Studia Psychologica, Vol. 60, No. 4, 2018, 209-225 doi: 10.21909/sp.2018.04.763

On the Unexpected Consequences of Perspective Taking: Influence of Spatial Perspective Rotation on Infra-humanization

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This research examined spatial perspective taking and its effect on the perception of other people's emotionality. Adopting the perspective of another person is considered an important factor enhancing interpersonal and intergroup relations. However, it requires conscious effort and reflection. Therefore, the aim was to determine whether rotating spatial perspective places demands on cognitive resources, thereby affecting automatic perception of other people's emotionality.

Inspired by previous research, the authors developed the software used in this study. Participants were prompted to move objects on a bookshelf according to the directions of a person standing either on the opposite side of the bookshelf or next to them, on the same side. Using an infra-humanization scale, participants rated their own emotions and those of the person whose perspective they assumed.

The results confirmed the hypotheses. Firstly, the need for perspective rotation resulted in decreased performance of the task (lower accuracy and longer time to complete). Secondly, perspective rotation conditions amplified the effect of infra-humanization, i.e., the partner was seen by the participant as less capable of experiencing uniquely human emotions. We can infer that the change of spatial perspective consumed cognitive resources, thereby promoting a simplified and automatic mode of perception.

Key words: perspective taking, infra-humanization, social perception, spatial perspective rotation, social *vs*. spatial perspective taking

Introduction

The aim of the study is to explore the phenomenon of spatial perspective taking and its regulatory consequences for social functioning of individuals and, specifically, for the infra-humanization effect. The researchers focused on one of the symptoms of infra-humanization that is manifested by the person's denying other people (those belonging to a different social category) the ability to experience specifically human emotions (Leyens, 2000).

Perspective taking is a complex and multidimensional concept. Social perspective taking (i.e., cognitive empathy, emotional intelligence) and spatial (visual and visuospatial) perspective taking are two different, yet interwoven, aspects and manifestations of this phenomenon. Beneficial consequences of social perspective taking for social functioning of individuals have been demonstrated in numerous studies. Their results consistently indicate a positive impact of perspective taking on inter-

Acknowledgments
Funding for the study was provided by the University of Warsaw, Faculty of Psychology: author Alicja Gniewek has received research grant DSM 114200/2016; author Anna Szuster has received BST 174415/2015.

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Received February 7, 2018

personal relationships: A dispositional level of perspective taking decreases automatic negative attitudes toward others (Szuster, Gniewek, & Wojnarowska, 2016) and within intergroup relations (Crisp & Hewstone, 2006; Drogosz, Bilewicz, & Kofta, 2012), and reduces negative behaviors (e.g., peer violence: Chalmers & Townsend, 1990; Chandler, 1973) and cyberbullying (Barlinska, Szuster, & Winiewski, 2013, 2015). Perspective taking has also been found to reduce age-related stereotyping (Galinsky & Moskowitz, 2000).

However, research exploring the influence of the *spatial* aspect of perspective taking on social perception (e.g., in the phenomenon of infra-humanization) is scarce. Few researchers have studied the effects of focusing the observer's attention on the other person's spatial perspective. We assume that the consequences of focusing on these two aspects of perspective taking (social and spatial) could prove to be quite diverse.

The Phenomenon of Spatial Perspective Taking

The very concept of perspective taking assumes the presence of an object viewed from multiple standpoints (Moll & Tomasello, 2007). Social perspective taking is defined as a process through which the perceiver discerns the thoughts, feelings and motivations of one or more persons. It comprises appreciating the point of view of people who represent different values and attempting to understand how a given situation is perceived by others (Gelhbach, 2004). Spatial perspective taking, on the other hand, is a process through which the beholder perceives how some physical objects look from different points of view (meaning different spatial positions).

It seems that the two aspects of this process – the spatial and the social – are intertwined. It is even manifested in language itself, in such expressions as "point of view", "to view something from a different standpoint", etc. They show how one's focusing on the situation of another person is actually related to the terms that are characteristic of the visual perspective (Lakoff & Johnson, 1980; Erle & Topolinski, 2015). They both also perform a similar function, i.e. they describe a situation (in its psychological or visual aspect) in relation to another, concrete person or object.

However, numerous other studies point to the distinctness and specificity of spatial perspective taking (Libby & Eibach, 2011). Their results indicate that social perspective taking could be an isolated cognitive process, both on the neuronal (Ruby & Decety, 2001; Ruby & Decety, 2003; Ruby & Decety, 2004), as well as behavioral level (Kozhevnikov & Hegarty, 2001; Hegarty & Waller, 2004), whereas spatial perspective taking is devoid of any social content (Surtees, Apperly, & Samson, 2013).

The studies conducted by Fiske and his colleagues show different consequences of social and spatial perspective taking (Fiske, Taylor, Etcoff, & Laufer, 1979). Assuming a spatial (visual) perspective causes the elements of a given situation to be remembered much better in comparison to the situation when a social (empathy arousing) perspective is adopted. Also, in the latter condition, the cause-effect attribution takes place more frequently.

The "bottom-up" path is specific to information processing, in which the visual perspective is taken, whereas the "top-down" path determines the processing channel when the social perspective taking occurs. Self-awareness and the awareness of other persons underlie the very phenomenon of perspective taking. On this abstract level, a psychological sense of understanding the other is being generated (Davis, Conklin, Smith, & Luce, 1996; Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). On the other hand, activation of the visual, spatial perspective occurs as a result of focusing the

person's attention on characteristic features of his or her surroundings, on a direct simulation and on creating concrete representations that enable the person to "step into the shoes" of the other. The thesis of "the bottom-up" type of processing in case of the visual perspective taking is also supported by findings of research on spatial embodiment. The visual perspective researchers emphasize that the body's posture, when consistent with an angle at which perspective is being taken, strongly influences the accurateness and speed at which it is adopted (Kessler & Thomson, 2010; Kessler & Rutherford, 2010).

One of the first paradigms dealing with the spatial, visual ability of perspective taking is the so-called Mountain Task (Piaget & Inhelder, 1956). A child, sitting in front of a model of a mountain, is asked to describe what a doll seated on the opposite side can see (Piaget, 1955). It turns out that children under the age of 7 are unable to effectively decentrate and mentally rotate the spatial perspective. The core of the task is to assume visual and spatial perspective (Flavell, Green, Flavell, Watson, & Campione, 1986; Kessler & Rutherford, 2010; Michelon & Zacks, 2006) and not to engage in social representations of what the other party is thinking or feeling. Developing the ability to perceive points of view within space (in the literal sense of the word) is the very measure of decentration and, at the same time, the basis for social perspective taking (Hamilton, Brindley, & Frith, 2009).

The spatial aspect of perspective taking appears to have a significant impact both on the person's further cognitive functioning as well as his/her social activity, i.e. orientation and attitudes towards others. The classic research by Storms (1973) demonstrated the significance of spatial perspective rotation for reducing the actor-observer asymmetry. When the actor's observation from the observer's own spatial perspective generated an actor-observer effect, placing the actor at the position of the observer proved sufficient not only for reducing but also for reversing that effect (Storms, 1973). The effect was caused not by the observer's mental rotation of the spatial perspective, but by the actual physical change of the observer's location.

Other consequences of spatial perspective rotation were demonstrated in the results of research conducted by Keysar and colleagues (Keysar, Barr, Balin, & Brauner, 2000). They used a communication game asking participants to move objects around on an array with slots in accordance with the instructions. Several objects were placed in the slots, most of them visible from both sides of the array. The participant sat on one side, and the experimenter's assistant, who was giving instructions, on the other. Participants were told that some slots on the array would be blocked so that the person giving instructions would not see the objects placed in them. The key role in the experiment was played by the same objects but of different sizes: a medium-sized and a large candle. The smallest or the largest of these objects was placed on the shelf that was occluded from the person giving instructions – e.g., the smallest candle. The task of the participant was to move the object as instructed. The instructions were designed so that the participant would have to take into account the perspective of the other person (e.g., the experimenter's assistant might say "Move the smallest candle one slot down", while the smallest candle seen from the assistant's perspective was the medium candle from the participant's perspective).

The results showed that participants not only made more mistakes, but spent significantly more time performing the task than those in the control condition (where both parties had unobstructed view of all shelves) looking at the "confounding" objects blocked from the person on the opposite side (e.g., at the smallest candle seen from their perspective and occluded from the person giving directions), before fi-

nally reaching for the right object (the medium-sized candle visible to the person on the other side). The authors explained this difference in terms of the egocentric strategy, pointing out that people orient themselves in that kind of spatial situation by starting from "egocentrism" and focusing on their own point of view because it is easily and readily accessible. This approach is then corrected in subsequent steps by using more cognitive resources, which enable individuals to view the situation from a different perspective and adjust their actions accordingly. Thus, the heuristic, effortlessly available content (our own point of view in this case) dominates the field of vision, potentially leading to errors in task performance. The need to rotate spatial perspective mobilizes cognitive resources, as well as the self-control required to inhibit the primary response following the "incorrect", but permanently available, perspective. This proves that spatial perspective taking engages a significant amount of attention and control resources.

Thus, there seems to be every reason to believe that activation of spatial perspective taking in which cognitive resources are engaged may intensify distortions related to automatic categorization processes, including the infra-humanization effect.

Infra-humanization – The Result of Simplified Cognitive Strategy

A number of studies have shown that people tend to perceive the quality of being human as an essential feature of their in-group, while denying that same quality to the members of an out-group. The results of research (Rodriguez-Torres et al., 2005) have shown that along with intelligence and the ability to think and use language, another vital criterion of being a human, is the ability to experience secondary emotions, which, as opposed to primary emotions, are considered specific to humans and remain inaccessible to animals (Ekman, 1992; Sroufe, 1979). In a series of studies, researchers proved that "strangers" are indeed less liked and considered less intelligent and creative, but also perceived as less capable of experiencing typically human emotions (such as pride or hatred – Paladino et al., 2002). This is a very subtle process. It does not consist of overtly denying "strangers" (out-group members) their belonging to the human species, yet it contributes to developing an opinion that, as human beings, they are less worthy and are devoid of substance and depth. One of the manifestations of subtle infra-humanization is the asymmetrical attribution of emotions recognized as typically human (secondary) and those experienced by people and animals alike (primary). While the intensity of experiencing primary emotions is not a differentiator between in-group and out-group, secondary emotions are more readily attributed to members of one's in-group (Leyens et al., 2001). Thus, the quality of being human is not something permanent and inalienable, but rather, a dynamic dimension of comparisons. The phenomenon of infra-humanization has been shown to be universal (Demoulin et al., 2009). Rather than denying other people's humanity, it involves relative differentiation in ascribing uniquely human traits to one's fellows and strangers. An out-group can still be seen as human, although to a lesser degree than the in-group. Infra-humanization has been shown to be independent of negative attitudes toward strangers: It affects both positive and negative emotions. It emerges between groups even in the absence of objective reasons [e.g., lack of conflicting interests between French and Spanish students or between students from continental Spain and the Canary Islands, as in the research conducted by Leyens et al. (2001)]. Moreover, it is not limited to relations with the least favorably perceived out-groups: The best-liked ones also tend to be seen as less human (Vaes & Paladino, 2010). The sole prerequisite

for its emergence is an act of categorization. Infra-humanization is an implicit, automatic process. People are not aware of applying inconsistent standards when assessing the emotional functioning of others. The effect is revealed with the use of implicit cognition measures, such as the Implicit Association Test (IAT). The time of categorization of secondary emotions in the "US" category was found to be shorter than in the case of the "OTHERS" category (Leyens et al., 2001; Boccato et al., 2007).

Although traditionally, the phenomenon of infra-humanization has been seen as an aspect of intergroup essentialism, i.e. perceiving others as qualitatively different from one's own group, the results obtained by Haslam (2006) showed that it also operates on the individual level. Unfamiliar individuals who were not perceived in terms of group affiliation were also seen as less capable of experiencing exclusively human emotions.

The automatic and universal character of infra-humanization drew the researchers' attention to the significance of cognitive resources. This phenomenon is often interpreted in terms of attribution error. Abstract contents defining secondary emotions are less accessible and, consequently, more rarely attributed to out-group members than to the in-group ones. The infra-humanization effect can be mitigated or even completely blocked in the condition of freely available cognitive resources and intentional activity (Leyens, Demoulin, Vaes, Gaunt, & Paladino, 2007).

Description of Current Research

The aim of the current research was to verify the effect of perspective rotation and the role of "fixing" cognitive resources in the domain of social perception. The studies focused on the infra-humanization effect.

The results of our previous experimental research showed that activation of social perspective taking by imitating a mimic expression of a person from the out-group significantly lowers infra-humanization in comparison with both the condition of mimicry inhibition and the control condition (Szuster & Wojnarowska, 2016). The findings obtained proved the beneficial effect of social perspective taking. In the case when spatial perspective is assumed, however, we expected different effects. Although infra-humanization and mimicry are activated at a similar, automatic level, spatial perspective taking involves systematic processing along the "bottom-up" path and is effort-consuming. Also, one of its significant components is inhibition. On the other hand, however, research shows the importance of freely available cognitive resources in reducing the infra-humanization effect (Levens, Demoulin, Vaes, Gaunt, & Paladino, 2007). It justifies the assumption that involvement of cognitive resources in the effort-consuming spatial perspective taking will tend to intensify the infra-humanization symptoms.

Therefore, we expected the involvement of cognitive resources in perspective rotation to increase infra-humanization: the automatic effect in social perception, secondary to the process of categorization.

The main *hypothesis* is as follows:

In the condition that requires the subject to take the partner's spatial perspective, that which is different from his/her own (experimental condition), the effect of infra-humanization of the partner increases, as compared to the condition where the partner's spatial perspective is the same as that of the subject (control condition).

In order to test that hypothesis, an adequate tool needed to be designed and verified. The first experiment aimed at verifying the method of activating spatial perspective taking.

The additional hypothesis is as follows:

In the condition that requires the subject to take the partner's spatial perspective, the one

different from his/her own (experimental condition), the performance of assigned tasks is lower (slower times and greater number of errors), as compared to the condition where the partner's spatial perspective is the same as that of the subject's (control condition).

Experiment 1

Materials and Method

The purpose of the first experiment was to verify the method activating spatial perspective taking. We expected a difference in task performance between subjects in two conditions: 1) the condition requiring spatial perspective rotation (experimental condition); and 2) the condition where the partner's spatial perspective is the same as that of the subject (control condition). A dedicated software application inspired by Keysar and Epley's methodology was used (Epley, Morewedge, & Keysar, 2004; Keysar et al., 2000). To test the hypothesis, a between-subject design was used.

Participants

Ninety-three participants took part in the trial (63 females and 30 males, aged 18 - 25 years M = 20.14, SD = 1.59), all of them applying for studies at the Faculty of Psychology. They were randomly assigned to the control (n = 46, 32 females and 15 males, aged 18 - 25 years, M = 20.26, SD = 1.87) and experimental conditions (n = 47, 32 females and 15 males, aged 18 - 25 years, M = 20.02, SD = 1.28). The participants in both conditions were comparable in terms of age and gender. All the participants were recently admitted students of psychology at the Faculty of Psychology. They came to the Faculty to submit their documents after being accepted to study there. At that time, they were invited to participate in the experiment. Participation was voluntary. Participants received a small reward: a badge with the logo of the Faculty of Psychology. Prior to the analysis, outliers were excluded from the database: times of task completion under 1 second suggesting accidental mouse clicks and those above 50 seconds that were likely due to the participant giving up on the task. Eventually, 86 participants were included in the analysis (58 females and 28 males).

Operationalization of Variables

The partner's spatial positioning was manipulated. A software application called Bookshelf was developed. It consists of about a dozen slides containing descriptions of the situational context, instructions and tasks. Participants were asked to imagine they were in a room in the middle of which stands a bookshelf with balls of various sizes, in different slots in the array, and that there was a partner whose instructions they would be following. The spatial location of the partner varied: 1) In the experimental condition, the partner stands at the opposite side of the bookshelf (facing the participant) and cannot see the contents of some of the shelves (slots in the array) as they are blocked from his view and remain visible only from the perspective of the participant (Figure 1); 2) in the control condition, the partner stands next to the participant, at the same side of the bookshelf, and sees everything from the same perspective as that of the participant.

Participants were asked to move objects as directed by the partner, e.g., "I want the smallest ball moved to the top right shelf of the bookshelf". The experiment consisted of two trials. In each trial there were 4 balls of different sizes in the array. The directions always referred to the "confounding" objects that, in the experimental condition, required adjustments of the participant's spatial perspective (e.g., the smallest ball placed on a shelf visible to the participant was blocked from the partner standing on

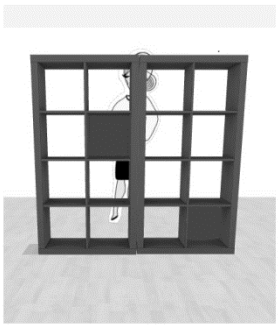

Figure 1 Experimental condition

the opposite side of the bookshelf [Figure 2]). In the experimental condition, the instruction for the task drew attention to the difference in the perspectives of the participant and partner of the interaction ("Remember that Alex is standing on the opposite side of the bookshelf and sees it differently"). Using a mouse, participants dragged selected objects to the slots indicated. The instructions and the aim of the task were comprehensible to the participants, according to the pilotage done prior to conducting the research.

Task performance was a dependent variable. The variable measures were:

- task completion time measured in seconds

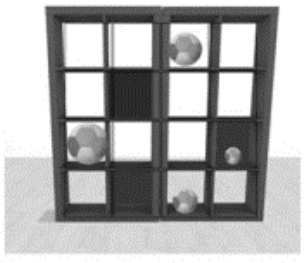

Figure 2 View of the bookshelf with balls

- accuracy of task performance (number of errors made by choosing a wrong object and/or a wrong slot to which the object was to be moved). One error of either of the two kinds (object/slot) was allowed in each of the two trials, so the total number of errors in the whole task ranged from 0 (no mistakes) to 4 (incorrect performance of the whole task)

Procedure

The study was anonymous and conducted individually. The experimenter invited individuals who showed up at the Faculty of Psychology at the University of Warsaw to sign up for the experiment. The study was conducted in a laboratory. Participants were randomly assigned to the control and experimental conditions. Consenting participants were told the true purpose of the study: to measure performance on a computer-simulated spatial task. Next, the experimenter started the application and left the room. The remaining instructions were given on the monitor screen. The task in each condition consisted of two trials. The indices were measured in the first trial; there were no practice tasks. At the end of the experiment, participants received a reward.

Statistical Analysis

Firstly, the differences in the number of errors in two conditions were examined using the Mann-Whitney U test. Next, similar analyses were done to establish differences in the distribution of error rates in two conditions for each type of an error (incorrect choice of a ball or space on the bookshelf). In order to assess which type of error (ball or bookshelf) was more frequent in experimental condition, the Wilcoxon-Sing test was used. Also, the comparison of completion times in two conditions was made, using the Mann-Whitney U test (distribution of dependent variable – completion

time – deviated from normal). All data analyses were conducted in SPSS 24.

Results

The analysis revealed a greater number of errors in the experimental (*Mdn* = 2, mean rank 63.50) than in the control condition (*Mdn* = 0, mean rank 22.55), $U = 44.00$, $p < .001$, $r = .897$. Overall, in the experimental condition, the overwhelming majority of participants performing the task committed one, two or three mistakes ($n = 34$), and 8 performed the entire task incorrectly. Only two participants in the experimental condition performed the entire task correctly. In the control condition, most participants made no mistakes ($n = 40$), with only two making some errors. The rates of errors in each condition are shown in Figure 3.

The analyses of differences in the distribution of error rates in two conditions for each type of error showed that both task performance parameters, the choice of an object and of a slot, were significantly differentiated between the two conditions. In the experimental condition, the number of errors was significantly greater than in the control condition. The manipulation effect was also present regardless of the measurement analyzed (trial 1/trial 2). In Table 1, we present detailed results of the analyses.

In the experimental condition, there was a greater number of errors in ball choices than in slot choices. Participants were significantly less frequently aware of the fact that the ball they saw as the smallest was occluded from the partner standing on the opposite side of the bookshelf ($Z = -5.143$, $p < .001$).

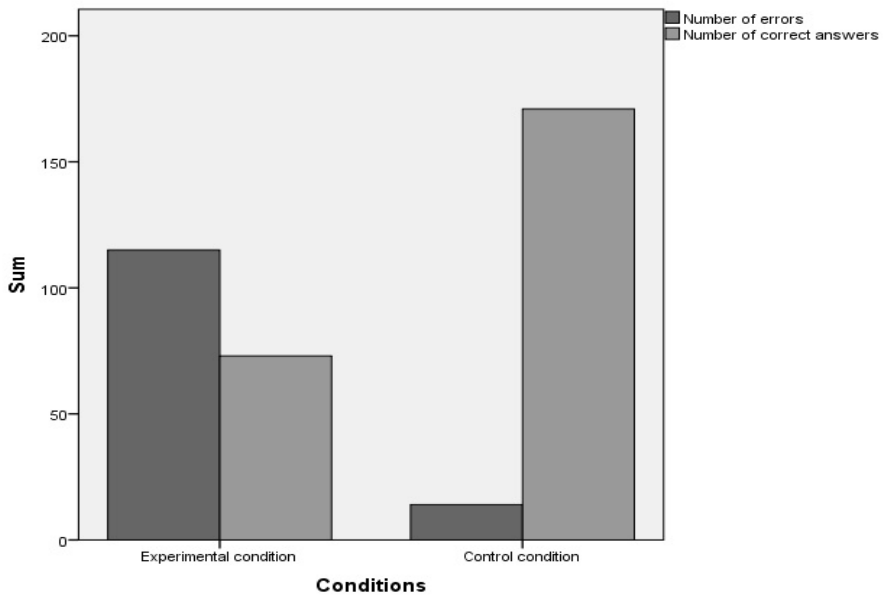

Figure 3 Number of errors and correct answers in experimental and control conditions

Table 1 *Comparison of number of errors in experimental and control condition*

	Experimental condition		Control condition		Comparison between conditions	
	n = 44		n = 42		U Mann test	
	Median	Mean rank	Median	Mean rank	U	P
Total number of errors	2	63.50	0	22.55	44.00	0.000
Incorrect choice of a ball	2	63.00	0	23.07	66.00	0.000
Incorrect choice of a space on the bookshelf	0	50.18	0	36.50	630.00	0.000
Number of errors in trial 1	1	62.77	0	23.31	76.00	0.000
Number of errors in trial 2	1	63.55	0	22.50	42.00	0.000

Analyses also demonstrated that the total completion time for the two tasks was significantly longer in the experimental condition than in the control ($U = 670.50, p = .029, r = .237$). The mean of the ranks for experimental condition was 49.26 ($Mdn = 18.43$), while the mean rank for the control condition was 37.46 ($Mdn = 16.79$).

Discussion

The results confirmed our hypothesis: Accuracy in task performance operationalized as the choice of correct objects and slots varied significantly across conditions. Spatial perspective rotation produced a marked decrease in both measures of task performance. The time for completion proved longer in the condition requiring spatial perspective rotation. Furthermore, no differences were found between two trials for any of the performance aspects analyzed. The greatest challenge was to identify the correct object: to point out the one that was perceptually available to the partner.

The starting point for much of the research conducted within the paradigm described above was Keyser's concept of the role of shared knowledge in communication and mutual understanding (Keysar et al., 2000). According to that idea, shared knowledge diminishes the likelihood of considering a "non-shared" object and helps correct the egocentric error. In our study, however, that was not the case: participants committed surprisingly many errors in the perspective rotation condition. The present study, however, revealed a time effect: Subjects took longer to complete the task if they had to rotate perspective. The effect was significant only for the second trial, which may suggest that experience gained in the first trial led participants to involve more cognitive resources: to be more careful and take more time to complete the task. Still, the longer time taken by participants for the task in the second trial did not translate into improved accuracy. Previous research (Epley et al., 2004) has demonstrated that although both children and adults looked at the confounding objects with equal frequency, the latter corrected their reasoning significantly more often, which was enhanced by the lack of other factors requiring cognitive resources and motivation to perform the task ac-

curately. Despite slight differences between the results obtained by Epley and Keysar and our findings, it turns out that the applied method is an apt operationalization of spatial perspective taking. Its efficiency as a task engaging cognitive resources was confirmed.

Experiment 2

Method

The purpose of the second experiment was to determine whether the overload of cognitive resources due to perspective rotation modifies the infra-humanization effect.

Participants

There were 80 participants (55 females and 25 males, aged 18 - 25 years, $M = 20.55$, $SD = 2.14$) in the study, all newly admitted psychology students. Participation was voluntary. Participants received, as their only reward, a badge with the logo of the Faculty of Psychology. The participants were randomly assigned to the control ($n = 40$, 28 females and 12 males, aged 18 - 25 years, $M = 20.5$, $SD = 2.16$) and experimental conditions ($n = 40$, 27 females and 13 males, aged 18 - 25 years, $M = 20.6$, $SD = 2.16$). The participants in both conditions were comparable in terms of age and gender. No participants were excluded from the database.

Operationalization of Variables

Manipulation involved the spatial location of the partner. For that purpose, the software application Bookshelf was used. In the experimental condition, the partner was standing at the opposite side of the bookshelf, whereas in the control condition, he was standing at the same side as the participant. The participant's task was to move objects around on the virtual array as directed by their partner.

To assess the level of infra-humanization, the emotions scale (Leyens, 2000) adapted by Mirosławska & Kofta (2007) was used. It consists of a list of 28 emotions that differ in terms of mood (positive *vs.* negative) and complexity (primary *vs.* secondary). Participants were asked to rate on a 7-point scale how often they experienced a given emotion (where 1 means "I never feel like this" and 7 means "I feel this way very often").

The subjects rated their own emotions ("Me") first and then, after the Bookshelf task, they rated the emotions of their partner ("Other"), whose directions they followed while performing the task.

Procedure

The study was anonymous and conducted individually. Participants were randomly assigned to the control and experimental conditions and were told that the purpose of the study was to check how people perceive themselves, others and the surrounding world. When the standard verbal consent was obtained, the experimenter primed the participants to think about the self by referring to the membership in the group of students of the Faculty of Psychology. He congratulated participants on having been accepted, referred to the prestige of the university, and gave them a badge with the logo of the Faculty of Psychology. The purpose was to trigger self-categorization as a university student. After the conversation, participants completed the "Me" version of the emotions scale while already in the lab. Next, they did the tasks in the Bookshelf application in one of two conditions, completing two trials. At the end, they completed the emotion scale, this time rating the person who was giving them directions in the computer application. The instruction for the scale noted that the person had decided not to go to university and was now working. The criterion for categorization was then the

affiliation with a students' group vs. with a group of non-studying working people, while the higher status of the students' group was highlighted.

Statistical Analysis

Firstly, to asses manipulation efficacy, differences in task completion times and the number of errors in two conditions were examined, using the Mann-Whitney U test. Distribution of task completion time deviated from normal, and therefore a non-parametrical test was used. Next, in order to test the hypothesis regarding the impact of perspective rotation upon attribution of the valence of primary and secondary emotions to the self and the other person, a 2 (object: the self/the other) x 2 (emotion type: primary/secondary) x 2 (condition: experimental/control) mixed ANOVA was calculated, with the first two factors varying within the subjects, and the last factor between the subjects. All data analyses were conducted in SPSS 24.

Results

Manipulation efficacy control. Analyses showed differences in task completion time between two conditions ($U = 564.50$, $p = .023$, $r = .255$). When the partner was at the opposite side of the bookshelf (experimental condition), participants took more time to follow his directions (mean rank 46.39, $Mdn = 18.43$) than in the control condition, where he was standing next to them (mean rank 34.61, $Mdn = 16.80$). The analysis of errors revealed significant differences in the number of errors made, depending on the spatial positioning of the partner ($U = 42.00$, $p < .001$, $r = .894$). Significantly more errors were made in the experimental condition than in the control one.

Hypothesis testing. Two main effects were revealed: object type and emotion type. Object type (the self vs. the other) was found to significantly differentiate the valence of attributed emotions [$F(1, 78) = 5.47$, $p = .022$, $\eta_p^2 = .07$]; a higher valence of all emotions was attributed to the self ($M = 4.28$, $SD = .63$) than to the other ($M = 4.11$, $SD = .59$). Types of attributed emotions turned out to be significantly differentiated [$F(1, 78) = 7.15$, $p = .009$, $\eta_p^2 = .08$]. A markedly higher number of secondary emotions was attributed ($M = 4.28$, $SD = .61$), compared with the primary ones ($M = 4.12$, $SD = .57$).

As expected, the results showed a significant interaction among conditions, types of emotions and objects [$F(1, 78) = 4.08$, $p = .047$, $\eta_p^2 = .05$. In the experimental condition, participants attributed a lower valence of secondary emotions to the other ($M = 4.15$, $SD = .54$) than to the self ($M = 4.45$, $SD = .88$), $p = .024$, yet there was no difference between the self and the other as far as primary emotion attribution is concerned. Thus, in the experimental condition we can see a clear effect of infra-humanization. Additionally, in the control condition, we found a significant difference in the attribution of primary emotions: Participants attributed a higher valence of primary emotions to the self ($M = 4.14$, $SD = .74$) than to the other ($M = 3.92$, $SD = .68$), $p = .05$, and, at the same time, no difference in the attribution of secondary emotions was revealed. The results are shown in Figures 4 and 5.

Discussion

The results of the study confirmed the predictions of the hypothesis. The requirement of perspective rotation increased the effect of infra-humanization. The result can be explained in terms of cognitive overload: The spatial perspective rotation task placed such high demands on cognitive resources that the perception of the partner's emotions (especially secondary ones, the content of which is less avail-

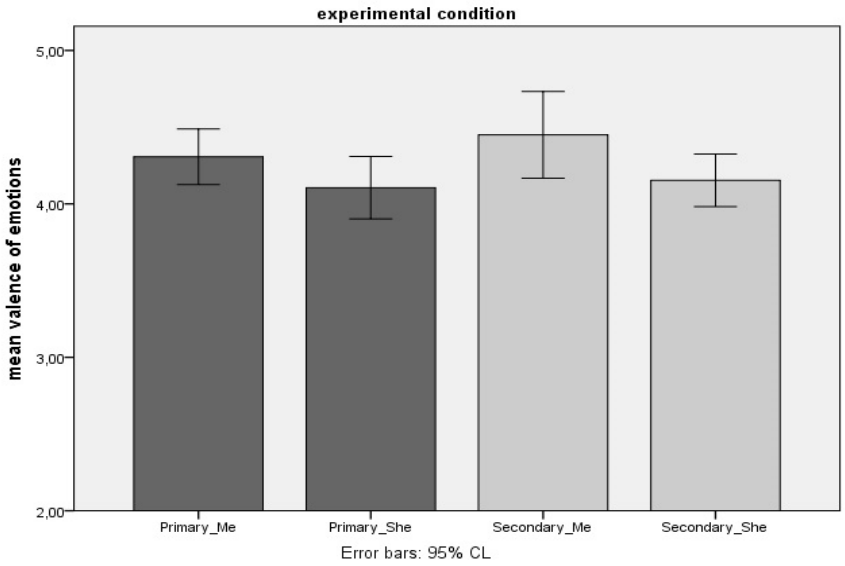

Figure 4 Mean valence of primary and secondary emotions attributed to the self and to the other in the experimental condition

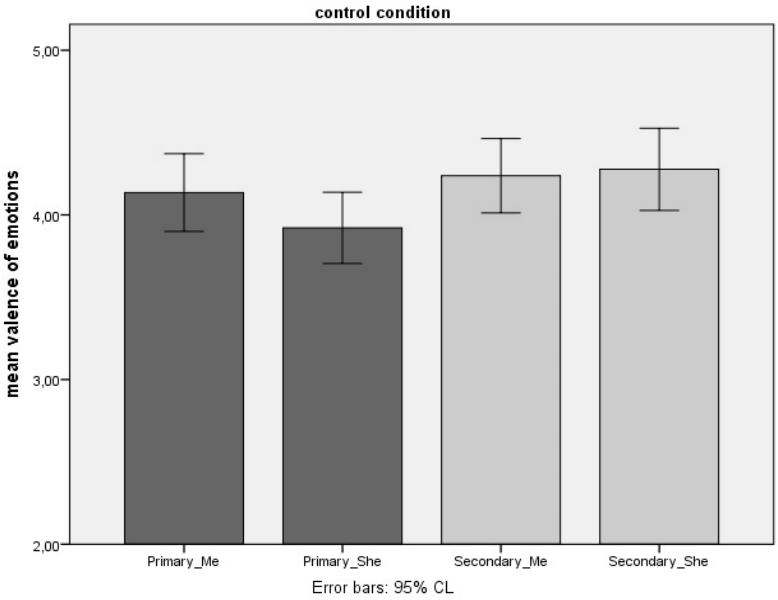

Figure 5 Mean valence of primary and secondary emotions attributed to the self and to the other in the control condition

able) was to a greater extent simplified and distorted. Thus, the presence of cognitive load can absorb available cognitive resources and disturb the processes of social cognition (reduce the ability to reflect more reflective forms of behavior). Limiting available cognitive resources decreases the chance of activating a reflective strategy that could overcome the automatic effects of infra-humanization. The results obtained are consistent with the research by Baumeister and colleagues (Baumeister, Vohs, & Tice, 2007), who showed that cognitive overload leads to a higher number of cognitive errors and increases the likelihood of falling prey to social influence traps.

No infra-humanization effect occurred under the control condition. There was no distortion between the perception of one's own and the other person's secondary emotions, which occurred in the experimental condition. However, there was a difference in the perception of primary emotions: The respondents attributed more primary emotions to themselves than to the other person.

It is worth recalling that such difference in perception of secondary emotions is the essence of the infra-humanization effect. The difference in the perception of primary emotions revealed under the control condition does not, therefore, change the basic interpretation of the obtained results. Rather, it indicates that in the context of freely available cognitive resources, the perception of another person changes not only within the scope of attribution of secondary, but also primary, emotions. There is a specific "humanization" of the other person, expressed not only in the lack of difference in the attribution of secondary emotions, but also in attributing to the other person less frequent experiencing of primary emotions. Freely available cognitive resources are conducive to building a more complex image of another person.

General Discussion

The findings from both studies are consistent and support the hypothesized relationships. The two experiments confirmed that spatial rotation required to assume the perspective of another person places demands on cognitive resources and, as a consequence, decreases cognitive task performance and affects the perception of others. The first study was mainly a replication to confirm the validity of a novel software-based method. The obtained results confirmed that the Bookshelf method can be used as an effective tool for cognitive resource overload manipulation. The findings from the second study suggest that the consequences of spatial perspective taking affect social attitudes by skewing the perception of other people's emotionality. Increased infra-humanization in the spatial perspective rotation condition indicates that a simplified and biased attribution of a poorer ability to experience uniquely human emotions to others may be cognitively determined. The overload of cognitive resources in the first task was found to undoubtedly intensify the infra-humanization effect. It confirms both the automatic and non-specific nature of the phenomenon, which, in this case, is not the result of a specific or generalized history of interactions. It is the effect of a limited opportunity to use complex, abstract concepts (secondary emotions) that play a key role in infra-humanization. The secondary emotions are of an abstract nature, and it was the development of the neocortex that made experiencing them possible. Hence, they constitute one of the attributes of humanity (Leyens, 2000). The complex and reflective nature of secondary emotions has been empirically proven by the findings that indicated that priming based on words related to such emotions increased the effectiveness of attention-processing con-

trol in Anti-saccade tests (Hallett, 1978) and mitigated the interference effect in the Stroop test (Imbir & Jarymowicz, 2013).

A change in spatial perspective requires attention focus: as a new, non-self-evident task, it may then generate certain deficits that are manifested in the availability and ease of operating abstract categories that actually define secondary emotions. The source of cognitive overload present in performing tasks requiring rotation of egocentric perspective was necessary, firstly, to inhibit the primal, egocentric response and then to modify it (Epley et al., 2004). The consequences of such cognitive resource mobilization were also evidently manifested in the second task, in the form of attributing simplified emotional characteristics to another person (in comparison to more accessible self-characteristics) (Markus, 1977). This confirms a certain inertia of cognitive processes and suggests that the availability of resources or attention allocation does not alter quickly from one task to the next. Adjustment takes time. These kinds of effects, which show increased manifestations of various automatisms caused by a prior overload of cognitive resources, have been confirmed in numerous studies (Brycz, 2004; Chen, Schechter, & Chaiken; 1996; Keysar, 2007; Lin, Keysar, & Epley, 2010; Brown-Schmidt, 2009; Wardlow, 2013). On the other hand, depletion of cognitive resources leads to activation of the automatic level of regulation, increases stereotyped functioning (Bargh, 1997/1999), is associated with relying on superficial arguments in constructing attitudes (Petty & Cacioppo, 1986; Johnson & Eagly, 1989) and amplifies preference for personal, self-related criteria of value judgments of others (Rutkowska & Szuster, 2011).

Lastly, there comes a question concerning the code through which perspective taking is activated. While the benefits of *social* perspective comprise stereotyped expressions reduction and enhancement of communication and negotiation efficacy (Galinsky, Maddux, Gilin, & White, 2008), the results of our research show that the *spatial* aspect of perspective taking has the opposite effect. In the studies that have demonstrated positive consequences of perspective taking, the social code was activated. Furthermore, there was a consistency between the activated code and the contents of the recorded attitudes. Priming cues referring to social perspective taking enhanced the availability of others, thereby generating a reflective information-processing mode. By contrast, the rotation of spatial perspective in the described research activated a different type of code, devoid of social content. It focused on the formal aspect of the perspective, the one not associated with social significance, and helped to activate simplified, categorical content.

The studies described have certain limitations. Firstly, we cannot rule out that a different task placing demands on cognitive resources without engaging perspective rotation would bring similar results. Therefore, the results gained may not be specific exclusively to spatial perspective taking.

Some questions concerning the type of errors made by the participants in the Bookshelf application may arise as well. There were two types of mistakes in the Bookshelf application: wrong shelf choice and wrong ball choice. While the first error includes mainly spatial rotation – as in a "mirror reflection" (which, as the experiment showed, was easier for the participants), the cognitive background for the second type of errors might be more complex. It may include processes such as rotating the perspective, deciding on the linear order of the balls (which one is the smallest/biggest) and taking into consideration the perceptive restrictions (hidden shelves). Our findings do not identify which of these processes is responsible for the ball errors. Additional experiments need to be conducted in order to make a definite conclusion.

There are also a few methodological issues that should be addressed in future research. The participants did not undergo a training session during the spatial perspective taking task, which could have influenced the difference between time reactions in the first and the second trial in the experimental condition. The design of the method was carefully drafted – two trials ensured that the cognition load effect would be a mere effect of the actual perspective taking, not a training effect. In future research it would be necessary to expand the paradigm with additional trials, so as to have a complete view of the perspective taking abilities and to measure the effect of learning.

Gender-specific effects should also be discussed here. The sample was not balanced across gender – there were more women than men. Longitudinal research has proven that girls in adolescence have higher levels of perspective taking than boys (Van der Graaf et al., 2014), which is consistent with the assumption that girls precede boys by about two years in intellectual and social cognitive functioning during adolescence (Silberman & Snarey, 1993). The effect of gender on perspective taking in adults is less clear, however – women score higher than men on self-reported empathy, but the results are not as reliable when a different measure is used (Eisenberg & Lennon, 1983). For future implications, it would be necessary to balance the sample across gender.

Undoubtedly, however, our findings revealed differences in the consequences of activating social versus spatial perspective taking in interpersonal situations and may serve as an important clue for researchers seeking factors that mitigate negative attitudes toward others.

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Studia Psychologica, Vol. 60, No. 4, 2018, 226-244 doi: 10.21909/sp.2018.04.764

Do Emotions Matter? The Relationship Between Math Anxiety, Trait Anxiety, and Problem Solving Ability

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In this study, we examined the relations between math anxiety, trait anxiety, and one's perceived problem solving ability on a sample of 128 university students. Participants completed a revised version of the Fennema-Sherman Mathematics Anxiety Scale, The State-Trait Anxiety Inventory, and the shortened version of Problem Solving Inventory. The results showed a moderate negative relationship between trait anxiety and individual's perceptions regarding his/her problem solving abilities. More specifically, we found that trait anxiety was negatively related to perceived self-confidence to solve problems and ability to self-control the emotions and behavior associated with the process of problem solving. However, it was not significantly associated with the tendency to avoid/approach problems. Finally, the perceived problem solving ability did not mediate the relationship between trait anxiety and math anxiety. Besides examining the effect of particular personality traits, we highlight the importance of further investigating the role of age and environmental and contextual factors, as well as the frequency and intensity of threatening math situations an individual faces in his/her life in regard to math anxiety.

Key words: problem solving, trait anxiety, math anxiety

Introduction

During studies, an individual has to face many stressful situations that are often associated with experiencing anxiety (Dowker, Sarkar, & Looi, 2016). Besides test anxiety (see Zeidner, 1988), there are some specific academic domains/subjects that trigger greater anxiety than others. Some studies show that one such domain is mathematics (Punaro & Reeve, 2012; Dowker, 2005; Wigfield & Meece, 1988). As Dowker, Sarkar, and Looi (2016) state, math anxiety can have a serious negative effect on mathematical learning and performance, because it causes avoidance of mathematics and overloads the working memory in mathematical tasks. Moreover, people exhibit math anxiety not only in the academic context, but also in everyday life when confronted with mathematical problem solving or situations where numerals have to be manipulated (Richardson & Suinn, 1972).

Although math anxiety and trait anxiety are distinct constructs, research shows that they are positively related (Hembree, 1990). Moreover, it has been shown that math anxiety affects performance in various cognitive tasks (Ashcraft, Kirk, & Hopko, 1998; Ashcraft & Rid-

Acknowledgements:
The paper was presented at the 38th STAR Conference: Stress, Anxiety, and Resilience: Challenges of the 21st Century, 5th-7th July, 2017, Hong Kong.
This work was supported by the grant agency VEGA no. 2/0116/15

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Received May 31, 2018

ley, 2005). A significant portion of research on math anxiety has focused on investigating its effect on problem solving. However, the majority of these studies examined only the problem solving performance on mathematical tasks (see Ashcraft, 1992 for a review). In these studies, math anxiety is often considered an independent factor affecting performance in mathematical problem tasks. However, Ashcraft and Rudig (2012) pointed out an important issue about research on math anxiety, and that is the problem of causality. They stated that we often do not know whether it is math anxiety that affects one's behavior, or it is the lower ability in mathematics that causes bad performance and subsequently triggers math anxiety. Considering this, we could assume that not just math anxiety affects problem solving, but also the individual's lower levels of problem solving abilities can lead to lower performance in math and be the antecedent of math anxiety. However, very little is known about the impact of general problem solving ability or problem solving style on the occurrence of math anxiety. This assumption can be supported by several studies, which indicated that problem solving ability was a significant predictor of psychological adjustment, or the ability to cope with stress and anxiety (see Heppner, Witty, & Dixon, 2004 for a review). Despite this assumption, based on the analysis of current relevant literature, the investigation of the relationship between an individual's general problem solving ability and math anxiety is not thoroughly researched.

In this study, we aim to investigate links between math anxiety, trait anxiety, and perceived problem solving ability. Since math anxiety is often associated with math avoidance (Turner et al., 2002) and also low self-confidence in mathematics (Hembree, 1990), our aim is to explore these factors as facets of general problem solving ability and investigate how they are associated with both math anxiety and trait anxiety.

Theoretical Background

The Definition and Consequences of Math Anxiety

Math anxiety can be defined as "a feeling of tension, apprehension, or fear that interferes with math performance" (Ashcraft, 2002; p. 181). Similarly, Fennema and Sherman (1976; p. 326) define math anxiety as "feelings of anxiety, dread, nervousness, and associated bodily symptoms related to doing mathematics". In their definition, Richardson and Suinn (1972), and Buckley and Ribordy (1982) highlighted that these negative feelings can be experienced not just during math courses or math testing, but also in many common everyday situations like reading a cash register receipt after the purchase or buying a math book. Similar to other types of anxiety, research on math anxiety shows that it impacts the individual's affect, behavior, cognition, and desires (the ABCDs of personality, see Wilt, Oehlberg, & Revelle, 2011).

Math Anxiety and Affect

The affective aspect of math anxiety is already stated in its definitions. Math anxiety is characterized as experiencing negative emotions of fear, tension, or nervousness. Considering standard diagnostic criteria (e.g., anxiety reactions, signs of elevated cognitive and physiological arousal, a learned situation- and stimulus-specific reaction, etc.), Faust (1992) claims that math anxiety could be perceived as a genuine phobia. Negative feelings are mostly triggered by situations that are perceived as threatening, such as new unfamiliar problems, overly complex problems, or situations where individuals perceive negative expectations (Onwuegbuzie & Wilson, 2003). Moreover, negative feelings are experienced also on a physiological level (Fennema & Sherman, 1976;

Faust, 1992). Pletzer et al. (2010) measured individuals' changes in cortisol level (stress hormone) and also math anxiety during statistics exams. They found that the majority of participants showed an increase in cortisol before the exams, and a decrease after the exams. Dogan (2010) discussed another factor that is tightly connected to individual's affectivity and that is self-confidence in relation to math anxiety. He claims that an individual's doubts about his own abilities not only limit him/her in acquiring the knowledge of the subject, but also lead to reluctance and discouragement from pursuing studies or jobs that require mathematical knowledge. The relation between self-confidence and math anxiety was also discussed by Ashcraft (2002), who stated that this relation shows to be strongly negative, ranging from -.47 to -.82. Finally, Hembree (1990) in his meta-analysis also found a strong negative relationship between math anxiety and self-confidence about math.

Previous studies showed that math anxiety is linked to several other forms of anxiety. Betz (1978), in her seminal work, found math anxiety to be positively associated with test anxiety and also trait anxiety. Dew, Galasi, and Galasi (1983) and Morsanyi, Busdraghi, and Primi (2014) found a positive relationship between math anxiety and test anxiety as well. Similarly, results of the meta-analysis of Hembree (1990) showed that math anxiety was associated with test anxiety, but it also correlated with state and trait anxiety, as well as general anxiety. All these relationships showed to be low-to-moderate, while the strongest association was reported between math and test anxiety. Although relatively high associations of math anxiety with other anxiety constructs were reported in previous studies, Dowker, Sarkar, and Looi (2016) highlight that math anxiety cannot be reduced only to test or general anxiety, because different measures of math anxiety correlate more strongly with each other than with test anxiety or general anxiety measures.

Math Anxiety and Cognition

Besides the affective dimension, math anxiety also affects individual's cognitions. Math anxiety was showed to be strongly related to mathematics achievement (Richardson & Suinn, 1972; Wigfield & Meece, 1988; Hembree, 1990; Ma, 1999; Zakaria & Nordin, 2008). The negative effect of math anxiety on math achievement was also reported in three meta-analyses (Hembree, 1990; Ma, 1999; Sad, Kis, Demir, & Özer, 2016). Moreover, this effect was reported across several age populations (Ma, 1999).

A significant number of studies on math anxiety investigated its effect on mathematical problem solving, or performance in math-related tasks (Maloney & Beilock, 2012). Yeo (2005) investigated the role of math anxiety in non-routine mathematical problem solving. He found a significant weak negative relationship between math anxiety and performance in these tasks. A very similar relationship was reported by Karasel, Ayda, & Tezer (2010). Novak and Tassel (2017) investigated the effect of math anxiety, working memory, spatial ability, and math attitudes on performance in geometry, word, and non-word problem solving. They found that the first three factors explained 62% of the variance in individuals' math performance, while math anxiety showed to be the highest negative predictor. In order to explain the negative association between math anxiety and performance in math-related tasks, several studies investigated the role of working memory in this relationship (Hitch, 1978; Fürst & Hitch, 2000; Ganley & Vasilyeva, 2014; Mattarella-Micke et al., 2011).

In a recent study of Ramirez et al. (2016), it was found that math anxiety was negatively related to the use of more advanced problem solving strategies, which in turn were related to an individual's math achievement. Moreover, Ramirez et al. (2016) found that this relationship

was the strongest mostly among individuals with the highest working memory capacity. According to Ashcraft (2002), negative feelings in highly math anxious individuals distract their attention from the task and overload their working memory. Since arithmetic and other math-related tasks are strongly affected by the working memory capacity, the disruption of working memory by math anxiety seriously impacts math performance. For instance, Ashcraft and Kirk (2001) found that highly math anxious individuals had reduced working memory capacity, which lead to the increase in reaction time and also to errors in math-related tasks.

Math Anxiety and Behavior

Both affective and cognitive consequences are tightly connected to one's behavior. In the literature, the mostly discussed behavioral consequence of math anxiety is math avoidance (Betz, 1978; Ashcraft, Kirk, & Hopko, 1998). As Ashcraft and Krause (2007) stated, math anxiety leads students to avoid taking mathematics classes, but also to avoid situations in which mathematics may be necessary. This tendency does not concern only avoiding math courses, or math testing, but also the reluctance to follow math-related studies and careers (Dogan, 2010; Ashcraft & Moore, 2009). Although from the perspective of others, math anxious individuals look like they are unmotivated, Covington (1992) states that, on the contrary, anxious individuals are actually very highly motivated, but this motivation occurs in order to avoid failure and not to learn mathematics. Even when math anxious individuals are in a situation requiring mathematical performance, they have tendencies to use the so called "local avoidance" strategy. Ashcraft (2002) describes this phenomenon as a certain tradeoff between speed and accuracy. With his colleagues, he found that highly-anxious individuals responded very rapidly to mathematical problems, sometimes as rapidly as individuals with low anxiety, but this speed was at the cost of accuracy. They stated that highly anxious individuals sacrifice accuracy (having more errors) in order to minimize the time and involvement in mathematics tasks.

Problem Solving Ability

We highlighted that math anxiety showed to be strongly related to avoidance behavior (e.g., Hembree, 1990). However, very little is known about whether this avoidant behavior is caused by math anxiety itself, or if it is driven by more general problem solving strategies. It is a well-researched finding that individuals vary in the degree to which they tend to approach or avoid problems and these tendencies are systematic (approach/avoidance coping strategies – see Roth & Cohen, 1986). Approach/avoidance strategies were thoroughly researched as a partial dimension of one's problem solving appraisal by Heppner and his colleagues (see Heppner, Witty, & Dixon, 2004 for review). The problem solving appraisal is defined as one's perception of his/her personal problem solving style and the identification of his abilities and skills to solve problems (D'Zurilla & Nezu, 2007). This construct consists of three dimensions: problem solving confidence (PSC), approach-avoidance style (AAS), and personal control (PC). The first dimension (PSC) is defined as a degree of certainty and self-assurance when facing a wide range of problems. It describes one's tendency to trust his/her own ability to solve problems. The second dimension (AAS) is describing a tendency to approach or avoid problems, and the third dimension (PC) is describing one's ability to control his/her emotions and behavior while facing problems (Heppner, Witty, & Dixon, 2004).

In general, problem solving ability helps to identify problems, find solutions, and cope with stressful everyday life situations through a cog-

nitive, affective, and behavioral process (D'Zurilla, Maydeu-Olivares, & Gallardo-Pujol, 2011). Additionally, many studies show that individuals having a positive appraisal of their problem solving ability are very likely to possess high problem solving skills (Heppner, Witty, & Dixon, 2004). Individuals with positive problem solving self-appraisal have also higher expectations of success in problem solving; they solve problems more systematically, and are more persistent when solving problems (Heppner, 1988).

The research on problem solving appraisal reported that low perceived problem solving ability is associated with psychological maladjustment (D'Zurilla & Goldfried, 1971; Heppner & Krauskopf, 1987), low adaptation to stress (Heppner & Baker, 1997), physical health problems (Heppner et al., 1987; Tracey et al., 1986) and perceived stress level, and most importantly, higher anxiety (Heppner, Kampa, & Brunning, 1987; Larson et al., 1990; Nezu, 1985, 1986; Sahin, Sahin, & Heppner, 1993; Tracey, Sherry, & Keitel, 1986; Carscaddon, Poston, & Sachs, 1988).

Problem Solving Ability and Math Anxiety

Although we already reported on several studies examining the relation between problem solving and math anxiety, these studies were mostly focused on mathematical task problem solving (Yeo, 2005; Karasel, Ayda, & Tezer, 2010; Novak & Tassel, 2017). Research examining the relationship of perceived problem solving ability, or systematic problem solving strategies and math anxiety is vastly missing in the literature. We found only two studies investigating this relationship (Akinsola, 2008; Murshidi, 1999). In the first study, Akinsola (2008) investigated math anxiety, math self-efficacy, locus of control, and study habits as predictors of perceived problem solving ability on a sample of in-service teachers. He found that these four constructs together contributed approx. 63% of the variance of perceived problem solving ability, while the math anxiety showed to be the strongest predictor. In the second study, Murshidi (1999) investigated the relationship between perceived problem solving ability (and its factors problem solving confidence, approach-avoidance style, and personal control) measured by PSI and math anxiety. The findings indicated a significant weak correlation between overall score in PSI and math anxiety. Moreover, the relationships between three problem solving sub-factors and math anxiety were significant but they were also weak, namely problem solving confidence (r = .019), approach-avoidance style (r = .07), and personal control (r = .26). The strength of these relationships indicated that math anxiety was associated more with the emotional facets of problem solving, while it did not associate with behavioral consequences of avoiding or approaching the problem.

Anxiety as a Personality Trait

A very important and influential development in the research on anxiety can be attributed to Spielberger, Gorsuch, and Lushene (1970), who have made a distinction between trait and state anxiety. According to their definition, the "*trait anxiety refers to relatively stable individual differences in anxiety proneness, that is, to differences between people in the tendency to respond to situations perceived as threatening...*" (Spielberger, Gorsuch, & Lushene, 1970, p. 2). High trait anxious individuals experience more frequent and more intensive anxiety compared to low trait anxiety individuals, but they are not anxious all the time. As Eysenck and Eysenck (1980) state, trait anxiety tends to moderate the level of state anxiety, which is triggered by situational demands. The State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) is one of the most widely used

measures of state and trait anxiety. Since the main aim of this study is to examine the relationships between trait anxiety, perceived problem solving ability, and math anxiety, the following section is limited to and focused on investigating studies on the relation between trait anxiety and problem solving ability, as well as math anxiety.

Trait Anxiety and Problem Solving Ability

In their review, Heppner, Witty, and Dixon (2004) reported eight studies discovering a negative association between one's perceived problem solving ability and trait anxiety. However, they concluded that most of these studies were made on white U.S. college students, suggesting a need for further research in this area.

The strength of the association between perceived problem solving ability and trait anxiety differs in the research, although most studies report a moderate relationship (e.g., Sahin, Sahin, & Heppner, 1993; Peng & Huang, 2014; Heppner et al., 2002). Perhaps the strongest association was reported by Kant, D'Zurilla, and Maydeu-Olivares (1997), who examined the relationship between trait anxiety and perceived problem solving ability using STAI and PSI measures. They found them to be negatively associated both in middle-aged and elderly samples (both correlations were $r = -.63$).

Although in general, problem solving ability significantly correlates with trait anxiety, research showed that different facets of problem solving ability differ in their relationship with trait anxiety. In their study, Davey et al. (1992) examined the relationships between trait anxiety and perceived problem solving ability measured by PSI. When examining the relationship between trait anxiety and individual factors of problem solving ability, they found trait anxiety to be significantly negatively correlated to problem solving confidence and personal control, with both of these relationships being moderate ($r = .49$, and $r = .55$, respectively). The relationship between trait anxiety and approach-avoidance style was not significant. Similarly, Heppner et al. (2002) examined three facets of PSI in relation to trait anxiety. They found a very similar relationships pattern as Davey et al. (1992) but the strengths were lower, namely a weak negative relationship between trait anxiety and perceived self-confidence ($r = .35$), as well as personal control ($r = .34$), and a non-significant relationship between trait anxiety and approach-avoidance style.

Another study, reporting similar findings about the relationship between trait anxiety and perceived problem solving ability measured by PSI, was proposed by Peng and Huang (2014). Like Heppner et al. (2002), they found a significant positive weak relationship between overall PSI score and trait anxiety ($r = .43$). Moreover, the trait anxiety was related mostly to problem solving confidence and personal control dimensions ($r = .46$, and $r = .44$, respectively), while the approach/avoidance style was very weakly related ($r = .24$).

Belzer, D'Zurilla, and Olivares (2002) examined the relationships between trait anxiety, problem solving ability, and worry, using a Social Problem Solving Inventory-Revised (Maydeu-Olivares & D'Zurilla, 1995) for measuring problem solving ability. They found that trait anxiety positively correlated with negative problem orientation ($r = .64$), impulsivity in applying problem solving skills ($r = .23$), and also avoidance style ($r = .37$). Moreover, it negatively correlated with positive problem orientation ($r = -.43$). These results suggest that individuals with high trait anxiety perceive problems as a threat and they tend to doubt their problem solving ability. Additionally, when solving a problem, they tend to be careless and impulsive, often procrastinate or wait for problems to resolve themselves, or shift the responsibility for problem solving to other individuals.

Trait Anxiety and Math Anxiety

In the study of Betz (1978), math anxiety positively correlated with trait anxiety. Similarly, Hembree (1990) in his meta-analysis reported a positive weak relationship between math anxiety and trait anxiety (r = .38). In a more recent study, Paechter et al. (2017) examined links between math anxiety, statistical anxiety and trait anxiety. They found that trait anxiety measured by STAI significantly predicted math anxiety. Trait anxiety together with grades in mathematics and gender explained approx. 37% of variance in math anxiety. When examining the relationship between trait anxiety and facets of math anxiety, Paechter et al. (2017) found a positive weak correlation with mathematics test anxiety (r = .33), positive very weak correlation with mathematics course anxiety (r = .18), and a non-significant relation with numerical task anxiety. Similarly to Paechter et al. (2017), McAuliffe and Trueblood (1986) also used STAI to measure trait anxiety and the Math Anxiety Rating Scale (MARS) to measure math anxiety. However, in this study, all three facets of math anxiety significantly positively correlated with trait anxiety, while all the relationships were weak, ranging from r = .41 to .44. In another study, Hopko, Mahadevan, Bare, and Hunt (2003) examined the relation between trait anxiety and math anxiety using two different measures of math anxiety (The Abbreviated Math Anxiety Scale – AMAS and Math Anxiety Rating Scale-Revised – MARS-R). In both of these measures, the relationship with trait anxiety showed to be significant positive and weak, ranging from r = .21 to .28. In addition to the above mentioned studies, reporting a positive association between trait anxiety and math anxiety, we found two studies which reported a non-significant relationship (Wu et al., 2012; Klados et al., 2015).

The Aim of this Study

In this study, we aim to investigate the relation between math anxiety, trait anxiety, and one's perceived problem solving ability. Although previous findings suggest that math anxiety, trait anxiety, and problem solving ability are closely linked to each other, from our analysis of literature, it seems that the relationships between these three constructs together have not been investigated yet. The following research questions are investigated:

- How does trait anxiety relate to the perceived problem solving ability, and mainly to personal self-confidence, approach-avoidance style, and personal control in problem solving?
- How does trait anxiety affect math anxiety?
- Does the perceived problem solving ability mediate the relation between trait anxiety and math anxiety?

To investigate the above research questions, we explore the relationship between trait anxiety and perceived problem solving ability, as well as its three facets. Moreover, we developed a mediation model of the relationship between trait anxiety, perceived problem solving and math anxiety.

Research on the relationship between trait anxiety and problem solving ability showed a negative association between these two constructs (Kant, D'Zurilla, & Maydeu-Olivares, 1997; Sahin, Sahin, & Heppner, 1993; Carscaddon, Poston & Sachs, 1988; Davey et al., 1992; Heppner et al., 2002). Moreover, it was found that trait anxiety relates mostly to perceived self-confidence and personal control in problem solving, while its relation with approach-avoidance style is weaker (Heppner et al., 2002; Davey et al., 1992; Peng & Huang, 2014). According to these findings we assume that:

H1 Trait anxiety is a significant predictor of perceived problem solving ability.

H2 There are negative moderate relationships of perceived-self-confidence and personal control facets with trait anxiety.

H3 There is a negative weak relationship between approach-avoidance style facet and trait anxiety.

Besides the negative relationship with perceived problem solving ability, the research on anxiety as a personality trait reported that this construct was positively related to math anxiety (Betz, 1978; Hembree, 1990; Paechter et al., 2017; McAuliffe & Trueblood, 1986; Hopko, Mahadevan, Bare, & Hunt, 2003). Moreover, research on math anxiety showed this construct to be negatively associated with problem solving ability (e.g., Yeo, 2005; Karasel, Ayda, & Tezer, 2010; Novak & Tassel, 2017). Most of these studies examined problem solving in mathematical tasks, where math anxiety acted as an independent predictor of this performance. However, as Ashcraft and Rudig (2012) stated, in the math anxiety research, very little is known about the causal mechanisms between the observed variables, i.e. we often do not know whether math anxiety causes a bad performance or math avoidance, or if it is the initially lower ability in mathematics that lead to lower math performance and subsequently to greater math anxiety. In the context of problem solving, this could mean that not just math anxiety affects the problem solving process, but also the initially lower level of one's general problem solving abilities can lead to lower math performance and thus systematically promote the creation and occurrence of math anxiety. We found two studies reporting a negative relationship between problem solving ability self-appraisal and math anxiety (Murshidi, 1999; Akinsola, 2008). Moreover, there are some studies suggesting that problem solving ability predicts anxiety in general (Heppner, Witty, & Dixon, 2004). According to these findings we assume that:

H4 Perceived problem solving ability will mediate the relationship between trait anxiety and math anxiety.

The mediation model of relationships between trait anxiety, perceived problem solving ability, and math anxiety is presented in Figure 1.

Method

Participants

The participants in this study were 128 undergraduate university students (93 females) attending psychology ($n = 49$) and social work studies ($n = 41$) at the Constantine the Philosopher's University in Nitra, Slovakia, and economic disciplines ($n = 38$) at the Slovak University of Agriculture in Nitra, Slovakia. The age of participants ranged from 18 to 39 ($AM =$

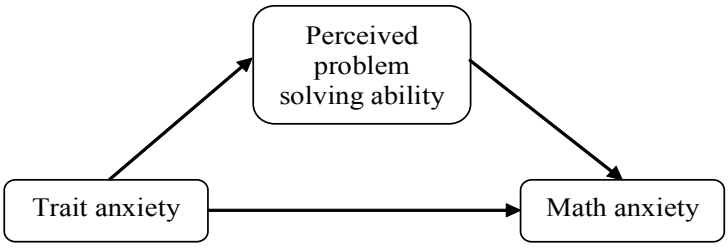


Figure 1 The mediation model

21.92; *SD* = 3.72). We used opportunity sampling, the participation was voluntary and no refusals were observed during data collecting. During their study, participants studying psychology and social work studies attended only few courses and lectures related to mathematics (only statistics). Participants studying economy had to use their mathematic skills in many lectures and courses during their study. They attended courses and lectures in mathematics, finance and currency, business economy, agriculture economics, statistics, basics of accounting, accounting for entrepreneurs, corporate finance, single entry accounting, costing and budgeting, financial and economic analysis.

Procedure

The data for this study was collected during a large group session after class periods. Before the data collection, participants were informed about the purpose of this study. Subsequently, they completed self-report measures in the following order: demographics, FSMAS-R, PSI, and STAI-X2. The data was collected using the pencil and paper method.

Measures

Math Anxiety

A revised version of the Fennema-Sherman Mathematics Anxiety Scale (FSMAS-R; Lim & Chapman, 2013) was used for measuring math anxiety. This scale consists of nine items with a two-factor structure – FS-EASE and FS-ANX subscales. Both of these subscales measure math anxiety, but they differ in wording – the first is negatively worded and the latter is positively worded. Recent studies showed that these two subscales indicated two distinct dimensions, although it looks like they are just opposing indicators of the same dimension (see Lim & Chapman, 2013). The scale contains items like: "*I usually don't worry about my ability to solve mathematics problems*", or "*My mind goes blank and I am unable to think clearly when working mathematics*". In our study, the internal consistency of this scale was very high (α = .904).

Trait Anxiety

We used the State/Trait Anxiety Inventory – Trait Form (STAI-T; Spielberger, Gorsuch, & Lushene, 1970) to measure trait anxiety. The Slovak version of this inventory was adapted by Müllner, Ruisel, and Farkaš (1980). The STAI-T consists of 20 items designed to measure an individual's longstanding proneness to anxiety, i.e. how individuals generally feel (anxiety as a personal trait). The inventory consists of items like: "*I worry too much over something that really doesn't matter*", or "*I take disappointments so keenly that I can't put them out of my mind*". Very similar to the FSMAS-R in our study, the internal consistency of this scale was very high (α = .907).

Perceived Problem Solving Ability

A shortened Slovak version of The Problem Solving Inventory (PSI; Heppner & Petersen, 1982) was used for measuring an individual's perceived problem solving ability. The original PSI is a 32-item self-report measure designed to assess individuals' perceptions of their problem solving ability and problem solving style. It consists of three factors: Problem Solving Confidence (PSC), Approach-Avoidance Style (AAS), and Personal Control (PC). The shortened Slovak version consists of 11 items (4 items for PSC and 4 items for AAS, and 3 items for PC). The scale contains items like: "*Given enough time and effort, I believe I can solve most problems that confront me* (PSC)", or "*When I have a problem, I think up as many*

possible ways to handle it as I can until I can't come up with any more ideas (AAS)". The previous confirmatory factor analysis showed a good model fit for the three-dimensional structure for this shortened version (Grežo & Sarmány-Schuller, 2018). The reliability test showed an acceptable internal consistency ($\alpha = .728$).

Data Analysis

The data was analyzed using SPSS software. Descriptive statistics were used to explore demographic characteristics of the research sample. Before examining the relationships between observed variables, we investigated whether our research samples differed significantly in these variables according to the field of study (psychology, social work, and economy). Since we did not find any significant differences in math anxiety, trait anxiety, or perceived problem solving ability in these three groups, we merged all participants into one group and conducted further analyses without regard to the field of study. Correlations of math anxiety, trait anxiety, and perceived problem solving ability were analyzed using Pearson's correlation test. Finally, the mediating effect of perceived problem solving ability on the relationship between trait anxiety and math anxiety was tested using Hayes' PROCESS macro for SPSS (see Hayes, 2013).

Results

Descriptive Statistics

Table 1 provides means and standard deviations for each measure used in this study and it also reports correlations between the observed variables. The level of all three main variables as well as their variances showed to be very similar compared to the values reported in previous studies (e.g., Paechter et al., 2017;

Table 1 *Descriptive statistics and correlations of study measures*

	PSI_OVRL	PSI_PSC	PSI_AAS	PSI_PS	MA	STAI
PSI_OVRL	1					
PSI_PSC	.767**	1				
PSI_AAS	.576**	.061	1			
PSI_PS	.806**	.615**	.133	1		
MA	-.013	-.009	.053	-.077	1	
STAI	-.473**	-.574**	.034	-.497**	-.090	1
AM	24.693	9.272	8.702	6.719	27.781	43.807
SD	4.137	1.873	2.013	1.916	8.786	9.316
Variance	17.117	3.509	4.052	3.673	77.199	86.794
Min	14	5	4	3	9	23
Max	34	13	15	11	43	69

Note. PSI_OVRL – Problem Solving Inventory overall score; PSI_PSC – Problem Solving Inventory personal control score; PSI_AAS – Problem Solving Inventory approach-avoidance score; PSI_PS – Problem Solving Inventory personal control score; MA – Math anxiety FSMAS-R score; STAI – State Trait Anxiety Inventory – Trait form score. Gender is partialled out of all correlations.

** $p < .01$

Heppner et al., 2002; Kourmousi, Xythali, Theologitou, & Koutras, 2016; Yeo, 2005; Peng, 2014), suggesting that, in general, our research sample exhibited normal and average values in math anxiety, trait anxiety and also perceived problem solving ability. In order to interpret the level of perceived problem solving ability, trait anxiety, and math anxiety of the research sample, it is helpful to analyze mean scores of variables. Table 1 indicates that mean scores of perceived problem solving ability and trait anxiety were under the mid-range values (2.81 and 6.19 points, respectively), while mean score of math anxiety was only slightly above the mid-range value (0.78 points) of the self-report scales used. Since some of the previous studies found significant gender differences in the perceived problem solving ability, trait anxiety, and also math anxiety, a series of independent sample *t*-tests were conducted with gender as a between-group variable for these measures. We did not find significant differences between men and women in PSI scores (overall, or any of the factors score), and trait anxiety. However, women reported significantly higher math anxiety overall score, and also both math anxiety factor scores compared to men. Therefore, we controlled for gender in all further analyses which included math anxiety scores.

Trait Anxiety as a Predictor of Perceived Problem Solving Ability

In order to examine whether trait anxiety predicts overall score and also scores of three factors of the perceived problem solving ability, simple linear regressions were performed. For each analysis, the trait anxiety score was entered as an independent variable. The first linear regression analysis showed that trait anxiety accounted for 22.5% of the variance in the perceived problem solving ability. The relationship between trait anxiety and perceived problem solving ability showed to be weak and negative (Table 2). When investigating the effect of trait anxiety on the three facets of the Problem Solving Inventory, we found that trait anxiety significantly predicted perceived self-confidence and personal control, explaining 33.2% and 24.7% of their variance, respectively. Analyses also showed that the relationships between the observed variables were negative and moderate, suggesting that the more anxiety one possesses, the lower perceived problem solving ability s/he has, and specifically, the lower self-confidence and personal control of emotions and behavior one experiences during problem solving. Finally, it was shown that trait anxiety did not significantly predict the approach-

Table 2 *Linear regressions showing the amount of variance in perceived problem solving ability explained by trait anxiety*

	β	R	R^2	d.f.	F
PSI_OVRL	.210	.473	.225	113	32.444**
PSI_PSC	.116	.576	.332	113	55.757**
PSI_AAS	-.008	.034	.001	113	.143
PSI_PC	.102	.497	.247	113	36.752**

Note. PSI_OVRL – Problem Solving Inventory overall score; PSI_PSC – Problem Solving Inventory personal control score; PSI_AAS – Problem Solving Inventory approach-avoidance score; PSI_PS – Problem Solving Inventory personal control score.
**p < .001

avoidance factor score, suggesting that trait anxiety does not affect whether one tends to avoid or approach problems (Table 2).

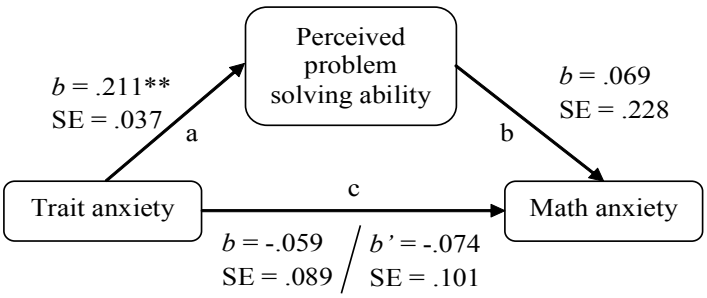
Perceived Problem Solving Ability as a Mediator of the Relationship between Trait Anxiety and Math Anxiety

In order to test the mediation effect of the perceived problem solving ability on the relationship between trait anxiety and math anxiety, a three-step regression analysis method was used (Baron & Kenny, 1986). In this method, three criteria have to be fulfilled to support the mediation model: 1) the independent variable must be a significant predictor of the mediator; 2) the independent variable must be a significant predictor of the dependent variable; and 3) the mediator must be a significant predictor of the dependent variable while the effect of the independent variable on the dependent variable must be lower than it was in the second step (Baron & Kenny, 1986). The results of the three-step regression analysis are reported in Figure 2. In the first step (path a), the trait anxiety showed to be a significant predictor of the perceived problem solving ability ($b = .211$; $t(112) = 5.696$; $p < .01$. In the second step (path c, Figure 2), the trait anxiety did not significantly predict math anxiety ($b = -.059$; $t(112) = -.668$; $p = .505$). Finally, in the third step (path b), the perceived problem solving ability did not significantly predict math anxiety ($b = .069$; $t(111) = .304$; $p < .762$). Moreover, in this step, the effect of trait anxiety was strengthened compared to the effect that was reported in the second analysis. Since the criteria of second and third step were violated, the mediation model was not supported and the perceived problem solving ability did not show to be a significant mediator of the relationship between trait anxiety and math anxiety. Moreover, it was found that not even trait anxiety significantly predicted math anxiety.

Discussion

The Relationship between Perceived Problem Solving Ability and Trait Anxiety

The results of this study support our hypothesis about the negative relationship between trait anxiety and perceived problem solving ability. Similar to most of the previous studies (Sahin, Sahin, & Heppner, 1993; Peng & Huang, 2014; Heppner et al., 2002), we found a moder-



Note. Figure shows unstandardized OLS regression coefficients; **$p < .01$.

Figure 2 Results of the mediation analysis

ate negative relationship between the overall perceived problem solving ability and trait anxiety. Additionally, we found that trait anxiety was negatively associated with perceived self-confidence and personal control factors of the perceived problem solving ability. This result supports our second hypothesis and it is also comparable with previous studies. Compared to our study, the most similar results about the relationship between trait anxiety and perceived problem solving ability factors were reported by Davey et al. (1992). They also found perceived self-confidence and personal control to be moderately related to trait anxiety and the strength of the relations was very similar to ours. In the study of Peng and Huang (2014), trait anxiety was also moderately associated with both perceived self-confidence and personal control, although the strength of associations was lower, compared to our results. However, our results do not support the third hypothesis about the weak association between approach-avoidance style facet and trait anxiety. In the study of Peng and Huang (2014), the relationship between trait anxiety and approach-avoidance style was found to be significant and weak. Similar significant weak association was reported by Heppner et al. (2002). Our results are consistent with those of Davey et al. (1992), who did not find a significant relationship between trait anxiety and approach-avoidance style. This inconsistency in the results concerning the relationship between trait anxiety and approach-avoidance style highlights the importance of further investigation of this area. In the previous research, perceived self-confidence and personal control factors of the shortened Slovak PSI version were strongly associated (Grežo & Sarmány-Schuller, 2018). In general, items in these two factors are more about one's emotional experiencing (e.g.: "*...I make snap judgments and later regret them; ...I become uneasy about my ability...; ...I am unsure whether I can handle the situation*"), while the approach-avoidance style is more about one's cognition and process of solving the problem (e.g., "*After I have solved a problem, I do not analyze what went right or what went wrong; I generally go with the first good idea...; When I have a problem, I think up as many possible ways to handle it as I can...*"). This overlap between perceived self-confidence and personal control, together with our results, could suggest that anxiety as a personality trait is mostly associated with the affective aspect of problem solving, i.e. the experiencing of doubts, uncertainty about one's own abilities, feelings of worry, fear, or regret about the results of problem solving.

The Independence of Math Anxiety

We assumed that the perceived problem solving ability would mediate the relationship between trait anxiety and math anxiety. However, the results of mediation analysis do not support this hypothesis. Although we found a significant effect of trait anxiety on the perceived problem solving ability, the effects of trait anxiety and also perceived problem solving ability on math anxiety were not significant. This result suggests that trait anxiety does not directly affect the amount of negative feelings experienced during math related tasks and situations, nor does trait anxiety lead to lower perceived problem solving ability, which in turn results in higher levels of math anxiety. Perhaps the most unexpected result of this study was that trait anxiety did not significantly correlate with math anxiety. This result is not in line with the majority of previous studies investigating this relationship (Betz, 1978; Hembree, 1990; Paechter, 2017; McAuliffe & Trueblood, 1986; Hopko, Mahadevan, Bare, & Hunt, 2003). We found two studies which did not find a significant relationship between trait anxiety and math anxiety but these studies differed from those reported above (Wu et al., 2012; Klados et al., 2015). In

the first study of Klados et al. (2015), the research sample consisted of a very small number of participants, which could affect the significance level of correlation between trait anxiety and math anxiety. In the second study, Wu et al. (2012) used their own method for measuring math anxiety. This method was created on the basis of the widely used MARS and MARS-E measures, but it was adapted for children who were in the early stages of math learning. To be able to compare the results from this modified method and other widely used measures (e.g., AMAS, MARS), it would require an initial testing whether/to what extent these different measures correlate and how they differ in their internal structures. Moreover, for measuring trait anxiety, Wu et al. (2012) did not use any of the widely used measures (e.g., STAI), but only an Anxiety Problems subscale of Child Behavior Checklist (Achenbach, 1991). This could be insufficient, since in this scale anxiety and depression items are not separated and are perceived as a part of the same continuum of problems (Wadsworth, Hudziak, Heath, & Achenbach, 2001).

Explaining a Non-Significant Relationship between Math Anxiety and Trait Anxiety

Although our mediation model was not supported, our results suggest that trait anxiety and math anxiety are clearly distinct and different constructs. When interpreting a non-significant relationship between math anxiety and trait anxiety, we checked for the level and variability of our variables and compared them with previous studies. However, we did not find any significant differences between our sample and the samples of other studies. The mean score and variability of trait anxiety differed negligibly, compared to studies of Paechter et al. (2017), Heppner et al. (2002) and Yeo (2005). We also did not find any significant differences in mean scores and variability of perceived problem solving and math anxiety, compared to previous studies (Kourmousi, Xythali, Theologitou, & Koutras, 2016; Heppner et al., 2002; Yeo, 2005; Peng, 2014; Novak & Tassel, 2017).

Although the level and variability of our variables did not explain a non-significant effect of trait anxiety on math anxiety in our study, there were several important differences between our and previous studies that could be important. Compared to trait anxiety, math anxiety seems to be a more complex construct that is affected by many different factors. These factors could be not just personality traits (e.g., trait anxiety) but also environmental and contextual factors. As Akinsola (2008) stated, they can be divided into three areas: environmental, intellectual, and personality factors. Environmental factors include parental pressure, insensitive teacher, non-participatory classrooms, and negative experiences with mathematics in the classroom. Intellectual factors include student attitudes toward mathematics, self-doubt and lack of confidence in one's abilities, and lack of perceived usefulness of mathematics. Finally, personality factors include reluctance to ask questions due to shyness, low self-esteem, or viewing mathematics as a male domain (Akinsola, 2008). Moreover, very important aspects affecting math anxiety include exposure to people's negative attitudes toward mathematics, experiencing failures or the threat of mathematics (Dowker, Sarkar, & Looi, 2016). Taking this into account, a very important aspect could be that our participants were university students of humanities. The majority of our sample were students of psychology and social work, who do not attend any math courses and they are not in contact with mathematics to a great extent. During their studies, they face math-related situations or tasks very rarely, therefore do not experience any failures or threat of mathematics. Moreover, their study success and self-image does not depend on their math ability. Another important aspect could be the age of

an individual. The majority of studies on math anxiety were conducted on primary and secondary school students. As Dowker, Sarkar, and Looi (2016) pointed out, during this period math anxiety is deteriorating and mostly escalating during adolescence. This can be caused by both greater demands for mathematics abilities (math is getting harder) and more sensitivity to anxiety in general in adolescence. Even though individuals in our study might experience various types of anxieties during their study, compared to the primary and secondary school-aged students they could not experience math anxiety in such great extent. This could lead to the importance of investigating the role of age in math anxiety, i.e. how math anxiety differs as a function of age and whether the relationship between trait anxiety and math anxiety differs across different age categories. Since there is an absence of studies on math anxiety conducted on middle-aged or older adults, we emphasize the need for conducting such research. Additionally, we can assume that the important aspect of the relationship between trait anxiety and math anxiety could be the amount of math-related situations and tasks one is exposed to. Since most of the studies investigate math anxiety on primary and secondary school students who study mathematics, very little is known whether math anxiety tends to disappear when these individuals no longer study math and are no longer exposed to math-related situations (e.g., math courses, doing math in front of classmates, math tests, math-related careers), i.e. they do not experience state math anxiety. The importance of properly distinguishing between math anxiety, as a relatively stable personality trait and as a current state that is more dependent on contextual and environmental factors, was already highlighted in a recent study of Roos et al. (2015). Translating our assumption into this context, the trait math anxiety could determine the amount of experienced state math anxiety, but also, the higher/lower number of math-anxious states or situations one experiences could foster/suppress the amount of one's trait math anxiety. However, since the issue of causality pointed out by Ashcraft and Rudig (2012) significantly limits the research on math anxiety, it could be difficult to investigate this assumption.

Study Limitations and Directions for Future Research

Despite this negative effect of trait anxiety on emotional experiencing during problem solving, our results also suggest that trait anxiety does not affect how an individual tackles the problem and what strategies s/he is using in the process of problem solving. Although higher trait anxious individuals experience more doubts, worry or fear about their abilities or the result of problem solving, they do not tend to avoid solving the problem, they search for various alternative solutions, and also monitor whether the solution was correct, similarly to lower trait anxious individuals. However, as we stated before, some studies found a significant association between trait anxiety and approach-avoidance factor of the perceived problem solving ability (Peng & Huang, 2014; Heppner et al., 2002). Therefore, we highlight the importance of further investigation of these two constructs. We propose examining individual differences in other related constructs, such as approach-avoidance coping strategies (Roth & Cohen, 1986), which could further explain the relation between trait anxiety and approach-avoidance problem solving style. Additionally, using real problem solving tasks, and not just self-report scales, could help to understand the effect of trait anxiety on one's approach-avoidance tendencies. In this study, and also in the above discussed studies on the perceived problem solving ability (Sahin, Sahin, & Heppner, 1993; Peng & Huang, 2014; Heppner et al., 2002; Davey et al., 1992), this aspect is missing. Butler and

Meichenbaum (1981) argue that one's self-perception of his/her own problem solving abilities strongly affect not just the real objective problem solving performance, but also the process of solving a problem. We highlight the importance of distinguishing and using both objective problem solving abilities, measured in problem solving performance tasks, and perceived problem solving ability based on a self-report scales in the future research.

Another missing aspect in this study is the deeper observation of the amount of math experience participants had and how many math related situations they encounter in their everyday life. Since our study sample consisted of university students, we possessed only information about what math related courses they attended during their study. Although our samples (psychology, sociology, and economy) differed significantly in the amount of attended courses related to math, they did not significantly differ in math anxiety score. However, as we stated before, math anxiety can be experienced not just during math courses or lectures, but also in math related everyday situations such as reading a cash register receipt (Richardson & Suinn, 1972; Buckley & Ribordy, 1982). A deeper observation of one's behavior in everyday math related situations as well as the frequency and intensity of threatening math situations an individual faces in his/her everyday life could further explain the inconsistent findings about the relationship between math anxiety and trait anxiety.

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Studia Psychologica, Vol. 60, No. 4, 2018, 245-258 doi: 10.21909/sp.2018.04.765

Differences in the Effects of Summarizing Skills Training by 4th Grade Students

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The study presents the effects of a 6-month intervention program for training students in using summarizing skills by informational texts. A total of 114 4th grade students and 5 of their teachers, who implemented the program, participated in the experimental group (EG), 76 students were in the control group (CG). We examined the students' skill of summarizing with a pre-, post- and a follow-up test. All students were divided into four groups according to their general reading competency (GRC) at pre-test: struggling, at-risk, average and good readers. We found: 1) important progress in summarizing by all groups of readers (EG and CG), with a more extensive progress made by readers in the EG; 2) stable proficiency differences between students in summarizing in general and in the elements of the summary (main ideas and coherence of text). The implications for further research and practice are discussed.

Key words: summarizing, differences between students, informational texts, intervention

Introduction

During the first years of schooling, students acquire basic reading skills (reading fluency and vocabulary), which enable good reading comprehension. In upper primary school, they start encountering informational texts in their textbooks, from which they are supposed to learn. According to the learning standards for the 4th and the 5th grade in many countries, students should be able to find important information in texts and summarize it (e.g., Common Core State Standards, 2014; Curriculum for the Slovene language, 2011). With regard to these standards, summarizing is one of the most effective strategies students can use.

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Received April 17, 2018

Summarizing and Differences Between Students

Summarizing strategy is a learning strategy, by which students find important information in a text and combine it into a short, coherent text – summary. To be able to do this, students have to analyze each of the sentences/paragraphs, search for important words, leave out the unimportant or specific information and then gather the important information into a whole that makes sense (Westby, Culatta, Lawrence, & Hall-Kenyon, 2010). The research findings by Kintsch (1974), and Kintsch and van Dijk (1978) offer a good foundation for understanding the summarizing process. Authors propose that each text comprises information on three levels: the most important statements are on the first level (i.e., macrostructures), statements with more details are on the second level and statements with the most details are on the third level (i.e., microstructures). They describe three processes, which are involved

in summarizing – deletion (unimportant and redundant information), generalization (using more general concepts) and integration into a joint general statement.

Despite the fact that students often have to use summarizing in their schoolwork, this is a very demanding strategy for younger students (aged 9 to 10 years). There are large (inter)individual differences in students' ability to summarize. Most of them use copy-delete strategy when making a summary (Brown, Day, & Jones, 1983; Reading Quest Organization, 2017) – they read sentence by sentence and decide whether to include each into a summary or not. If they decide to include a sentence, they almost literally copy it from the text.

Summarizing and Reading Abilities

The most important factor of making a quality summary is *reading comprehension*. In younger students, this is a multiplicative function between decoding and linguistic comprehension, which involves lexical information and deriving text representation from it. This points out "that neither decoding nor linguistic comprehension is sufficient by itself, but that good reading comprehension requires both skills" (Schwanenflugel & Flanagan Krapp, 2016, p. 168). Therefore, good reading comprehension as a prerequisite for summarizing is facilitated by automatized decoding skill and well developed vocabulary. Similarly, Cromley and Azevedo (2007) describe reading comprehension as a function of prior knowledge, fluency, vocabulary, strategies and inferences. The authors propose that reading fluency and prior knowledge influence reading comprehension directly and indirectly (through vocabulary) and that reading strategies support the processes of inferring, which enable comprehension.

On account of the proposed interactive impact of different factors on reading comprehension as the base for learning how to summarize, we combined reading fluency, vocabulary and general reading comprehension into a composite variable of GRC (see Current study and Instruments).

Differences in Reading Comprehension and Summarizing

The basic variable that differentiates students in their reading comprehension is their mastery of automatized *decoding*, which is demonstrated through reading fluency (McKenna & Stahl, 2003; Nunes, Bryant, & Barros, 2012). Students, who use most of their working memory attention for decoding, have a poorer understanding of the material they read (Hintze, Mathews, Williams, & Tobin, 2002). Research shows that reading fluency is more connected with reading comprehension of 3rd and 4th grade students, whereas 5th-graders are already able to use the context to help them understand the reading material (Saarnio, Oka, & Paris, 1990).

Reading vocabulary also affects reading comprehension in upper primary school. It has a moderate direct effect on 4th (Quellette, 2006) and 5th (Pečjak, Podlesek, & Pirc, 2009) grade students' reading comprehension. In addition, by facilitating the process of decoding (Yap, Balota, Sibley, & Ratcliff, 2012) and increasing reading fluency (Nouwens, Groen, & Verhoeven, 2015), the effect is also indirect. Larger vocabulary enables readers to decipher the meaning of individual paragraphs or sentences faster (Nation, 2004).

However, there are differences between students in reading variables, which represent the foundation for summarizing, e.g., PIRLS, 2016 (Mullis, Martin, Foy, & Hooper, 2017). From primary to upper primary school, these inter-individual differences are demonstrated in three patterns (Pfost, Hattie, Doerfler, & Artelt, 2014): 1) inter-individual differences increase during

schooling – i.e. Matthew effect (Stanovich, 2000); 2) differences decrease – students with lower reading achievement compensate for certain deficits in reading; 3) reading achievement of all students increases, yet differences between students at the starting point remain in higher grades.

In longitudinal research (Aarnoutse, Van Leeuwe, Voeten, & Oud, 2001; Baumert, Nagy, & Lehmann, 2012), authors found high stability of inter-individual differences in reading between students, which lead to numerous intervention programs with the intention of improving fundamental reading skills (decoding, vocabulary) as well as programs to improve comprehension (Schwanenflugel & Flanagan Knapp, 2016). In designing our intervention program, we wanted to address the differences in students' fundamental reading skills, which were often ignored in traditional reading research (Paris, 2005).

Current Study

Summarizing proved to improve students' reading achievement significantly in programs, where it was used in a combination with other strategies (e.g., Reciprocal teaching; Palinscar & Brown, 1984); a part of cognitive and/or metacognitive strategies (e.g., McKown & Barnett, 2007); motivational strategies (e.g., CORI program; Guthrie et al., 2004). However, it is difficult to define the "pure" contribution of summarizing to final reading achievement due to simultaneous training of other strategies in the program. By focusing only on training students in summarizing as an independent strategy, we were able to do so.

In line with Suggate's (2016) recommendation »that reading interventions generally benefit all readers, although research is needed investigating effects at a more long-term follow-up to test whether and how different readers respond to reading intervention« (p. 78), we used a follow-up test. Intervention studies usually report about the following groups of students: 1) normal readers, 2) at-risk readers (reading below the 50th percentile), 3) low-performing readers (reading below the 25th percentile and 4) disabled readers (reading below 10th percentile or those who have been diagnosed as having reading – IQ discrepancy of one standard deviation) (Suggate, 2016). In our study, we assessed students' reading decoding, vocabulary and comprehension before the intervention. As researchers suggest (Paris, 2005; Riddle Buly & Valencia, 2002), we combined these variables into a composite variable of GRC and divided students into quartile groups, according to their GRC: 1) Q_1 group with students' GRC below 25th percentile ("struggling readers"); 2) Q_2 group with GRC between 25th and 50th percentile ("at risk readers"); 3) Q_3 group with GRC between 50th and 75th percentile ("average readers") and 4) Q_4 group with GRC above 75th percentile ("good readers"). We were interested in the progress of individual groups of students after the intervention program, in their developmental pattern, and in the long-term effect of the intervention. Our study was based on the following assumptions:

First, all groups of students in the EG and in the CG will make progress in summarizing and will be able to create summaries with better quality at the end of the school year, compared to the time before the intervention. We expected more extensive progress of students in the EG after the program, with larger long-term training effects and stable proficiency differences between all groups of readers in summarizing. Namely, we designed the program to be helpful to all students and the teachers trained the whole classroom in summarizing.

Second, we assumed that students with better GRC (average and good readers) in the EG would make a more extensive progress in the program – we predicted the Mathew effect. There were two reasons for this assumption:

1) summarizing is a demanding thinking strategy, which predisposes an individual to gain the ability to separate important from unimportant information and to organize important information into sentences coherently and 2) GRC proved to be an important predictor of summarizing achievement (Pečjak & Pirc, 2018).

Method

Participants

In a convenient sample (teachers were directly invited to cooperate voluntarily), 190 4th grade students from eight Slovenian public schools participated, 114 in the EG (60%) and 76 (40%) in the CG. In the EG, there were 50.9% boys and 49.1% girls and 5 of their teachers; in the CG there were 51.3% boys and 48.7% girls. The average age of students at the beginning of the intervention in both groups was the same (9.27 years; SD = 0.31). All students had Slovene nationality, there were no students with special needs or language deficiencies involved, families' SES was not gathered.

Students in the EG and in the CG were divided into four groups according to significant differences in their GRC: struggling, at-risk, normal and good readers. In EG $F(3) = 318.05$, $p < .001$, $\eta^2 = .897$ and in CG $F(3) = 175.064$, $p < .001$, $\eta^2 = .879$.

Instruments

We used the Reading test (Pečjak, Potočnik, & Podlesek, 2011) and the Vocabulay test (Hershel, 1963) for evaluating the students' GRC. The Reading test comprises two subtests: Reading fluency and Reading comprehension. In Reading fluency (25 items, maximum score 25 points; Cronbach's $\alpha = .92$), students fill in the missing words by choosing from the four provided words to complete the sentence meaningfully. In Reading comprehension, students read five short texts and answer 20 multiple-choice questions (maximum 20 points, $\alpha = .85$). Test of Reading (Level 3 – Elementary Form) from the Herschel's Vocabulary test (1963) was translated and adapted into the Slovenian language (Toličič & Zorman, 1977). Students answer 20 questions by selecting the right word from a choice of five words (maximum 20 points, $\alpha = .88$). We combined the results from both tests into a composite variable of GRC, representing the sum of all possible scores from both instruments with a maximum of 75 points.

We assessed summarizing three times: before the intervention (pre-test – Summarizing_1), after the six month intervention (post-test – Summarizing_2) and three months after the intervention finished (follow-up test – Summarizing_3). In the pre-test and in the follow-up test we used three short informational text excerpts from science and social textbooks (from 99 to 120 words). After reading each text, students had to write a summary. We evaluated the summaries according to the adapted version of Friend's criteria (2001): 1) amount of important information in the summary (each text comprised three semantic units, representing important information in the text; the total score for all three texts was 9 points); 2) coherence of the summary (students connected the sentences in a meaningful way or not) – students did not receive any points if the summary was incoherent; 0.5 point for a partly coherent summary and 1 point for a coherent summary (the total score was 3 points); 3) title of the text (0 points for inappropriate; 0.5 points for partly appropriate and 1 point for appropriate title; the total score was 3 points). For Summarizing_1 and Summarizing_3, the total score from all three texts was 15 points. In Summarizing_2, we used one longer text with 237 words. Our aim was to determine whether the students would be able to use the learned summarizing strategy in a different context as

well – in a longer text. We evaluated these summaries by the same criteria – maximum 9 points for important ideas, 1 point maximum for coherence and 1 point maximum for the title; maximum 11 points total.

Two independent reviewers assessed the students' summaries. If their scores differed, they had to reach consensus – they discussed the differences in a meeting until a score they agreed upon was accepted. Internal consistency of the reviewers before the meeting was .86 for Summarizing_1, .87 for Summarizing_2 and .88 for Summarizing_3.

Description of the Intervention Program

The six-month intervention program was developed by the authors, based on previously designed similar programs (e.g., Guthrie et al., 2004; McKown & Barnett, 2007). It had two parts. The first part consisted of a two-month intensive training, including 14 sessions (14 texts), which took place two times a week for 30 minutes. Teachers received manuals, in which the schedule of contents was exactly described. Texts prepared in advance for the first two months of training were also included. Students were supplied with workbooks including short informational texts (50 – 170 words). The purpose of this part of the training was to teach the students how to use summarizing gradually. Therefore, teachers trained their students in: 1) finding important information in the texts; 2) marking the main ideas; 3) meaningfully connecting the important ideas into 1–2 sentences (summary). Teachers explicitly modeled what had to be done and guided each student in his/her work with regular feedback about the appropriateness of his/her summary.

The second part was less intensive and lasted for four months. In this part, students used their newly developed summarizing skills by working with texts from their textbooks (20 texts). The main goal was that students consolidate the skills of summarizing by using them in texts, which they encounter in their regular lessons. Hence, teachers used longer texts (2–3 paragraphs) from required science or social studies textbooks, referring to the subjects they were involved with at the time. These lessons took place 1–2 times a week and students processed the texts the same way as they did during the first two months of the intensive training. However, in this phase of the program, teachers guided students mostly by frontal feedback and only occasionally supervised independent practice of individual students or pairs of students. For each lesson of both parts of the training, we defined the goals and didactic methods. Both parts took place during regular school hours.

Teachers, who taught the EG of students, attended a one-day training, in which they were thoroughly acquainted with the content and the course of the implementation of the intervention program. They also took part in a workshop, in which we simulated the training of using summarizing strategy by the students. The purpose of the training was to achieve the most standardized implementation of our program as possible.

The authors met the teachers after the first part of the intervention was finished and again at the end of the program. In these meetings, teachers provided feedback about the course of the implementation of the program.

Data Collection

After the schools agreed to take part in our study, we gathered the parents' written consents for their children to participate. In each classroom, data collection took place during regular school hours three times: in November 2016 (pre-test), in June 2017 (post-test) and in September 2017 (follow-up test).

Results

GRC in the EG and in the CG before Intervention

First, we examined, whether individual groups of readers in the EG and in the CG were comparable in their results of GRC before the intervention (Table 1). Distribution of GRC was normal in the EG (M = 35.18; SD = 12.59; min = 11.00; max = 62.00; $Skewness$ = 0.25; $Kurtosis$ = -0.59) as well as in the CG (M = 38.42; SD = 11.38; min = 10.00; max = 60.00; $Skewness$ = -0.30; $Kurtosis$ = -0.48). There were no significant differences between the EG and the CG of students in GRC before the intervention $t(188) = -1.80$; $p = 0.073$, the effect size was small (d = .25).

The results show no significant differences in GRC in any of the groups of readers between EG and CG before the intervention. The effect sizes were small (Richardson, 2011), which indicates that all groups of readers in the EG and in the CG were comparable in reading competency at pre-test.

EG and CG Students' Progress in Summarizing

First, we evaluated students' achievement in summarizing at pre-test (Summ_1) and at the follow-up test (Summ_ 3) in the EG and in the CG, because the results were directly comparable due to the use of similar instruments (Table 2). Then we examined the progress different groups of readers made in both groups from pre-test to the follow-up test (Table 3).

It is evident from Table 2 that there were no significant differences in summarizing in any of the groups of readers in the EG and in the CG before the intervention (at pre-test, Summ_1). There were also no significant differences between groups of struggling and at-risk readers in the EG and in the CG at the follow-up test (Summ_3). However, with 7.4% risk rate in the group of average readers and with 8.1% risk rate in the group of good readers, the results show significantly better achievement of these groups of readers in the EG.

Table 3 shows that struggling readers in the EG and in the CG made significant progress from pre- to the follow-up test. However, there were no significant differences between both groups in summarizing achievement at any measurement time (Table 2), with small effect sizes between the groups (Richardson, 2011). In the group of at-risk readers, there were no significant differences in summarizing before the intervention program, but at-risk readers in the EG made significant progress compared to the same group in the CG, with regard to the results in summarizing before the intervention.

Table 1 *Descriptive statistics and ANOVAs for GRC for each group of readers with regard to EG and CG*

Groups of readers		*N*	*M*	*SD*	*F*	*df*	*p*	η^2
Q1 - struggling	EG	29	19.55	4.05	0.547	1	.464	.013
	CG	13	20.61	4.86				
Q2 - at-risk	EG	28	30.68	2.33	0.155	1	.696	.067
	CG	13	31.00	2.64				
Q3 - average	EG	30	39.03	2.89	0.169	1	.683	.003
	CG	22	38.68	3.24				
Q4 - good	EG	27	52.37	6.20	2.745	1	.103	.049
	CG	28	49.93	4.65				

Note. η^2 – effect sizes

There were no significant differences between the groups of average and good readers in the EG and in the CG before the intervention (Table 2). However, at the follow-up test, average readers in the EG and good readers in the CG made significant progress.

In the next step, we examined students' achievement in summarizing a longer text at the end of the intervention program (post-test, Summ_2). Our goal was to investigate if students were able to make a transfer of the learned summarizing skill and use it in a new situation (Table 4).

It is apparent from Table 4, that the better the readers (in the EG as well as in the CG) the higher their achievement in summarizing a longer text.

Table 2 *Descriptive statistics and MANOVAs for Summarizing 1 and 3 with regard to different groups of readers*

Groups of readers			*N*	*M*	*SD*	*F*	*df*	*p*	partial η^2
Q1 - struggling	Summ_1	EG	27	3.83	2.92	0.084	1	.774	.002
		CG	10	4.15	3.04				
	Summ_3	EG	27	6.57	2.65	0.163	1	.689	.005
		CG	10	6.15	3.32				
Q2 - at-risk	Summ_1	EG	23	6.43	2.36	0.211	1	.649	.006
		CG	12	6.04	2.47				
	Summ_3	EG	23	8.06	2.00	0.596	1	.445	.018
		CG	12	7.42	2.94				
Q3 - average	Summ_1	EG	25	7.00	3.00	1.173	1	.285	.028
		CG	18	7.97	2.76				
	Summ_3	EG	25	9.00	2.17	3.356	1	.074	.076
		CG	18	7.58	2.91				
Q4 - good	Summ_1	EG	23	9.19	2.81	2.459	1	.124	.050
		CG	26	7.85	3.16				
	Summ_3	EG	23	10.21	1.83	3.185	1	.081	.063
		CG	26	9.10	2.47				

Note. partial η^2 – effect sizes.

Table 3 *Differences between pre- and follow-up test of summarizing in groups of readers from EG and CG*

Groups of readers		Summ3_1	
		t(*df*)	*p*
Q1 - struggling	EG	4.256(26)	.000***
	CG	2.469(9)	.036*
Q2 – at risk	EG	3.347(25)	.003**
	CG	1.658(11)	.125
Q3 – average	EG	3.103(24)	.005**
	CG	-0.483(19)	.635
Q4 - good	EG	1.403(22)	.174
	CG	2.627(25)	.014*

Note. $p < .05$*; $p < .01$**; $p < .001$***

The results also show that students from all groups of readers in the EG made better summaries than their peers from these groups in the CG. The summarizing achievement of at-risk, average and good readers in the EG was significantly higher than the achievement of students from these groups in the CG and the effect sizes were moderate (Richardson, 2011).

Progress of Groups of Readers in the EG with Regard to Summarizing Elements

In general, we found larger progress in summarizing achievement in the quartile groups of readers in the EG. Thus, we were interested in defining how the key elements of a good sum-

Table 4 *Descriptive statistics and ANOVAs for Summarizing 2 with regard to different groups of readers*

Groups of readers		*N*	*M*	*SD*	*F*	*df*	*p*	partial η^2
Q1 - struggling	EG	29	4.34	2.15	0.079	1	.780	.002
	CG	13	4.12	3.00				
Q2 - at-risk	EG	25	5.46	2.68	5.195	1	.029*	.126
	CG	13	3.46	2.31				
Q3 – average	EG	29	6.45	2.00	6.916	1	.012*	.128
	CG	20	4.70	2.66				
Q4 - good	EG	27	8.13	2.01	16.711	1	.000***	.243
	CG	27	6.09	1.63				

Note. $p < .05$*; $p < .01$**; $p < .001$***; partial η^2 – effect sizes.

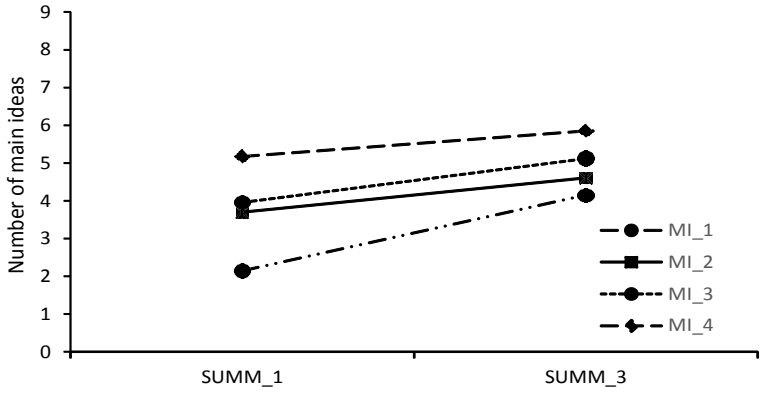

Figure 1 The average number of main ideas in summaries for individual groups of readers. MI_1(2, 3, 4) – number of main ideas in Q1(Q2, Q3, Q4).

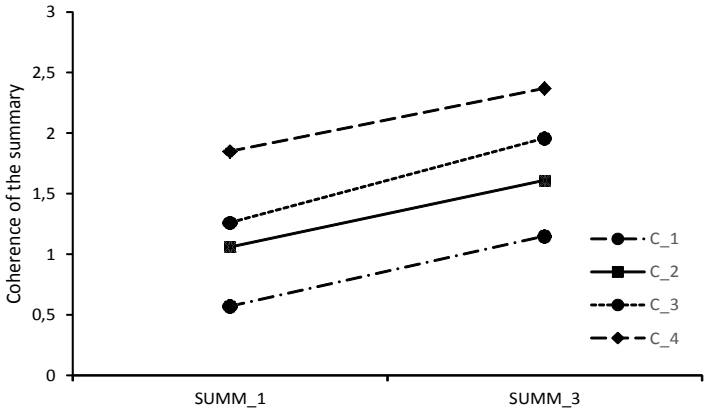

Figure 2 The coherence in summaries for individual groups of readers. C_1(2, 3, 4) – coherence of the summary in Q1 (Q2, Q3, Q4).

mary – main ideas and coherence of the text influenced this progress. In Figures 1 and 2, we present the progress of students in different quartile groups of readers in these elements from pre- (Summ_1) to the follow-up test (Summ_3).

Figure 1 shows large and significant differences between groups of students in their ability to find main ideas before the intervention $F(3) = 12.478$; $p < .001$; partial $\eta^2 = .263$ and moderately significant differences at the follow-up test $F(3) = 6.773$; $p < .001$; partial $\eta^2 = .166$. Students from Q_1, Q_2 and Q_3 made significant progress in identifying main ideas Q_1: $t(26) = 4.447$; $p < .001$; Q_2: $t(25) = 3.217$; $p < .01$; Q_3: $t(25) = 2.926$; $p < .01$, whereas students in Q_4 group made progress, but it was not significant $t(22) = 1.338$; $p = .194$.

Figure 2 shows large and important differences between groups of readers in their ability to create a coherent summary before the intervention $F(3) = 11.896$; $p < .001$; partial $\eta^2 = .254$ and at the follow-up test $F(3) = 14.578$; $p < .001$; partial $\eta^2 = .300$. Moreover, all groups of students made significant progress from pre- to the follow-up test, with the achievement of all students being significantly better than before the intervention Q_1: $t(26) = 3.217$; $p < .01$; Q_2: $t(25) = 2.872$; $p < .01$; Q_3: $t(24) = 3.422$; $p < .01$; Q_4: $t(22) = 2.709$; $p < .05$).

Discussion

The aim of our study was to investigate the effects of an experimental program for training 4th grade primary school students in summarizing. The program was designed on the basis of the following rationales: first, 4th grade students are faced with a transition from a period when reading is primarily aimed at developing a reading ability to a period when reading becomes a learning tool. Second, teachers' expectations that the students will be able to learn from texts by themselves increase. This means that the students have to master strategies for good comprehension. One of them is the summarizing strategy, which is an important predictor of

the students' reading achievement (Callan, Marchant, Finch, & Flegge, 2017; Hattie & Donoghue, 2016; Pečjak & Pirc, 2018).

Because of the large inter-individual differences between students in GRC, it is not reasonable to consider them as a unified group, but rather to address individual subgroups of students (see Afflerbach, 2016). Therefore, we divided students in the EG and in the CG according to their GRC achievement into quartile groups: struggling (Q_1), at-risk (Q_2), average (Q_3) and good readers (Q_4). The results showed that our decision to design groups of students with regard to their GRC was a sensible one.

Progress of Individual Groups of Readers in EG and CG by Summarizing

To some extent, our results support the first assumption in all three parts. First, the results showed that all students (in the EG and in the CG) made progress in summarizing, since students in both groups created summaries with better quality at the end of the intervention. Second, we can confirm the part of the assumption that students in the EG would make more extensive progress after the intervention, to a certain degree. Namely, three groups of readers – struggling, at risk and average readers in the EG made significant progress. There was also evidence of significant progress in the groups of struggling and good readers in the CG. Third, the results supported our assumption about the existence of stable proficiency differences between quartile groups of readers only in the CG of students (Pfost et al., 2014), however, we found a small decrease of the differences between the extreme groups of readers (Q_1 and Q_4) in the EG. These results indicate that we were able to make a somewhat more homogeneous group of students during the implementation of our program. This is important not only from the students' point of view, but also for the teachers, whose work is facilitated if they teach a more homogeneous group.

In the next step, we investigated in more detail the progress of quartile groups of students in the EG, compared to the same quartile groups in the CG. Our results show that struggling readers in the EG and in the CG made significant progress during and after our intervention program, yet we found no significant differences between any of the groups, either at pre- or at the follow-up test. Consequently, with our intervention program, we were not able to improve the summarizing skill of the struggling readers in the EG to the extent that they would make significantly better summaries than this group of readers in the CG. One of the reasons might be that in both groups of struggling readers (EG and CG), students at this stage have poor reading competency. Many of them still do not have the reading technique automatized. They do not read fluently yet, which means they use a lot (too much) of mental energy from their working memory (Hintze et al., 2002). In many cases, these students have narrow vocabulary, which impedes the understanding of the reading material (Pečjak et al., 2009). Hence, our results suggest that it is too demanding for struggling readers to use summarizing strategy independently at this age (Brown et al., 1983). Most of them probably used only the copy-delete strategy when creating a summary, which means they chose a few sentences from the text and literally copied them, more or less finding main ideas only by accident.

We found a similar pattern in the groups of at-risk readers (EG and CG). There were no significant differences between them, either before the intervention or at the follow-up test. However, at-risk readers in the EG made significant progress compared to equally competent readers in the CG, but the progress was not extensive enough to make a significant difference at the end of the program. In the group of average readers, the results of students in the EG indi-

cated lower achievement in summarizing before the intervention compared to these readers in the CG, but the difference was not significant. With our intervention, average readers in the EG were able to make a shift and with significant progress created better summaries than the average readers in the CG did at the follow-up test. The achievements of at-risk and average readers imply that students, who have the reading technique at least partly automatized, were able to create better summaries after the training of summarizing skills, which was confirmed in some previous studies as well (McKenna & Stahl, 2003; Nunes et al., 2012; Pečjak et al., 2011).

The good readers in the EG and in the CG did not differ significantly in their summarizing achievement before the intervention, but according to students' results at the follow-up test, we can conclude with an 8.1% of risk rate that good readers in the EG created better summaries compared to their peers in CG, although the latter made more extensive progress. This indicates that good readers with good GRC can be trained in summarizing merely by working with texts during regular lessons, which can be explained by the fact that their entire attention is focused on creating a summary. They do not have to consider issues regarding decoding or poor understanding because of modest vocabulary etc., as in the case of the other groups of readers (Aarnoutse et al., 2001).

At the end of the program, we examined if students in all groups of readers in the EG and in the CG were able to make a transfer of their trained summarizing skill from a short to a longer text. The results showed that all groups of readers in the EG, compared to the groups in the CG, were able to make a better transfer, with the exception of the struggling readers. At-risk, average and good readers created significantly better summaries of the longer text than their peers in the CG. This indicates that these groups of students mastered the skill of summarizing to such a degree that they were able to use it in a different learning context.

The Progress of Groups of Readers in the EG in Summarizing Elements

Finally, our goal was to examine and more thoroughly analyze the use of individual elements of summarizing by the EG before and after the intervention. Therefore, we evaluated the quality of the summaries according to the number of main ideas and the coherence of the text. Finding main ideas and connecting them into a coherent whole are two key activities, which enable students to create a good summary (Westby et al., 2010). We found significant differences between groups of students in their ability to find the main ideas, which decreased slightly in the follow-up test. This suggests that our program had a compensatory effect to some extent (Pfost et al., 2014). It seems that teachers were able to teach struggling and at-risk readers to search for (and find) most important information in the text relatively quickly by applying the program, which lasted for six months. This is important considering the fact that different students have diverse dynamics in reading skills development, and as discussed above, reading skills are a prerequisite for summarizing. Namely, struggling and at risk readers are considered to be late starters in summarizing (i.e., students with developmental delay) (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996).

We can conclude that our intervention program had the characteristics of a developmental-lag model of reading development (Parrila, Aunola, Leskinen, Nurmi, & Kirby, 2005) in finding main ideas.

With regard to the coherence of the summary, our results indicate the existence of significant differences with a large effect size between groups of students even before the intervention. The differences increased slightly

at the follow-up measurement, but the pattern of stable proficiency development could be established (Pfost et al., 2014). All groups of readers made a significant progress, which indicates that by systematically training summarizing skills we were able to develop the process of integration already in younger students. This process demands that students integrate the selected important ideas into a meaningful whole. The integration process is more common for older students in upper secondary and high school (Franzke, Kintsch, Carmicase, Johnson, & Dooley, 2005). Namely, coherence of the summary correlates with higher cognitive (executive) functions – especially with cognitive flexibility (Adams, 1990; Cartwright, 2002). For a coherent summary, the reader must switch between different language levels (syntactic, phonological and semantic) and combine them thoughtfully into a comprehensive unit. Hence, we find the significant progress of poorer readers in the EG especially important.

To sum up, our intervention program stimulated an improvement in the general ability of summarizing in all groups of readers. They included more important ideas and formed summaries that were more coherent after the intervention. However, the differences between high- and low-performing students remained. Therefore, our second assumption that better readers would make more progress than the disadvantaged ones could not be confirmed. Coherence of the summary, where we saw a trend of a more intensive progress in the group of average and good readers, was an exception.

Finally, we should emphasize that the results of our study are generalizable across different languages because the effects of training in summarizing depend on specific language and reading competency of students. Namely, how well they master the structure of their language.

Study Limitations and Pedagogical Implications

The effect of our intervention program has to be evaluated with regard to which reading skill we were developing. Reading skills differ in the degree of constraints that determine the speed of developing an individual skill. Students learn highly constrained reading skills (e.g., letter knowledge) in a shorter period, compared to less constrained skills (e.g., reading fluency), and more quickly than comprehension (comprising the summarizing skill), which is the least constrained skill (Paris, 2005). Therefore, even small training effects – especially in younger students – are very important.

In further summarizing interventions, more students should be included in each of the quartile groups and the individualization of the process of acquiring this skill for different groups of readers should be more emphasized. Especially among the struggling readers, which progressed the least, additional didactic support would be beneficial – e.g., mnemonic cards WIN (Write a topic sentence, Identify important information, and Number the FRI – facts, reasons, and ideas from the author; Saddler, Asaro-Saddler, Moeyaert, & Ellis-Robinson, 2017).

Despite the fact that we used different forms of strategy instruction in our program (approximately 50% of the training time the teachers worked frontally with the students and 50% of the time students worked in pairs or small groups), the amount of collaboration between the students should be increased because such approach enhances the students' achievement (Guthrie et al., 2004; Kyndt et al., 2013). We suggest more teacher-guided work with smaller homogeneous groups of students, which showed to be an effective way of instruction (Spörer & Brunstein, 2009).

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Studia Psychologica, Vol. 60, No. 4, 2018, 259-273 doi: 10.21909/sp.2018.04.766

Effect of a Short-Term Online Version of a Mindfulness-Based Intervention on Self-criticism and Self-compassion in a Nonclinical Sample

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Our goal was to investigate the efficacy of a Mindfulness-Based Intervention (MBI) in the form of a short-term, online intervention using exercises from Mindfulness-Based Stress-Reduction program on self-compassion, self-reassurance and self-criticism in a non-clinical population. We conducted pre-, post- and two-month follow-up measures of self-compassion, self-reassurance and self-criticism. A total of 146 participants, recruited through convenience sampling, were randomly allocated to the intervention with daily exercises for consecutive 15 days and to a control condition with no treatment. The intervention group reported a significant reduction in self-criticism and self-uncompassionate responding with effects present at two-month follow-up. There was a short-term effect of the training on self-compassion with no effect present at the two-month follow-up and no significant effect on self-reassurance. A limitation of the study is that participants' previous experience with meditation was not assessed, and thus the findings may be a result of previous meditation practice and not the intervention itself. Despite this limitation, the findings show that an online short-term MBI may be helpful in reducing self-criticism in general population, but a larger study taking into account the limitations needs to be conducted to replicate this effect before recommendations for clinical practice can be made.

Key words: self-compassion, self-criticism, self-reassurance, mindfulness-based intervention, experiment

Introduction

Mindfulness is non-judgmental and accepting awareness of moment-to-moment experience (Kabat-Zinn, 1990). Over the last two decades, mindfulness has become a popular target for interventions with clinical and nonclinical populations (Spijkerman, Pots, & Bohlmeijer, 2016). Importantly, easy-to-administer methods

Acknowledgement: We would like to acknowledge Kristína Jakubcová, Alexandra Pačutová and Karolína Varšová for help with data collection and reaching consensus about the selection of the MBSR exercises implemented in the shortened version of the intervention. This work was supported by the Vedecká grantová agentúra VEGA (Grant number: 1/0578/15). Nuriye Kupeli was supported by Marie Curie core grant funding, grant MCCC-FCO-16-U.

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Received May 19, 2018

such as web-based mindfulness interventions are suggested to be effective in reducing stress and increasing mindfulness and well-being (Spijkerman et al., 2016). By the means of this non-judgmental and accepting awareness of momentary experience, mindfulness interventions are expected to alleviate unpleasant emotions (Keng, Smoski, & Robins, 2011). Several approaches to teach ways to cultivate mindfulness already exist. According to Neff and Germer (2013), the most commonly offered Mindfulness-Based Intervention (MBI) is the Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990). In addition to MBSR, Spijkerman et al. (2016) also refer to Mindfulness-Based Cognitive Therapy (MBCT; Teasdale, Segal, & Williams, 1995), Dialectical Behaviour Therapy (DBT; Linehan, 1993), and Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) as the most frequently studied MBI.

Mindfulness-Based Stress Reduction Program

The MBSR program (Kabat-Zinn, 1990) is designed to support ways to cultivate mindfulness. Cultivating mindfulness improves the ability to be adaptive and deal effectively with stressful mental and physical experiences (Kabat-Zinn, 1990). MBSR is provided in groups by certified teachers. MBSR generally consists of a body scan exercise with awareness of body, yoga with awareness of movement or postures, sitting meditation with awareness of breathing and loving kindness meditation with awareness of human kind, which are all considered to be formal mindfulness practices and an informal mindfulness practice with awareness of activities in everyday life (MBSR Training Online, 2017) like washing dishes, driving or taking a shower. The manualized structured group sessions include training in formal and informal mindfulness practices as well as group interaction about their experience using mindfulness in their everyday lives. Informal practices aim to support the use of mindfulness in everyday life by being aware of one's own experience from moment to moment, while formal practices require deliberate commitment to practice mindfulness through guided awareness.

The Impact of MBSR

To date, several studies and meta-analyses have shown the MBSR program to be effective in reducing physical and mental symptoms and improving quality of life for people with a variety of physical and mental problems as well as for healthy individuals (e.g., Chiesa & Serretti, 2009; Grossman et al., 2004; Huang et al., 2015; Khoury et al., 2015). Specifically, the MBSR is suggested to reduce stress, anxiety, depression, burnout and increase quality of life in nonclinical samples (Chiesa & Serretti, 2009; Khoury et al., 2015). In summary, these meta-analyses suggest that MBSR is effective in reducing stress and unpleasant emotions related to negative experiences in both clinical and nonclinical samples but that there are varying degrees of effect across these outcomes. Moreover, there are some critical studies on MBSR (e.g., Dobkin, Irving, & Amar, 2012) suggesting increases in intense reactions, stress or depression for some of the participants because of being more aware of unpleasant emotions, thoughts, or interpersonal problems. Also, Farias and Wikholm (2016) proposed that the effects of MBSR are only sustainable over short periods of time.

The Impact of MBSR on Self-Compassion

A resent meta-analysis of Zessin, Dickhâuser and Garbade (2015) demonstrated that there is a strong positive relationship between self-compassion and well-being. Although MBSR

(Kabat-Zinn, 1982) was originally developed to alleviate suffering from stress, it also promotes the cultivation of self-compassion with several studies demonstrating that MBSR is related to increases in self-compassion (e.g., Birnie et al., 2010; Robins et al., 2012; Shapiro et al., 2005; Shapiro et al., 2007). However, other studies have not always found a positive effect of MBSR on self-compassion (Abercrombie et al., 2007; Jazaieri et al., 2012; Shapiro et al., 2011). According to Keng, Smoski, Robins, Ekblad, and Brantley (2012), self-compassion might be a key process of change responsible for MBSR effectiveness. Therefore, in this study, we are interested in investigating the effect of an online MBI based on MBSR on self-compassion. To date, many studies have documented the positive effect of interventions designed to cultivate self-compassion (e.g., Kirby, 2017) but there are so far inconsistent findings about the effect of MBSR on self-compassion. In addition, no study to date has explored the effect of MBSR on self-criticism, which has been suggested to decrease through cultivating self-compassion (Gilbert, 2010). Self-criticism has been shown to be related to stress (e.g., Priel & Shahar, 2000) and to be a major underlying factor for psychopathology (e.g., Falconer, King, & Brewin, 2015). As a result, MBSR programs have been designed to target the effects of stress (e.g., Priel & Shahar, 2000). People who indicate high levels of self-criticism have also been found to be reactive and sensitive to stressors (Dunkley, Zuroff, & Blankstein, 2003). We hypothesize that if MBSR affects stress levels (Khoury et al., 2015), then MBSR and interventions based on MBSR should produce an effect on self-criticism. However, previous studies suggest that self-compassion and self-criticism are not simply the opposite poles of the same construct, and that the relationship between these constructs remains unclear (Gilbert, McEwan, Matos, & Rivis, 2011; Neff, 2003). However, a caveat of these findings is that all the mentioned studies used the total score of the Self-Compassion Scale (SCS; Neff, 2003) to assess levels of self-compassion. Recent research on the factor structure of the SCS suggested that using the total score is not recommended and that positive and negative items should be calculated separately (e.g., López et al., 2015). This may explain the inconsistent findings between the studies. These conflicting findings suggest that the possible influence of the MBSR on self-compassion needs further testing. Finally, although increasing self-compassion should influence a decrease in self-criticism (Gilbert et al., 2004), to our knowledge, no study to date has explored the impact of MBSR on self-criticism. Thus, it is necessary to explore the possible impact of the MBI based on MBSR on self-compassion and self-criticism.

Adaptations to MBSR

The MBSR program was developed as an eight-week course, with participants completing a weekly 2.5-hour session for eight consecutive weeks and a one-day six-hour session. According to previous research (Carmody, 2008), 45% participants declined to participate in the study because of the time commitment required to complete the program. In addition, Carmody and Baer (2009) showed that there was no evidence that the shortened versions of MBSR were less effective than the standard format in reducing psychological distress. In support of this, several studies have reported a positive effect of MBSR on various outcomes such as depression, anxiety, mindfulness, positive moods, burnout symptoms, relaxation, and life satisfaction, when delivered as a shortened version (Abercrombie et al., 2007; Hallman et al., 2014; Jain et al., 2007; Speca et al., 2000; Klatt et al., 2009; Mackenzie et al., 2006). These findings illustrate that the benefits of MBSR can be achieved without committing too much time to completing the program.

Online Implementations of MBSR

Delivering interventions using an online format can be cost-effective and convenient due to improved access, quicker provision of care because of no waiting list and no travelling time to sessions, less or no direct health professional input reducing the stigma of being labelled as a patient or client with a mental health condition, and automatic monitoring of progress through online assessments (Andersson & Titov, 2014; Cuijpers et al., 2009).

Although the majority of MBSR sessions are delivered in group format (e.g., Kabat-Zinn, 1982; Kabat-Zinn, 2013; Kabat-Zinn, 2016), 42% of people would prefer to complete mindfulness meditation on their own using an online format, compared to completing it during group or individual face-to-face sessions (Wahbeh et al., 2014). Despite the popularity of online-based interventions, there are a limited number of RCTs examining the effectiveness of online based MBSR programs (Aikens et al., 2014; Glück & Maercker, 2011; Mak, Chan, Cheung, Lin, & Ngai, 2015; Morledge et al., 2013; Wolever et al., 2012; Zernicke et al., 2014). Participants, who completed the online-based MBSR program from Aikens et al. (2014), reported significant decreases in perceived stress as well as an increase in mindfulness, resiliency, and vigour. Similarly, the study by Mak et al. (2015) displayed significant improvements in mindfulness as well as mental well-being. In the study of Morledge et al. (2013), the online adaptation of the MBSR significantly improved perceived stress, mindfulness, self-transcendence, psychological well-being, and quality of life. Research study of Wolever et al. (2012) showed significant improvements on perceived level of stress, quality of sleep, and heart rate variability. In the study of Zernicke et al. (2014), the online mindfulness-based intervention significantly improved mood disturbance, stress symptoms, spirituality, mindful behavior, post-traumatic growth, and mindfulness. All of the changes were compared with the control groups in all the mentioned online research studies. In addition, Wolever et al. (2012) tested difference in effectiveness of either group or online versions of the mindfulness program with basically equivalent results of those two types of program delivery. Contrary, Glück and Maercker (2011) did not find any significant effects of their mindful intervention. However, analysis of persons with over 50% participation discovered significant effects for perceived stress and negative emotions.

Although there are several studies on the effectiveness of MBSR and its adaptations, to our knowledge, no study to date has examined the impact of the MBI based on MBSR on self-compassion and self-criticism concurrently.

Aims

The primary aim of the current study was to evaluate the immediate and longer-term impact of a 15-day internet-based MBI consisting of MBSR exercises on self-compassion, self-criticism and self-reassurance in a non-clinical population.

Methods

Trial Design

We used open parallel-groups design of RCT. All participants completed demographic information and baseline measures and were then allocated using block randomization to the intervention and control groups knowing to which group they belong. To enable random allocation into the two conditions, the first fifteen participants were allocated to the intervention condition and the next eight participants were allocated to the control condition. This was done until all participants were allocated into the two condi-

tions. More participants were allocated to the intervention group because due to the time commitment required of the intervention group, we expected higher attrition for the intervention group. The control group was not provided with any further instructions until 15 days after completing the baseline measures when they received an email to a link to complete the online self-report measures. This process was repeated for the two-month follow-up.

Participants

Participants were recruited from the general community through social media, social networking sites and health and well-being forums in Slovakia. As a gesture of gratitude, those who completed the study were entered into a prize draw to win a tablet. The only inclusion criterion was adults over the age of 18 years.

A total of 146 participants completed the pre-intervention measures and from this sample, 93 were randomly allocated to the intervention group and 53 were assigned to the control condition. From this sample, 42 participants from the intervention group and 23 participants from the control group completed the post-intervention measures. All 42 participants completing post-intervention measures in the MBI group completed the two-month follow-up and 20 of the 23 participants of the control group completed the follow-up measures (see Figure 1 for

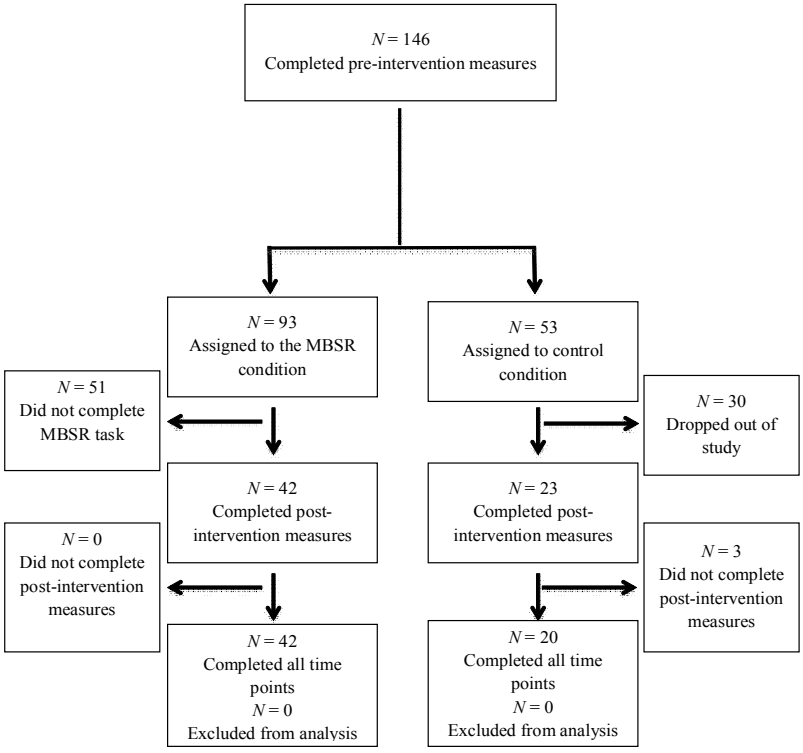

Figure 1 Flow chart for the number of participants who completed each phase of the study and attrition

study attrition). The final control group consisted of 17 women and 3 men with a mean age of 25.35 years ($SD = 6.32$) and the intervention group consisted of 36 women and 6 men with mean age of 25.57 years ($SD = 11.76$). Results show that no significant differences were present between those who completed the intervention and those who dropped out, for all SCS subscales and for all FSCRS subscales (p-values 0.170).

Intervention

Participants assigned to the MBI condition were instructed to complete a daily MBSR exercise for 15 consecutive days and were advised to commit 15 minutes each day to practice each exercise. To make it comparable to other studies, a number of intervention days was determined in order to increase accessibility of the intervention for the participants, along with achieving at least some effectiveness, based on previous research studies with two-weeks interventions (e.g., Banerjee, Cavanagh, & Strauss, 2018). Participant's assigned to the intervention group received an email prompting them to complete the MBSR task and each participant received the same exercise each day in the same order (i.e., the order of the exercises was not randomized). All emails were presented in the same format consisting of a short introduction in the form of psychoeducation, explaining the intended impact of the exercise in order to motivate participants to complete it, instructions for the exercise, and post-exercise questions. These were designed to encourage participants to reflect on the experience in order to increase and imbed the impact of the exercise. The additional function of the post-intervention questions following each exercise was to check if participants performed the exercise. If the participant had not completed the exercise, they were sent an email reminder.

The tasks were selected by consensus of our research team from different exercises available from previous publications on MBSR (e.g., Kabat-Zinn, 1982; Kabat-Zinn, 2013; Kabat-Zinn, 2016; MBSR Palouse Mindfulness, 2017; MBSR Training Online, 2017) and approved by a certified trainer of MBSR in Slovakia. Majority of the exercises were presented in the form of an audio recording, the yoga exercise was presented in the form of pictures. All the exercises as well as audio recordings were translated into Slovak. The intervention was accessible on any computer or smartphone via a link on the day the email was sent. For the first three days, participants practiced "Body Scan", followed by "Sitting meditation", then "Yoga", and the last exercises were "Loving Kindness Meditation", and "Informal mindfulness practices". Following the final exercise, participants were instructed to complete the post-intervention measures and this was repeated at the two-month follow-up.

Measures

Self-criticism/reassurance was assessed using the *Forms of Self-Criticising/Attacking & Self-Reassuring Scale* (FSCRS; Gilbert et al., 2004). The FSCRS is a 22-item measure requiring participants to rate statements on a 5-point Likert scale. Positive items reflect the ability to self-reassure (referred to as Reassured self) and negative items indicate self-critical thoughts and feelings (split into subscales of Inadequate self and Hated self). This scale has been validated in various samples in different countries (e.g., Castilho, Pinto-Gouveia, & Duarte, 2015; Kupeli, Chilcot, Schmidt, Campbell, & Troop, 2013) including Slovakia (Halamová, Kanovský, & Pacúchová, 2017a). According to these studies, FSCRS has good psychometric properties including reliability and validity. In this study, Cronbach's alpha for Inadequate self was 0.87, for Hated self 0.68, and for Reassured self 0.86.

Self-compassion was assessed using the *Self-Compassion Scale* (SCS; Neff, 2003). The SCS measures six components of self-compassion experienced during perceived difficulty. The scale consists of 26 items rated on a 5-point Likert-type scale. The scale consists of six subscales that measure the degree to which individuals display self-kindness against self-judgment, common humanity versus isolation, and mindfulness versus over-identification. Recent findings demonstrated that the negative and positive subscales of the SCS should be calculated separately and not summed as a single score (e.g., Brenner, Heath, Vogel, & Credé, 2017; López et al., 2015; Muris & Petrocchi, 2017). According to these studies, SCS has good reliability and validity. These findings have been replicated using the Slovak version of the scale (Halamová, Kanovský, & Pacúchová, 2017b). Therefore, for the purpose of this study, the combined score of the positive constructs will be used as a reflection of self-compassionate responding (self-kindness, common humanity and mindfulness) and the combined score of the negative constructs will reflect self-uncompassionate responding (self-judgement, isolation and over-identification). In this study, Cronbach's alpha for Self-compassionate responding was 0.88, and for Self-uncompassionate responding was 0.89.

Data Analyses

For the statistical analysis, program R (Version 3. 4. 0, R Core Team, 2017), and the package nparLD (Noguchi et al., 2012) were used.

Factorial designs are usually analyzed by means of parametric procedures (ANOVA). However, the assumptions of parametric methods such as homoscedasticity, normality, or absence of outliers are seldom met in practice. Classical non-parametric alternatives (Wilcoxon-Mann-Whitney test, Kruskal-Wallis test, Wald-type statistics) perform poorly for small sample sizes, heteroscedasticity and unbalanced designs (when the size of control and the experimental sample are different; see Brunner et al., 1999; Brunner et al., 2002; Brunner et al., 2016). Our dependent variables are raw scores of ordinal items, so we cannot just assume their normal distribution, and intervention design practically excludes equal variances of control and experimental groups (see Tables 2 and 4). Therefore, our data are heteroscedastic, as it should be: intervention usually decreases variance in its group. We will report ANOVA-type statistics (Brunner et al., 2016) from non-parametric rank-based test for longitudinal data, and relative effects, which can serve as effect size measures. The relative effect can be regarded as the probability that a randomly chosen observation from the treatment group takes on larger values than an observation randomly chosen from the mean distribution function. Therefore, a relative effect significantly higher (for increasing effect) or lower (for decreasing effect) than 0.50 indicates that an intervention was effective. ANOVA-type statistics (ATS) performs well even for small sample sizes and unbalanced designs (Brunner et al., 2002).

In this design, it is mainly of interest to investigate an interaction between groups (factor G) and time (factor T). There is a control group without intervention (group 1) and the active treatment is given to an intervention group (group 2), therefore, the distribution functions at the start of the trial (time point 1) are identical because the subjects were randomly assigned to the two groups of factor G. Then, an effect of the active intervention should produce nonparallel time curves of the measurements. This means that there should be a significant interaction between factor G and factor T if the intervention is effective. We hypothesize that our intervention will be significantly effective if and only if the interaction between group (control vs. intervention) and time (three time points) is significant: the significant difference between

control and experimental group and/or between time points alone will not do. Main factorial effects (difference between groups regardless of time, or difference among time points regardless of groups) are of no use here, so we will not report them.

Data analyses were decided before the data were gathered and it was selected because this statistical method was recently developed for non-parametric analysis of longitudinal data in parallel and factorial experiments. These non-parametric methods allow for robust statistical analysis of small sample sizes and unbalanced designs (Delaney & Vargha, 2002; Erceg-Hurn & Mirosevich, 2008).

Results

Before testing our hypothesis, we conducted preliminary analyses to ensure participants were successfully randomized into the two groups. Since distributions and variances of groups are almost equal, we used the nonparametric Wilcoxon-Mann-Whitney test to compare baseline scores for the intervention and control groups. Results show that no significant differences occurred (p-values range from 0.22 to 0.83 for all SCS subscales, and from 0.15 to 0.71 for all FSCRS subscales).

The results revealed that there was a significant immediate effect of the intervention on self-criticism (Inadequate self and Hated self) and Inadequate self and longitudinal change on Hated self (see Table 1 and Table 2). There was no effect of the intervention on Reassured self. Relative effects with their confidence intervals for each group and time point illustrate that the effect of the intervention on self-criticism and its subscales is present at the two-month follow-up. A comparison of the relative effects for Hated self and Reassured self shows that there is a significant and persistent change in Hated self but no effect on Reassured self.

There was an effect of the intervention on the total score of the SCS (see Table 3), but this effect is due to a reduction in Self-uncompassionate responding (negative items). The effect of the intervention on self-uncompassionate responding scores significantly decreased immediately post-intervention and at the two-month follow-up. There was an immediate effect of the intervention on the Self-compassionate responding subscale but no effect of intervention at the two-month follow-up. Again, relative effects with their confidence intervals for each group and time point is presented in Table 4, which illustrates these effects in clearer detail.

Relative marginal effects express the strength of the effect based on the magnitude of their distance from .50 (null hypothesis: the probability is at random). Based on this criterion, effect sizes are small (0.50 – 0.60 or 0.40 – 0.50).

Table 1 *Results for interaction effects of the FSCRS scale*

	ATS		
	F	*df*	*p*
FSCRS Reassured self	0.03	1.54, ∞	0.950
FSCRS Inadequate + Hated self	4.39	1.88, ∞	*0.014**
FSCRS Inadequate self	4.34	1.73, ∞	*0.017**
FSCRS Hated self	4.29	1.99, ∞	*0.014**

Note. FSCRS – The Forms of Self-Criticising/Attacking & Self-Reassuring Scale, ATS – ANOVA Type Statistics, *F* – F-ratio, *df* – degrees of freedom.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2 *Relative effects, their confidence intervals and variances of the FSCRS scale*

		FSCRS Reassured Self		
		Relative effect	*Confidence Interval*	*Variance*
Control	Pretest	0.48	0.37 – 0.60	0.229
	Posttest	0.47	0.35 – 0.59	0.248
	Follow-up	0.49	0.37 – 0.61	0.242
Intervention	Pretest	0.52	0.47 – 0.57	0.044
	Posttest	0.50	0.45 – 0.55	0.041
	Follow-up	0.51	0.46 – 0.57	0.042
		FSCRS Inadequate + Hated Self		
Control	Pretest	0.49	0.38 – 0.61	0.217
	Posttest	0.47	0.35 – 0.58	0.218
	Follow-up	0.46	0.36 – 0.57	0.178
Intervention	Pretest	0.49	0.42 – 0.52	0.056
	Posttest	*0.44**	*0.38 – 0.49*	0.042
	Follow-up	0.49	0.43 – 0.54	0.042
		FSCRS Inadequate Self		
Control	Pretest	0.49	0.37 – 0.61	0.265
	Posttest	0.48	0.37 – 0.60	0.235
	Follow-up	0.50	0.40 – 0.60	0.271
Intervention	Pretest	0.50	0.44 – 0.54	0.058
	Posttest	*0.46**	*0.39 – 0.49*	0.044
	Follow-up	0.49	0.43 – 0.54	0.049
		FSCRS Hated Self		
Control	Pretest	0.57	0.46 – 0.67	0.164
	Posttest	0.55	0.44 – 0.64	0.167
	Follow-up	0.57	0.46 – 0.67	0.181
Intervention	Pretest	0.51	0.46 – 0.57	0.048
	Posttest	0.47	0.42 – 0.52	0.040
	Follow-up	*0.42**	*0.37 – 0.47*	0.036

Note. FSCRS – The Forms of Self-Criticising/Attacking & Self-Reassuring Scale.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 *Results for interaction effects of the SCS scale*

	ATS		
	F	*df*	*p*
SCS sum score	8.11	1.86, ∞	*0.001**
SCS positive (Self-compassionate responding)	1.56	1.73, ∞	0.213
SCS negative (Self-uncompassionate responding)	13.48	1.99, ∞	*0.001**

Note. SCS – The Self-Compassion Scale, ATS – Anova Type Statistics, *F* – F-ratio, *df* – degrees of freedom.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 *Relative effects, their confidence intervals and variances of the SCS scale*

		SCS sum score		
Group	*Time point*	*Relative effect*	*Confidence Interval*	*Variance*
Control	Pretest	0.47	0.35 – 0.60	0.260
	Posttest	0.49	0.38 – 0.62	0.241
	Follow-up	0.44	0.33 – 0.56	0.219
Intervention	Pretest	0.45	0.39 – 0.51	0.055
	Posttest	*0.56**	*0.51 – 0.62*	0.051
	Follow-up	*0.56**	*0.51 – 0.62*	0.052
		SCS positive (Self-compassionate responding)		
Control	Pretest	0.45	0.35 – 0.56	0.202
	Posttest	0.48	0.37 – 0.59	0.204
	Follow-up	0.47	0.35 – 0.59	0.231
Intervention	Pretest	0.47	0.42 – 0.52	0.040
	Posttest	*0.59**	*0.54 – 0.63*	0.033
	Follow-up	0.49	0.45 – 0.54	0.035
		SCS negative (Self-uncompassionate responding)		
Control	Pretest	0.44	0.34 – 0.54	0.149
	Posttest	0.46	0.35 – 0.57	0.144
	Follow-up	0.42	0.32 – 0.53	0.121
Intervention	Pretest	0.43	0.33 – 0.53	0.076
	Posttest	*0.60**	*0.55 – 0.65*	0.060
	Follow-up	*0.58**	*0.53 – 0.63*	0.061

Note. SCS – The Self-Compassion Scale.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion

The present study examined the immediate and long-term effects of a 15-day internet-based MBI using exercises from the Mindfulness-Based Stress Reduction (Kabat-Zinn, 1990) program on self-compassion and self-criticism. To our knowledge, this is the first study to examine the impact of MBI on self-criticism in a Slovak sample.

Cultivating mindfulness by means of MBI for 15 days decreased self-criticism, as measured by the FSCRS (Gilbert et al., 2004) and self-uncompassionate responding as measured by the SCS (Neff, 2003), immediately and these changes persisted over two months. In contrast, practicing mindfulness was effective in increasing self-compassionate responding in the short term but this effect was not present at the two-month follow-up. There was no change in self-reassurance after the intervention, which could have been caused by possible difference between self-compassion and self-reassurance, even though Kupeli et al. (2013) suggest that these two constructs are the same.

We also explored the effect of mindfulness training on the dimensions of the scales separately. Our findings suggest that the MBI does not induce a persistent change in self-compassion, thus supporting previous research (Abercrombie et al., 2007; Jazaieri et al., 2012; Shapiro et al., 2011). Our findings did reveal a

significant decrease in self-criticism (specifically Hated self and Inadequate self) and also in Self-uncompassionate responding. This is not surprising, as there is some similarity between the items for the FSCRS self-criticism and SCS critical self-judgement.

As MBSR was originally developed to alleviate suffering during adversity, it is quite plausible that it reduces the effects of stress resulting from self-critical thoughts and feelings. The generalized effect of MBI based on MBSR on stress targets self-criticism, which is represented by Hated self and Inadequate self, but the MBI had a different effect on these two forms of self-criticism. MBI had a more immediate effect on IS and a slower effect on HS, which was present by Hated self being significant only in follow-up measures. The possible explanation of such significant effect for Hated self could be that subjects with higher levels of Hated self had higher inertia for any change and the effect was therefore delayed. Also, our differing findings related to Inadequate self and Hated self supported the findings of previous research study (Longe et al., 2010), which suggested that the experience of IS and HS activate different parts of the brain. Further research is required to address this issue.

It is true that reported effect sizes were small when considered separately. However, they showed a systematic pattern: the main impact was on negative parts (Hated self, Inadequate self, Self-Uncompassionate Responding), which refers to systematic effectivity of intervention despite its small effect sizes.

The present findings also support the idea that the total score of the SCS (Neff, 2003) may not be useful, either for research or for practice (e.g., López et al., 2015). In our study, the total score of the SCS showed significant increase but this effect was due to a decrease in self-uncompassionate responding since the effect on self-compassionate responding was short lived.

Limitations

The current study did not involve certified MBSR teachers in implementing the intervention, which is the major limitation of the study. However, we selected exercises from the original MBSR to emulate sufficient exposure to mindfulness, and the selection was approved by a certified trainer of MBSR in Slovakia. Also, as this study recruited a sample from the general population, these findings cannot be generalized to the clinical population and thus, this adaptation to the MBI needs to be evaluated with people with psychological morbidity. Another limitation of the present study is that a smaller proportion of men took part in the study and thus these findings may not be applicable to men. However, previous research has suggested that gender differences are not evident when assessing the effectiveness of MBSR (Shapiro et al., 2007). Nonetheless, further research on how men and women respond to MBSR, MBI or their online version is required.

Also, the sample in the study was not representative of the general population, since there were mostly young adults. Therefore, the findings in our study have only limited generalizability and practical implications.

Another limitation of the study is that participants were not initially assessed in terms of their familiarity with mindfulness and related practices, so we do not know how many of them had previous experience with mindfulness.

As we did not include a measure of mindfulness, it is difficult to quantify the overall efficacy of the shortened program and compare it with studies investigating other versions of the program.

Moreover, we did not measure participants' previous experience with meditation. So, we are not able to eliminate the possibility that our significant findings are a result of previous medi-

tation practice and not the online intervention itself.

In addition, there is a limitation of a non-treatment control condition used in this study. All effects could possibly be attributed to the demand effects because receiving some kind of treatment might encourage participants in the intervention group to indicate that there was some improvement, simply because they believe that this is what they are supposed to say.

As the research relied on self-report measures of self-compassion and self-criticism, it could potentially be biased for socially desirable responding, however, these measures have been shown to have good psychometric properties (Halamová, Kanovský, & Pacúchová, 2017a, 2017b). Therefore, future research should assess outcomes using objective measures such as physiological measures (e.g., heart rate variability, respiration rate variability).

Furthermore, Cronbach's alpha for Hated self (FSCRS) was .68, which is slightly below the recommended guidelines (Lance, Butts, & Michels, 2006) and might be attributed to the small size of our sample. However, this subscale showed acceptable psychometric properties in previous research in Slovak population (Halamová, Kanovský, & Pacúchová, 2017a).

Conclusion

An abbreviated and web-based version of the Mindfulness-Based Intervention has significantly decreased self-criticism and self-uncompassionate responding with effects lasting at least two months. It also increased self-compassionate responding, but these effects were short-lived. These results are promising and posit that interventions can be provided using cost-effective methods and be accessible for broader populations without direct involvement of mental health professionals. This is particularly relevant to those who might be unable or reluctant to contact a mental health care provider.

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Studia Psychologica, Vol. 60, No. 4, 2018, 274-286 doi: 10.21909/sp.2018.04.767

The Influence of Personality Traits on Life Satisfaction Through Work Engagement and Job Satisfaction among Academic Faculty Members

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The aim of this study was to examine both direct and indirect associations of the personality traits of extraversion, neuroticism and conscientiousness with life satisfaction through work engagement and job satisfaction. The study population consisted of 2229 academics (57.1% men) throughout Czech public universities, who completed a questionnaire comprising measures of employee personality traits (BFI-10), work engagement (Utrecht Work Engagement Scale short form), job satisfaction (job satisfaction short scale from the COPSOQ-II) and general life satisfaction (Satisfaction With Life Scale). Structural equation modeling was used to analyze the relationships. The strongest predictor of life satisfaction was neuroticism, the effect of which manifested itself through both direct and indirect pathways. Extraversion and conscientiousness had positive indirect influences on job satisfaction through work engagement, but their direct influences on job satisfaction were negative. While extraversion also had a direct influence on life satisfaction, conscientiousness did not directly influence life satisfaction.

Key words: personality traits, characteristic adaptations, life satisfaction, job satisfaction, work engagement

Introduction

Well-being has long been researched in psychology. Over the years, several influential theories explaining the nature and describing the components of this psychological construct have been created (Diener, 2000; Lyubomirsky, Sheldon, & Schkade, 2005; Ryff, 2014; Seligman, 2011), and many studies have identified factors contributing to well-being. Personality traits were identified as factors significantly influencing well-being, among other characteristics. Within the five-factor model of personality, traits of neuroticism, extraversion and conscientiousness appear to be the strongest and most consistent predictors of well-being (Steel, Schmidt, & Shultz, 2008).

In the past, research primarily addressed the relationship between personality traits and various aspects and facets of well-being. Recently, there has been increasing interest in exploring specific pathways by which personality traits influence well-being (Lent et al., 2005). Personality dispositions affect well-being not only directly, through emotions, but also indirectly

Acknowledgements
The study was supported by grants No. GA17–20856S and RVO: 68081740. The study is a part of research program "Strategy AV21".

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Received May 31, 2018

through their influence on many other important life outcomes at the interpersonal (quality of relationships) and social institutional levels (occupational choice and performance, community involvement) (Ozer & Benet-Martínez, 2006).

Indirect influences of personality traits on well-being can be mediated through both characteristic adaptations and domain satisfaction. Under current approaches (McAdams & Pals, 2006; McCrae & Costa, 1999), personality comprises two basic levels – basal tendencies, represented by personality traits, and characteristic adaptations, referring to "a wide range of motivation, socio-cognitive and developmental adaptations" that are specific to a given time, place or role (McAdams & Pals, 2006, p. 208). Previous research has shown that variables such as self-efficacy or the use of coping strategies contribute to life satisfaction and are correlated with personality traits (Cellar, Yorke, Nelson, & Carroll, 2004; Watson, Suls, & Haig, 2002). Therefore, there arose a reasonable assumption that motivational and socio-cognitive variables mediate or moderate the relationship between personality dispositions and well-being, and this hypothesis was confirmed in subsequent studies (Blatný & Šolcová, 2015).

Human life includes a series of areas in which different levels of satisfaction can be achieved. Diener, Suh, Lucas, and Smith (1999) refer to satisfaction with a given area of human life as domain satisfaction. Even satisfaction in specific life domains is influenced by personality characteristics, including both domain-specific social cognitive variables and affective and temperamental traits (Lent et al., 2005).

In our study, we focused on job satisfaction because work is one of the most important areas of adult life and because job satisfaction can significantly contribute to overall life satisfaction. We specifically examined how work engagement, a sense of energetic and effective connection with work activities that supports people in handling the demands of their job, serves as a characteristic adaptation that mediates the relationships between personality traits and job satisfaction.

Life Satisfaction

Life satisfaction is a key indicator of subjective quality of life, especially in the theory of subjective well-being (SWB) of Diener (2000), nonetheless, life satisfaction is also considered in other conceptions of well-being (Lyubomirsky et al., 2005; Seligman, 2011). Life satisfaction represents the perceived difference between current life status and an individual's expectations and aspirations (Campbell, Converse, & Rodgers, 1976); life satisfaction has been defined as "global evaluation by the person of his or her life" (Pavot, Diener, Colvin, & Sandvik, 1991, p. 150). It has been repeatedly proven that life satisfaction is associated with personality traits of neuroticism (negatively), extraversion and consciountiouness (Lucas, 2008; Pavot & Diener, 2011).

Job Satisfaction

Life satisfaction is a very general evaluative judgment about the quality of one's own life. Diener et al. (1999) therefore subdivided life satisfaction into so-called domains of satisfaction, including satisfaction with work, family, leisure, health, finances, self and one's group. From this perspective, job satisfaction is one such domain.

In contrast to life satisfaction, which reflects an overall view of life, job satisfaction is a more complex construct. Job satisfaction is composed of several factors such as achievement, recognition, the work itself, career prospects, salary status, collegial relationships, institutional climate, physical working conditions etc. (Hagedorn, 2000; Herzberg, 1959; Kristensen, Hannerz, Høgh, & Borg, 2005).

Job satisfaction is therefore a multidimensional construct, and considering these factors, it would be expected that job satisfaction is affected primarily by objective working conditions or attitudinal or motivational personality characteristics. However, personality traits also partially predict job satisfaction. Similarly to life satisfaction, job satisfaction is influenced by neuroticism, extraversion and conscientiousness (Judge, Heller, & Mount, 2002; Bruk-Lee, Khoury, Nixon, Goh, & Spector, 2009; Hahn, Gottschling, König, & Spinath, 2016).

Work Engagement

The concept of work engagement emerged in the framework of burnout research (Maslach, Schaufeli, & Leiter, 2001). According to Schaufeli, Taris, and Van Rhenen (2008), engaged employees have a sense of energetic and effective connection with their work activities and see themselves as able to effectively handle the demands of their job. Work engagement comprises three components (Schaufeli & Salanova, 2002): vigor (high levels of energy and mental resilience while working), dedication (a sense of significance, enthusiasm, inspiration, pride, and challenge), and absorption (being fully concentrated and engrossed in one's work). According to meta-analysis by Mäkikangas, Feldt, Kinnunen, and Mauno (2013) neuroticism and extraversion were negatively and positively related to work engagement, respectively. Of the other Big Five personality traits, conscientiousness was positively associated with high work engagement levels.

Current Study

The aim of the study was to examine the role of characteristic adaptations among personality traits, domain satisfaction and overall life satisfaction. Since characteristic adaptations are contextually conditioned, it is necessary to take into consideration the settings in which they manifest themselves. We focused on one of the most important domains in the life of an adult: the work domain.

Previous research has shown associations of personality traits with work engagement (Mäkikangas et al., 2013), job satisfaction (Judge et al., 2002) and life satisfaction (Steel et al., 2008), as well as relationships between work engagement and job satisfaction (Rayton & Yalabik, 2014) and between job satisfaction and life satisfaction (Li, Fan, & Zhao, 2015). Li, Wang, Gao, and You (2015) examined the mediating effects of work engagement between proactive personality and job satisfaction, and Zhai, Willis, O'Shea, Zhai, and Yang (2013) studied the mediating role of job satisfaction between the Big Five personality traits and life satisfaction. To our knowledge, no study has investigated the relationships between personality traits, work engagement, job satisfaction and life satisfaction.

Although several authors consider work engagement as an indicator of occupational well-being (Mäkikangas et al., 2013) or job satisfaction outcome (Rayton & Yalabik, 2014), we interpret work engagement as a characteristic adaptation. We begin from the operational definition of work engagement by Christian, Garza, and Slaughter (2011), who emphasized two characteristics of Kahn's (1990) conceptualization of work engagement. First, work engagement concerns more the psychological relationship with performance of work tasks than with attitudes regarding aspects of the organization or job. Second, work engagement concerns self-investment of personal resources into work – i.e., the physical, emotional and cognitive potential that people apply to their job roles. Our interpretation of work engagement as a characteristic adaptation is further supported by the evidence that work engagement appears to remain relatively stable over the long term, although there are day-to-day fluctuations (state

work engagement) that are likely context dependent (Bakker & Leiter, 2010; Christian et al., 2011). Engagement thus varies both between persons and within a person, but this variability is a common characteristic of many psychological constructs, including personality traits, which are also stable over time while exhibiting slight state fluctuations in the short term (Tickle, Heatherton, & Wittenberg, 2001). We suppose that identified personality correlates of work engagement, the traits of neuroticism, extraversion and conscientiousness, influence work engagement through energy-efficient features (vigor, achievement).

In our study, we assessed whether work engagement and job satisfaction intervene in the relationship between personality traits and life satisfaction in a sample of academic workers. In these assessments, we hypothesized that personality traits would retain their direct influence on both job satisfaction and life satisfaction. Neuroticism, extraversion and conscientiousness, as the most consistent and stable predictors of work engagement, job satisfaction and life satisfaction, were identified within the framework of Big Five personality constructs (Blatný & Šolcová, 2015; Judge et al., 2002; Mäkikangas et al., 2013). We focused on these three traits in our research. We assumed that neuroticism would reduce work engagement and both directly and indirectly decrease job satisfaction and life satisfaction, while extraversion and conscientiousness would directly influence job satisfaction and life satisfaction and would increase enthusiasm and effective connection with work, thus indirectly promoting job satisfaction and life satisfaction.

Method

Procedure

The data were collected using our web-based questionnaire with response validation to ensure the completeness of the data. To contact the participants, we compiled a list of email addresses of all academic faculty members publicly available from websites of Czech public universities. The respondents were invited to participate in the research via e-mail; the invitation included a brief summary of the research aims and a direct link to the questionnaire. Data collection occurred in the second half of the 2014 fall semester. To protect the anonymity of the respondents, we decided not to ask the exact age of the respondents but rather to select the appropriate age category.

Sample

Alltogether, more than 20 000 academic workers were contacted via e-mail. About 23% of contacted academics followed the provided link to the survey and started responding. The research sample in our study consisted of 2229 (57.1% men) participants who finished completing the questionnaire. The basic characteristics of the sample are summarized in Table 1.

Instrument

The instrument consisted of various measurement scales and questionnaires concerning the respondents' demographic characteristics (age, gender, etc.), employment variables (formal position, type of contract, length of employment, etc.), work content and productivity variables (working hours, proportion of work time dedicated to research/teaching/administration, numbers of publications, grants, and scholarships, etc.), work environment variables, aspects of employee well-being, and personality characteristics.

In this study, we used the following measures:

Short version of the Big Five Inventory (BFI-10) (Rammstedt & John, 2007). This instrument consists of 10 items (2 items per dimension, one

Table 1 *Descriptive characteristics of the research sample*

Age	< 25 years: 0.8 %
	25 – 29 years: 14.4 %
	30 – 39 years: 40.4 %
	40 – 49 years: 17.2 %
	50 – 59 years: 13.6 %
	60 – 69 years: 9.8 %
	70 – 79 years: 3.3 %
	≥ 80 years: 0.4 %
Discipline	Humanities/Social sciences: 42.2
	Natural sciences: 30.3 %
	Technical sciences: 22.7 %
	Other: 4.8 %
Position	PhD student/postdoc: 16.4 %
	Lecturer: 4.4 %
	Researcher: 9.5 %
	Assistant professor: 42.9 %
	Associate professor: 15.2 %
	Professor: 7.9 %
	Other: 3.8 %

coded in the positive direction and one in the negative direction of the scale), as well as 1 additional positively directed item for the agreeableness scale. The response format is a five-step scale from 1 = "disagree strongly" to 5 = "agree strongly". Only three dimensions were used in this study – conscientiousness (Spearman-Brown $\rho = 0.441$), neuroticism ($\rho = 0.636$), and extraversion ($\rho = 0.514$). Although there is a debate concerning the usability of the short version of BFI in different countries (Ludeke & Larsen, 2017), in the context of the Czech Republic it was verified that the short version is able to reconstruct information about the five personality traits to a high degree (Hřebíčková et al., 2016). Moreover, we decided to use BFI-10 to avoid the time demands of the full-length BFI.

Utrecht Work Engagement Scale short form (Schaufeli, Bakker, & Salanova, 2006) – This 9-item scale uses a response format of a scale from 1 = "never" to 7 = "all the time/every day". Cronbach's α of the scale is 0.912. The scale is tended as a three-dimensional measure of vigor, dedication, and absorption. Based on the results of exploratory factor analysis (first eigenvalue to second eigenvalue ratio of 5.82) and in accordance with Sonnentag (2003), we decided to use the total score as a measure of work engagement.

Job Satisfaction Scale – The 4-item job satisfaction short scale from the COPSOQ-II (Kristensen et al., 2005), supplemented by an item focused on the financial aspect, uses a response format of a scale from 1 = "very unsatisfied" to 4 = "very satisfied". Cronbach's α of this five-item scale is 0.759.

Satisfaction with Life Scale (Pavot & Diener, 1993) – This is a 5-item scale with a response format of a scale from 1 = "strongly disagree" to 7 = "strongly agree". Cronbach's α of this scale is 0.893.

Statistical Analysis

The structural model presented in the Results was computed using the lavaan package in R (Rosseel, 2012) and was estimated using the robust maximum likelihood method (MLM – maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistics). For personality characteristics, we used individual items as indicators. For all remaining latent variables, we used three parcels per variable as indicators to reduce the sampling variability and the amount of model incorrectness (Little, 2013). Individual scale items were distributed into parcels based on their order. The parcels were computed as mean scores for relevant items. We controlled for the influence of age and gender by incorporating them as predictors of each latent variable. We used the marker variable method to set the scale of each latent variable. Due to the large sample size, we report and interpret results only for variables meeting a 1% threshold for significance. When describing effect sizes in case of correlations we stick to the guidelines suggested by Gignac and Szodorai (2016).

Results

In Table 2, we summarize descriptive univariate and bivariate statistics for the variables used in the subsequent analyses. The presented results clearly show that general life satisfaction is notably related to personality characteristics (to extraversion on small level and neuroticism on medium level) and to job-related characteristics on large level (work engagement and job satisfaction).

Based on theoretical considerations we postulate a structural model in which personality characteristics predict work engagement, which consequently predicts job satisfaction and, ultimately, overall life satisfaction. We also hypothesize that personality traits directly influence both job satisfaction and life satisfaction and, therefore, the appropriate direct paths were incorporated into the model (see Figure 1). The model overall shows very good fit ($\chi^2 = 659.4$; $df = 94$; $p < 0.01$; RMSEA = 0.055; 90 % CI [0.051

Table 2 *Descriptive statistics of basic demographic, personality-related and job-related variables and their correlations*

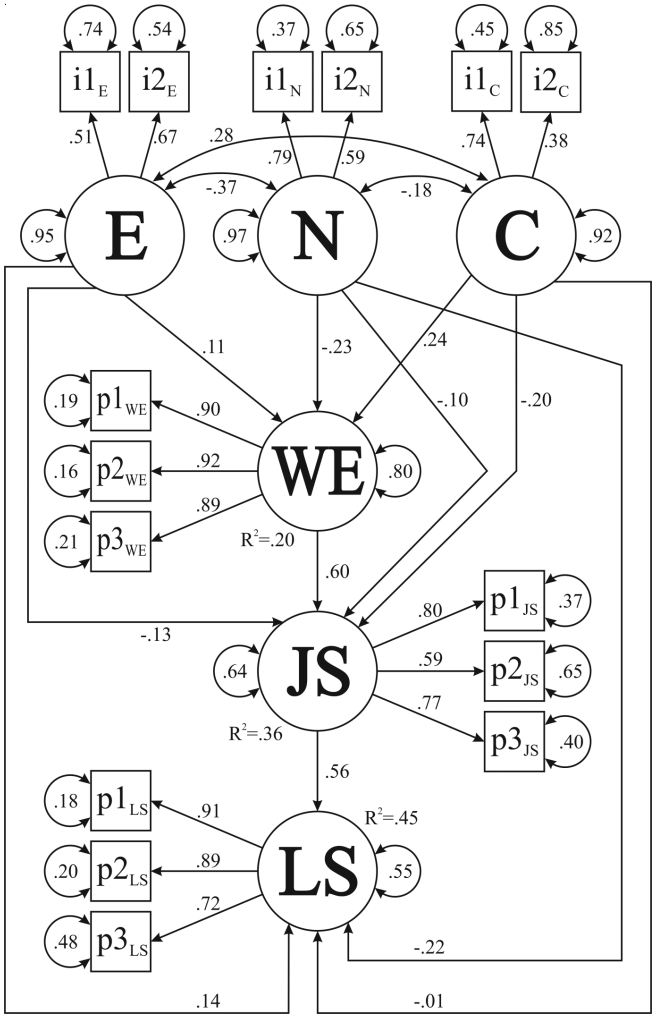
	Gender	Age	E	N	C	WE	JS	LS
Age	.094*							
E	-.163*	-.045						
N	-.070*	-.141*	-.201*					
C	-.160*	.094*	.149*	-.123*				
WE	-.002	.147*	.157*	-.238*	.232*			
JS	.084*	.109*	-.031	-.120*	-.024	.399*		
LS	-.031	.045	.147*	-.271*	.047	.417*	.473*	
m/sd			3.22/0.89	2.91/0.89	3.77/0.81	4.96/1.01	2.76/0.54	4.76/1.19

Note. E – Extraversion; N – Neuroticism; C – Conscientiousness; WE – Work Engagement; JS – Job Satisfaction; LS – Life Satisfaction.

Scale scores were computed as sums of the respective items.

* Meets 1% threshold for significance.

Age and gender characteristics are described in the Sample section. Gender is coded as 1 for males and 0 for females.



Note. E – Extraversion; N – Neuroticism; C – Conscientiousness; WE – Work Engagement; JS – Job Satisfaction; LS – Life Satisfaction. All presented estimates are in the standardized form. With the exception of the regression coefficient between C and LS, all relations are significant at the 1% level. For the sake of clarity, age and gender relations are not depicted in the schematic: E ~ gender = -.21**; N ~ gender = -.07**; C ~ gender = -.22**; WE ~ gender = .05; JS ~ gender = .00; LS ~ gender = -.07**; E ~ age = -.01; N ~ age = -.16**; C ~ age = .18**; WE ~ age = .07**; JS ~ age = .06**; LS ~ age = -.06** (gender is coded as 1 for males and 0 for females; ** meets 1% threshold for significance).

Figure 1 Structural model – Personality characteristics as predictors of work engagement, job satisfaction and life satisfaction

to 0.059]; SRMR = 0.037; CFI = 0.956). Even though the chi-square ratio does not favor the model tested, other indices strongly support the fit of the model (Hooper, Coughlan, & Mullen, 2008).

As shown in Figure 1, close relations were observed between work engagement and job satisfaction, as well as between job satisfaction and general life satisfaction. Personality characteristics are directly related to work engagement as well as to job and life satisfaction. Relationships were found between neuroticism and work engagement (β = -.23) and neuroticism and life satisfaction (β = -.22). Interestingly enough, in case of conscientiousness, significant relationships were found only for work related characteristics. Conscientiousness positively influence work engagement (β = .24), while its direct influence on job satisfaction is negative (β = -.20). Relationships between extraversion and the other constructs are relatively small but still significant. To produce a clear profile of the influence of personality characteristics on job and life satisfaction, we summarize their direct and indirect effects in Table 3.

The strongest predictor of life satisfaction is neuroticism, with a total standardized effect of -.36; this effect manifested through one direct and two indirect pathways. One indirect way involves work engagement and job satisfaction, and the other indirect pathway involves job satisfaction but not work engagement. Overall,

Table 3 *Direct and indirect relations of personality characteristics with job satisfaction and life satisfaction*

Relation	Effect type	Standardized estimate
E → JS	Direct	-.13*
	Indirect	.07*
	Total	-.07
E → LS	Direct	.15*
	Indirect 1 (E → WE → JS → LS)	.04*
	Indirect 2 (E → JS → LS)	-.08*
	Total	.11*
N → JS	Direct	-.10*
	Indirect	-.14*
	Total	-.24*
N → LS	Direct	-.22*
	Indirect 1 (N → WE → JS → LS)	-.08*
	Indirect 2 (N → JS → LS)	-.05*
	Total	-.36*
C → JS	Direct	-.20*
	Indirect	.14*
	Total	-.05
C → LS	Direct	-.01
	Indirect 1 (C → WE → JS → LS)	.08*
	Indirect 2 (C → JS → LS)	-.11*
	Total	-.04

Note. E – Extraversion; N – Neuroticism; C – Conscientiousness; WE – Work Engagement; JS – Job Satisfaction; LS – Life Satisfaction.

* Meets 1% threshold for significance.

neuroticism showed a consistent negative effect on life satisfaction. To fully clarify the effect of extraversion on life satisfaction, we focused on the relationship between extraversion and job satisfaction. Even though its indirect effect on job satisfaction through work engagement was positive, its direct effect was negative. Therefore, extraversion showed both negative (E → JS → LS) and positive (E → WE → JS → LS) indirect effects on life satisfaction. These indirect effects were accompanied by a positive direct effect of extraversion on life satisfaction. The indirect influences of conscientiousness on life satisfaction were stronger than those of extraversion, but their pattern was similar (positive effect when involving work engagement and negative effect when not involving work engagement). In contrast to extraversion, conscientiousness did not show a direct effect on life satisfaction, and the total effect of conscientiousness on life satisfaction was insignificant.

Discussion

Our main objective was to evaluate the influences of the personality traits of neuroticism, extraversion and conscientiousness on life satisfaction through work engagement and job satisfaction. Additionally, we monitored the direct influences of these personality traits on job satisfaction and life satisfaction. The results regarding the influences of these personality traits on life satisfaction and job satisfaction through work engagement were consistent with our hypotheses and are consistent with previous findings. Extraversion, conscientiousness and emotional stability showed a positive effect on work engagement (Inceoglu & Warr, 2011; Pocnet et al., 2015); as expected, high work engagement in turn positively affects job satisfaction (Karanika-Murray, Duncan, Pontes, & Griffiths, 2015), and job satisfaction is associated with life satisfaction (Newman, Nielsen, Smyth, & Hooke, 2015). Furthermore, the indirect influences of all three personality traits on life satisfaction were significant.

Our assumption that personality traits directly affect life satisfaction was also partially confirmed. While the direct influences of extraversion (positive) and neuroticism (negative) on life satisfaction were significant, the influence of conscientiousness on life satisfaction was not confirmed. One explanation for this result may be that our sample includes predominantly people with above-average levels of conscientiousness. This distribution favoring the upper portion of the conscientiousness range may not adequately distinguish the effect of conscientiousness on life satisfaction. Another explanation may be that conscientiousness affects life satisfaction indirectly through either work engagement or job satisfaction. Given that conscientiousness includes personal characteristics associated with performance, competencies, self-discipline and responsibility, this trait influences overall life satisfaction primarily through the exercise of the professional role, for which these characteristics are important.

Regarding the influence of personality traits on job satisfaction, we found that while the influence of neuroticism was significantly negative as expected, the influences of extraversion and conscientiousness were ambiguous. In addition to the positive effects of both traits on job satisfaction through work engagement, weak negative direct influences of both traits on job satisfaction were observed. Although this finding of a negative effect of conscientiousness on job satisfaction is uncommon, the meta-analysis by Judge et al. (2002) revealed a negative correlation between conscientiousness and job satisfaction. In a previous study (Zábrodská et al., 2016), we explored various aspects of job satisfaction in the same sample (i.e., using scale items) – satisfaction with the job as a whole (everything taken into consideration), physical working conditions, use of abili-

ties, career prospects and pay. While satisfaction with the job overall and with the working conditions was reported by more than 80% of respondents, only 2/3 of academic faculty members were satisfied with the use of their own abilities and with their career prospects, and less than half were satisfied with their salary. It is therefore possible that these aspects reduce job satisfaction in individuals with high conscientiousness because they are performance-oriented, ambitious, have a sense of competence and generally focus on success and on achieving their goals, which may exceed the potential of the organization. Experience of inner satisfaction is certainly important, but external factors such as the prospect of a promotion or a financial reward are important as well (Bandura, 1999; Seligman, 2011).

The observed negative influence of extraversion on job satisfaction can be explained according to the concept of proactive personality, in which dispositional characteristics contribute to proactive behavior (Wu, Parker, & Bindl, 2013). In addition to socio-cognitive (self-efficacy) and affective traits (positive and negative affectivity), extraversion is considered to be a constituent of proactive personality, especially in the facets of assertiveness and activity. In our research, we used the short version of the BFI, which does not measure facets. However, as shown in a study by Rammstedt and John (2007), the dimension of extraversion in BFI-10 correlates with all NEO-PI-R facets. Additionally, in the aforementioned study, extraversion according to BFI-10 most closely correlated with the facet of assertiveness. According to Wu et al. (2013), proactive behavior is particularly suitable for complex and uncertain environments, as it enables people to control a situation in advance and act in accordance with their own initiative, without the need for supervision by others. In a fairly structured academic environment, such behavior may not be beneficial and may lead to a feeling of wasted potential. Conversely, characteristics associated with introversion, preference for working alone or leaving leadership to others may be advantageous in an academic environment.

Of all three studied traits, neuroticism has the strongest and most consistent negative effect on life satisfaction. Given that the basis of neuroticism is negative emotionality, it is plausible that negative emotions systematically reduce life satisfaction, job satisfaction and work enthusiasm. The effects of extraversion and conscientiousness on life satisfaction are similar in that both show negative influences on life satisfaction through job satisfaction but positive influences on life satisfaction through work engagement. In contrast to neuroticism, extraversion and conscientiousness are rather complex traits (McCrae & Costa, 1999) that include a variety of characteristics. Further research is needed to determine whether different facets have distinct effects on job satisfaction.

Conclusion

Of all three studied traits, neuroticism has the strongest and most consistent negative effect on life satisfaction, and this effect was manifested both directly and indirectly – through job satisfaction alone or through work engagement and job satisfaction. Given that the basis of neuroticism is negative emotionality, it is plausible that negative emotions systematically reduce life satisfaction, job satisfaction and work enthusiasm. The effects of extraversion and conscientiousness on life satisfaction show a similar pattern with the exception that conscientiousness has no direct effect on life satisfaction and the overall effect of conscientiousness is insignificant. The effects of extraversion and conscientiousness on life satisfaction are similar in that both show negative influences on life satisfaction through job satisfaction but positive influences on life satisfaction through work engagement. In contrast to neuroticism, extra-

version and conscientiousness are rather complex traits (Costa & McCrae, 1992; DeYoung, Quilty, & Peterson, 2007) that include a variety of characteristics. Further research is needed to determine whether different facets have distinct effects on job satisfaction.

Limitations

There are several limitations requiring to be mentioned. First, the study design was cross-sectional. Thus, causality (from Big Five personality traits to work engagement, job satisfaction and life satisfaction) cannot be inferred. Moreover, some recent longitudinal studies in this area have also shown that reverse causality is a distinct possibility. For example, Rayton and Yalabik (2014) have found negative effect of work engagement on job satisfaction. Future longitudinal work, which is able to better address the direction of these complex associations, will likely further inform this issue.

Another limitation of the study arises from the use of an abbreviated versions of questionnaires, in particular of the personality questionnaire BFI-10. We chose these shortened versions to reduce the total time required to complete the set of questionnaires with the aim of increasing the response rate and indirectly supporting the representativeness of the final sample. Although less information regarding the structure of personality traits was obtained, we believe that the abbreviated version of the BFI-10 allows for adequate testing of the postulated hypotheses, supported by a study by the authors of the method (Rammstedt & John, 2007), as well as by a subsequent verification of the method in a corresponding national context (Hřebíčková et al., 2016).

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