process can be observed in the ER strategies discussed here, in which an individual performs a cognitive transformation of emotional content, for instance by transforming an emotionally charged experience into emotionally neutral experience (cognitive reappraisal) or by assigning positive meaning to a negative event (positive reappraisal). As the latest research shows, affective flexibility is a significant construct since it is related to effective cognitive reappraisal (Malooly, Genet, & Siemer, 2013). It has been found that the higher affective flexibility a person has, the more probable it becomes that he or she will use the reappraisal strategy to reduce the feeling of sadness caused by a movie scene. Changes pertaining to the neutralization of a negative image and attributing emotional meaning to a positive image are particularly strong predictors of the usage of reappraisal.

The main limitation of the study is the above-mentioned usage of self-report instruments for measuring ER strategies. Eliminating this limitation should become the subject of further explorations, for instance in experimental studies involving the arousal of emotions and *in vivo* observation of ER strategies being applied. This is justified by the fact that reappraisal can take different forms. The most common among them is so-called detached reappraisal (Wager, Davidson, Hughes, Lindquist, & Ochsner, 2008), which consists in switching from emotional to unemotional mode of interpreting an emotion-eliciting situation. Another form of reappraisal is positive reappraisal, defined as interpreting an emotion-eliciting situation in positive terms. The third kind of reappraisal is neutralizing the negative emotional meaning of a stimulus by treating a situation as fictional or unrealistic. As we can see, each of the presented forms of reappraisal involves applying different processes; consequently, their efficacy can be moderated by WM capacity.

REFERENCES

Baddeley, A. (1999). Working memory: The multiple – component model. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanism of active maintenance and executive control* (pp. 257-297). Cambridge: Cambridge Univeristy Press.

Brzezicka-Rotkiewicz, A., & Sędek, G. (2005). Porównanie ograniczeń pamięci operacyjnej w starzeniu się i depresji. Przegląd i wnioski z badań własnych. *Studia Psychologiczne, 43*, 63-73.

Cheng, P. W., Holyoak, K. J., Nisbett, R. E., & Oliver, L. M. (1986). Pragmatic versus syntactic approaches to training deductive reasoning. *Cognitive Psychology, 18*, 293-328.

Daneman, M., & Merikle, P. M. (1996). Working memory and language comprehension: A meta-analysis. *Psychonomic Bulletin & Review, 3*, 422-433.

Ericsson, K. A., & Delaney, P. F. (1999). Long-term working memory as an alternative to capacity models of working memory in everyday skilled performance. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanism of active maintenance and executive control* (pp. 257-297). Cambridge: Cambridge Univeristy Press.

Genet, J. J., & Siemer, M. (2011). Flexible control in processing affective and non-affective material predicts individual differences in trait resilience. *Cognition & Emotion, 25,* 380-388, doi:10.1080/02699931.2010.491647.

Garnefski, N., Kraaij, V., & Spinhoven, Ph. (2002). *Manual for the use of the Cognitive Emotion Regulation Questionnaire.* Leiderdorp, The Netherlands: DATEC.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271-299, doi: 10.1037/1089-2680.2.3.27.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348-362, doi: 10.1037/0022-3514.85.2.348.

Jasielska, A. (2013). *Charakterystyka i konsekwencje potocznego rozumienia emocji*. Poznań: Wydawnictwo Naukowe UAM.

Kesinger, E. A., & Corkin, S. (2003). Effect of negative emotional content on working memory and long-term memory. *Emotion, 3*, 378-393, doi: 10.1037/1528-3542.3.4.378.

Kossowska, M. (2005). *Umysł niezmienny. Poznawcze mechanizmy sztywności.* Kraków: Wydawnictwo UJ.

Kobylińska, D. (2015). Kwestionariusz Regulacji Emocji (Emotion Regulation Questionnaire by J. J. Gross and O. P. John; translated with the authors' consent by D. Kobylińska). Retrieved from: http://spl.stanford.edu/pdfs/erq10-polish.pdf.

Malooly, A. M., Genet, J. J., & Siemer, M. (2013). Individual differences in reappraisal effectiveness: The role of affective flexibility. *Emotion, 13,* 302-313, doi: 10.1037/a0029980.

Marszał-Wiśniewska, M., & Fajkowska, M. (2010). Właściwości psychometryczne Kwestionariusza Poznawczej Regulacji Emocji (Cognitive Emotion Regulation Questionnaire – CERQ) – wyniki badań na polskiej próbie. *Studia Psychologiczne, 49*, 19-39.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41,* 49-100, doi: 10.1006/cogp.1999.0734.

Oberauer, K., Süß, H. M., Schulze, R., Wilhelm, O., & Wittmann, W. W. (2000). Working memory capacity – Facets of a cognitive ability construct. *Personality and Individual Differences, 29*, 1017-1045, doi: 10.1016/S0191-8869(99)00251-2.

Piotrowski, K. T., & Wierzchoń, M. (2009). Wpływ emocji na funkcjonowanie pamięci roboczej. In J. Orzechowski, K. T. Piotrowski, R. Balas, & Z. Stettner, (Eds.), *Pamięć robocza* (pp. 133-148). Warsaw: Academica.

Philips, L. H., Bull, R., Adams, E., & Fraser, L. (2002). Positive mood and executive function: Evidence from Stroop and fluency task. *Emotion, 2*, 12-22, doi: 10.1037/1528-3542.2.1.12.

Schmeichel, B. J., Volokhov, R. N., & Damaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology, 95*, 1526-1540, doi: 10.1037/a0013345.

Schweizer, S., Hampshire, A., & Dalgleish, T. (2011). Extending brain-training to the affective domain: Increasing cognitive and affective executive control through emotional working memory training. *PloS ONE, 6*(9), e24372, doi: 10.1371/journal.pone.0024372

Szczygieł, D. (2014). Regulacja emocji a dobrostan. Konsekwencjewyprzedzającej i korygującej regulacji emocji. In R. Derbis & Ł. Baka (Eds.), *Oblicza jakości życia* (pp. 193-209). Częstochowa: Wydawnictwo Akademii im. Jana Długosza w Częstochowie.

Szczygieł, D., Bazińska, R., Kadzikowska-Wrzosek, R., & Retowski, S. (2009). Praca emocjonalna w zawodach usługowych – pojęcie, przegląd teorii i badań. *Psychologia Społeczna, 4*(3), 155-166.

Śmieja, M., Morozowicz, M., & Kobylińska, D. (2011). Emotional intelligence and emotion regulation strategies. *Studia Psychologiczne, 49*, 55-64, doi: 10.2478/V10167-010-0040-x.

Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language,28*, 127-154, doi: 10.1016/0749-596X(89)90040-5.

Unsworth, N., Heitz, R. P., & Engle, R. W. (2006). Pojemność pamięci operacyjnej w gorącym i zimnym poznaniu. In R. W. Engel, G. Sędek, U. von Hecker, & D. N. McIntosh (Eds.), *Ograniczenia poznawcze. Starzenie się i psychopatologia* (pp. 31-58). Warsaw: Academica & PWN.

Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). An automated version of the operation span task. *Behavior Research Methods, 37*, 498-505.

Wager, T. D., Davidson, M. L., Hughes, B. L., Lindquist, M. A., & Ochsner, K. N. (2008). Prefrontal-subcortical pathways mediating successful emotion regulation. *Neuron, 59*(6), 1037-1050, doi: 10.1016/j.neuron.2008.09.006.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 120*, 3-24.