Big Five Personality Traits, Cognitive Appraisals and Emotion Regulation Strategies as Predictors of Achievement Emotions

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Abstract

In academic settings, emotions can arise in a variety of contexts and have adverse and interfering effects on learning and performance, especially those of negative valence. Thus, the investigation of their personal antecedents and different strategies implemented by students in order to regulate them, are important topics of research. The aim of this study was to examine the unique contribution of Big Five personality traits (as distal personal antecedents of emotions), cognitive control and value appraisals (as their proximal antecedents) and students' tendencies to reappraise or suppress their emotions (as most important emotion regulation strategies) for experiencing academic emotions of unhappiness, anger, anxiety and humiliation. The sample consisted of 500 high school students who completed the self-report questionnaire during their regular scheduled classes. The series of multiple hierarchical regression analyses showed that all groups of predictors have made significant and independent contribution to the explanation of all analysed emotions.

Keywords: achievement emotions, big five personality traits, cognitive appraisal, emotion regulation strategies.

Introduction

The lack of research on emotions in educational contexts (with the exception of research on test anxiety and research on emotional consequences of causal attributions) has been noted by a number of education scholars (Boekaerts, 2007; Op't Eynde, De Corte, & Verschaffel, 2007; Schutz & Pekrun, 2007; Schutz, Quijada, de Vries, & Lynde, 2011). However, this deficiency has recently been recognized and a heightened interest in the study of emotional experience has appeared, both in students and teachers in the educational context. As a consequence, the role of emotions in students' learning and achievement, as well as

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in teachers' instructional practice and professional development, is the subject of consideration in the most recent theories and research on self-regulation of learning.

Mauss, Bunge, and Gross (2007) define emotions as multifaceted, whole-body responses that involve synchronized changes in the domains of subjective experience, behaviour, and peripheral physiology. They propose that emotions arise when an individual attends to a situation and evaluates it as relevant to his or her goals. Similarly, Schutz et al. (2011) pointed out two key aspects of the definition of emotion. First, emotions involve judgments or appraisals of what is happening during a particular person-environment transaction. Individuals assess where they are in relation to where they want to be with regard to their own goals, values and beliefs as well as their social network. In educational context, appraisals include students' or teachers' perceptions of how the pursuit of a goal progresses during an academic transaction. Second, emotions are social constructs and arise from particular social-historical contexts. Thus, specific emotional experiences comprise person-environment transaction and are influenced by the certain social-historical context in which this transaction occurred.

As Pekrun, Frenzel, Goetz, and Perry (2007) emphasised, educational settings are permeated with intense emotional experiences that influence learning and performance, interactions and personal growth in both students and teachers. In the control-value theory of achievement emotions (Pekrun, 2006; Pekrun, Goetz, Titz, & Perry, 2002), which is the main theoretical framework of this study, achievement emotions are defined as emotions linked directly to achievement activities (in relation to learning, classroom instruction and taking tests and exams) or achievement outcomes. Theory postulated that control appraisals and value appraisals are the proximal determinants of achievement emotions (different patterns of these appraisals instigate different achievement emotions). In addition, more distal individual antecedents could, through control and value appraisals (mediators), influence emotional experiences also. These distal antecedents could be students' achievement goals, motivational beliefs, non-cognitive factors such as genetic dispositions and temperament, or determinants in classroom interaction, social environments and the broader socio-historical context. As postulated in this theory, emotions, their appraisal antecedents, their distal individual antecedents, their environmental antecedents and their performance outcomes are typically linked by reciprocal causation (Pekrun & Stephens, 2010). Empirical findings are largely in line with assumptions of the control-value theory (Burić, 2010; Burić & Sorić, 2012; Burić, Sorić, & Penezić, 2011; Goetz, Pekrun, Hall, & Haag, 2006; Goetz, Preckel, Pekrun, & Hall, 2007; Frenzel, Pekrun, & Goetz, 2007; Pekrun et al., 2002; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011).

Achievement emotions affect the cognitive, motivational, and regulatory processes mediating learning and achievement, as well as psychological well-being, happiness, and life satisfaction (Pekrun, 2006). Generally, there is accumulating evidence that students' positive emotional experiences (e.g. joy, proud, hope) have a positive impact on learning and academic achievement, while negative emotional experiences (e.g. anxiety, boredom, anger) have a negative impact (Burić et al., 2011; Burić & Sorić, 2012; Goetz et al., 2007; Pekrun, Elliot, & Maier, 2006; Pekrun et al., 2002, 2011; Petrešević & Sorić, 2011; Schutz & Davis, 2000). For example, Pekrun et al. (2004) found that positive test emotions of joy, hope and pride are positively associated with measures of general self-esteem, self-efficacy, perceived academic control and interests. On the other hand, negative test emotions of anger, anxiety, shame and helplessness were negatively associated with these beliefs. Goetz et al. (2006) found that students' emotions of joy and pride were positively correlated with their general self-esteem, academic self-concept and valuation of learning as well as with knowledge and achievement in the context of Latin instruction. However positive achievement emotions do not always produce positive effects and negative achievement emotions do not always produce negative effects on learning and academic achievement. That is, the pattern of these relationships is more complex than simplistic hedonism would suggest (Pekrun, 2006). For example, in students who have confidence in their capabilities, the shame of exam failure can influence motivation to invest more effort in the future (Turner & Schallert, 2001). Therefore, negative activating emotions can enhance performance in specific cases, although their average affects across students are mostly negative.

Recognizing the importance of student's emotional experience for the success of the learning process has resulted in researchers investigating the process involved in emotional regulation (Schutz et al., 2011). Prominent models of self-regulated learning as an essential feature of self-regulation emphasise a self-oriented feedback loop in which students monitor the effectiveness of their learning attempts and respond to this feedback in a variety of ways, ranging from covert changes in self-perception, to overt changes in behaviour (Zimmerman, 2001). It is certain that emotional experiences (pleasant or unpleasant) could provide multidirectional feedback for other processes involved in self-regulation (Schutz et al., 2011). In this way, since self-regulated learning implies that students are metacognitively, motivationally and behaviourally active participants in their own learning process (Zimmerman, 2001), students' attempts to regulate their emotional experience should be an essential part of self-regulation of learning. Starting from the premise that students are active beings rather than passive emitters of their

emotions, psychologists have become increasingly interested in the ways they attempt to regulate their emotional responses (Gross, 2008).

Emotion regulation refers to the processes by which individuals influence which emotions they have, when they have them, and how they experience or express them (Gross, 2002). Emotion regulation may dampen, intensify, or simply maintain emotion, depending on an individual's goals (Gross & Thompson, 2007). Emotion regulation involves different processes that are directed at monitoring, evaluating and modifying emotional experiences (Schutz et al., 2011). Since emotions are multicomponent processes that unfold over time, regulation of emotions involves changes in the dynamics, or the latency rise time, magnitude, duration and offset of responses in the behavioural, experiential or physiological domains (Gross, 2002). Emotion regulation involves modifications of one or more aspects of the emotion, including the eliciting situation, attention, appraisals, subjective experience, behaviour, or physiology (Gross & Thompson, 2007). In accordance with their assumption about reciprocal nature of links between emotions, their antecedents and effects, Pekrun et al. (2007) pointed out that emotions can be regulated and altered by addressing any of the elements involved in these cyclic feedback processes. In most cases, emotion regulation aims to enhance the experience of positive emotions and reduce the experience of negative emotions, but individuals attempt to increase, maintain or decrease both negative and positive emotions. Further, emotion regulation can be conscious as well as unconscious and emotion regulation is neither inherently good nor bad (Gross, 2002).

Gross (2001) postulated the process model of emotion regulation which differentiates specific emotion regulation strategies along the timeline of the unfolding emotional response. According to this model an emotion can be regulated at five points in the emotion generative process, that is, five different families of emotion-regulatory processes may be distinguished according to when in the emotion-generative process they have their primary impact (Sheppes & Gross, 2011). These five families of emotion regulation strategies are: selection of the situation, modification of the situation, deployment of attention, change of cognitions and modulation of responses (behavioural, experiential or physiological). The first four groups are antecedent focused (refer to things we do before the emotion response is fully activated), while the fifth is response focused (refers to things we do once when an emotion is already on-going).

Numerous studies have shown that differences in emotion regulation are associated with a variety of important outcomes in individuals' lives (Mauss, Bunge, et al., 2007; Mauss, Cook, Cheng, & Gross, 2007). This prior research has also showed that different emotion regulation strategies have different profiles of

consequences (Gross, 2001), but what makes an effective emotional regulation is still an unanswered question. Therefore, identifying effective forms of regulation is an important goal of future research. Mauss, Cook, et al. (2007) have suggested that one way to predict the adaptiveness of different emotion regulation strategies is to use a process model of emotion regulation (Gross, 2001) that distinguishes between response-focused and antecedent-focused emotion regulation strategies. In this way, regulatory strategies focused on altering some components of the emotional response after they have arisen (response-focused regulation) would seem to have less adaptive effects because other components of the emotional response still remain active. Contrary, regulation strategies which are aimed to alter the whole emotional response before it arises (antecedent-focused regulation) would seem to have more adaptive effects.

Two emotion regulation strategies that have received particular attention are cognitive reappraisal and expressive suppression (Balzarotti, John, & Gross, 2010). Cognitive reappraisal is a frequently used antecedent-focused strategy which is characterised by an individual's attempts to cognitively transform or reappraise an emotional situation by changing the way he or she thinks about it (to alter its meaning and emotional impact). The emotion regulation strategy of expressive suppression (a type of response modulation strategies) consists of attempts to inhibit or reduce on-going emotion-expressive behaviour (Gross, 2002).This type of strategy should decrease expressive behaviour, but should not decrease emotion experience, and might even increase physiological responding (e.g. increase sympathetic activation of the cardiovascular and electrodermal systems).

Cognitive reappraisal and suppression can be distinguished according to their long-term affective, cognitive and social consequences. Both experimental and correlational studies have shown that reappraisal is associated with reduced experience of negative emotion and greater experience of positive emotion, while suppression is associated with experience of lesser positive emotions and greater negative emotions (Gross, 2001; Gross & John, 2003; Mauss, Cook, et al., 2007). Furthermore, unlike reappraisal, suppression is cognitively expensive (deteriorates verbal memory). Also, suppression is negatively associated with sharing emotions with other people and using social support (Gross, 2002; Gross & John, 2003) and positively associated with greater levels of negative affect and depressive symptoms (Balzarotti et al., 2010). Altogether, empirical findings indicate that reappraisal has more favourable consequences than suppression (Balzarotti et al., 2010; Gross, 2002; Gross & John, 2003; John & Gross, 2004).

As Tyson, Linnenbrink-Garcia, and Hill (2009) pointed out even with the increased popularity of research on self-regulated learning, little attention has been paid to the emotion regulation in educational settings. It is surprising because of the

stressful nature of academic settings (high-stakes testing, challenging tasks, interpersonal interactions, etc.) that elicit students' various and intense emotional reactions. In fact, students' ability to intervene and modify their emotional reactions when they perceive the incongruence between these responses and situations (when these emotions are not adaptive for the goal attainment) seems to be crucial to their self-regulation of learning and academic success. In general, research on self-regulated learning has shown that emotion regulation has an important role for successful learning. As a result, demands for a more explicit attention to developing emotion regulation skills and designing powerful learning environments for the acquisition of these skills are increasing (Pekrun et al., 2007). The control-value theory implies that students' emotions can be positively influenced by fostering their perceptions of control over academic activities and outcomes and their appraisals of the values of these activities and outcomes. Also, regulating control and value appraisals is assumed to be one of the most important mechanisms for emotional self-regulation. Therefore, it is assumed that by supporting students in developing their emotional regulatory skills educators can shape their overall self-regulation of learning thereby contributing to their positive emotional experience and academic achievement. If we want to be able to design effective learning environments targeting achievement emotions, we have to develop empirically based generalizable knowledge about their antecedents, relations and effects. Thus, students' emotional experience, personal antecedents of that experience and different strategies implemented by students in order to regulate them, should be an interesting and useful research topic.

Accordingly, in the present research we try to examine the contribution of students' appraisals of control and value of learning to their emotional experience of negative achievement emotions. In doing this, we decide to operationalize the appraisal of control through the construct of self-efficacy. Pekrun (2006) stated that expectancies of achievement can be assumed to depend primarily on perceived internal control over achievement, as implied by achievement-related action–control and action–outcome expectancies. Action–control expectancies are expectancies that an action can be initiated and performed, and amongst various terms that have been used to designate these expectancies the term "self-efficacy expectation" proposed by Bandura (1977; according to Pekrun, 2006) became the most popular.

Perceived self-efficacy refers to personal beliefs about one's capability or competence to learn or perform a particular behaviour at designated levels, that is, personal beliefs that they have the prerequisite skills necessary to successfully complete a particular task. In the framework of control-value theory this term simply denotes appraisals of being able to produce an action (not outcome of that

action). Bandura (1997) proposed that self-efficacy was a powerful predictor of behaviour because of explicitly self-referent nature of self-efficacy beliefs and because of their focus on a given specific task. Considerable research in various fields has confirmed this assumption. Research has demonstrated a positive link between students' self-efficacy and academic performance and self-regulated learning (Pajares, 2002; Schunk, 2001; Zimmerman, 2001), and a negative link with anxiety and depression (Linnenbrink & Pintrich, 2002; Muris, 2001; Zimmerman & Schunk, 2004). Sorić (2007) has found that a lack of perceived self-efficacy was connected with negative emotional experience in both successful and unsuccessful students.

In addition, further research should investigate how personality traits, as more distal personal antecedents, predispose individuals to experience different achievement emotions and to employ different emotion regulation strategies. The Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional stability/Neuroticism and Intellect/Openness) are related to a wide range of behaviours including learning and academic achievement. According to Bidjerano and Dai (2007) it seems that positive associations of Conscientiousness, Intellect and Agreeableness with components of self-regulated learning (e.g. persistence, methodical and analytical learning, deep approach to learning, elaborative learning, etc.) have more theoretical and empirical support than associations of Extraversion and Emotional stability which might be more complex. Concerning emotional experience, Extraversion and Neuroticism (sometimes referred to by the other end of the dimension as Emotional Stability) have been associated with individual differences in the affective level and environmental responsivity (Revelle & Scherer, 2009). For example, high scores on Neuroticism are related to experiencing frequent negative emotional states, such as anxiety and anger, interpreting ambiguous situations as negative, and having a poor ability to respond to stress. Similarly, regarding emotion regulation studies have shown only modest relations with neuroticism and extraversion (John & Gross, 2004). Specifically, reappraisal is negatively related to neuroticism, and suppression is negatively related to extraversion (Balzarotti et al., 2010). Since these relations are rarely investigated in the educational context, we also decided to validate whether learner's personality traits predict the experience of negative emotions strategies in context of chemistry learning.

Specifically, the aim of this study was to examine the unique contribution of Big Five personality traits (as distal personal antecedents of emotions), cognitive control and value appraisals (as their proximal antecedents) and students' tendencies to reappraise or suppress their emotions (as most important emotion regulation strategies) to their experience of negative achievement emotions of

unhappiness, anger anxiety and humiliation. In addition, considering that achievement emotions can be differentiated according to their object focus, in this research we examine emotions relating to achievement activities (learning) and not emotions relating to the success and failure outcomes of these activities. Because the control-value theory proposes that achievement emotions, as well as their cognitive antecedents, are organized in domain-specific ways (Goetz et al., 2006, 2007; Frenzel, Pekrun, & Hall, 2006; Pekrun et al., 2002), it is necessary to analyse them in relation to specific academic domains. Likewise, studies showed that students' emotion regulation strategies may differ from one academic domain to another (e.g., a student can use one form of regulating their emotions when learning history, but quite different form when learning mathematics). For this reason we explore the relationships amongst students' emotions, their antecedents and regulatory strategies with regard to specific school subject of chemistry.

Method

Participants and procedure

The sample consisted of 500 high-school students in Croatia (159 boys and 341 girls; M_{age}=16.19) which completed the questionnaires anonymously during a regularly scheduled classroom period. Participation in the study was voluntary and anonymous. Students were informed about the purpose of the study, and had half an hour to complete the self-report questionnaires.

Instruments

Personality traits. The IPIP Big-Five factor markers is a 50 or 100-item inventory that can be freely downloaded from the internet for use in research (http://ipip.ori.org/). For this study we used the 50-item version comprising 10 items for each of the Big Five personality factors: Extraversion (E), Agreeableness (A), Conscientiousness (C), Emotional Stability (ES) and Intellect (I). Participants were instructed to indicate how accurate each phrase-item was for them, using a 5-point Likert-type scale. Ratings were averaged for all items on each subscale. Reliability coefficients (Cronbach alpha) of these scales were (in above order) .80, .80, .75, .75 and .74.

Appraisals of control and learning value. Students' appraisals of control were measured by the eight items of the *Self-efficacy for Learning scale* from *the Motivated Strategies for Learning Questionnaire (MSLQ)* developed by Pintrich

and colleagues (Pintrich, Smith, Garcia, & McKeachie, 1991). Scale measured the extent to which students believed that they were competent in terms of task-related abilities and skills and had a high probability of a successful academic performance (e.g. "I'm confident I can learn the basic concepts taught in this course."). Participants were instructed to refer to the specific academic tasks they encountered in the context of the chemistry classes when responding on these items. Students' *perceptions of the value of learning* and knowledge acquisition in chemistry were assessed by the corresponding subscale of a Croatian version (Rijavec & Brdar, 2002) of the *Components of Self-Regulated Learning (CSRL)* questionnaire (Niemivirta, 1996). Six items on the scale were adapted for a course in chemistry and measured the extent to which students believed that studying and attending courses in chemistry was useful, interesting and important (e.g. "In my opinion, things to be learned on a chemistry course are important.").

For both scales, control and value appraisal, participants responded on a Likert-type scale ranging from *1, strongly disagree*, to *5, strongly agree*. To obtain scores on these scales, ratings were averaged for all items on each subscale. Reliability coefficients (Cronbach alpha) of these scales were .86 (self-efficacy/control) and .90 (value).

Emotion regulation strategies. Students' tendencies to reappraise or suppress their academic emotions in context of chemistry learning were measured by two corresponding subscales of *The Academic Emotion Regulation Scale* (Burić, Sorić, & Penezić, in press) which consists of eight different subscales assessing different forms of academic emotion regulatory strategies. *The Reappraisal Subscale* contains 6 items (e.g. "When I feel frightened by the exam, I tell myself there is always a second chance", $\alpha=.75$) and *The Suppression Scale* contains 7 items (e.g. "I tend to suppress anger and rage that I feel during my chemistry classes", $\alpha=.66$). Participants responded on a Likert-type scale ranging from *1-strongly disagree*, to *5-strongly agree*. Ratings were averaged for all items on each subscale.

Academic emotions. The Emotional Experience Scale (Sorić, 2002) was originally developed for measuring participants' temporary emotional state. The scale consists of 47 adjectives-items which describe different emotions (e.g. satisfied, good, unhappy, proud, etc.) and participants by circling one number on a 5-point scale (*1- not at all, 5- completely*) assess how they feel at that moment. In the present research, an instruction was altered and participants assessed how they usually feel while learning chemistry and only four subscales which measure negative emotions of Unhappiness ($n=6$, $\alpha=.88$), Anger ($n=7$, $\alpha=.85$), Anxiety ($n=8$, $\alpha=.91$) and Humiliation ($n=10$, $\alpha=.94$) were applied. Each subscale contains the list

of adjectives to describe a particular emotional experience and ratings were averaged for all items on each subscale.

Results

Firstly, the statistical significance and general strength and direction of the relationships between the examined variables were analysed by Pearson's correlation coefficients.

The results indicate that male and older students experience higher levels of negative emotions of unhappiness, anger and humiliation, but girls and boys do not experience different levels of anxiety. Personality trait of extraversion was significantly correlated with humiliation and anxiety indicating that more extraverted students tend to experience slightly less humiliation and anxiety in academic situations. Higher levels of agreeableness, conscientiousness and emotional stability are associated with lower levels of all analysed negative emotions, with the exception of non-significant correlation between agreeableness and anxiety. When considering cognitive appraisal variables, lower perceptions of self-efficacy and higher perceived value of learning were associated with more negative emotions of unhappiness, anger, anxiety and humiliation. Finally, students' tendencies to reappraise the situation in order to regulate emotions were related to higher levels of unhappiness, anxiety and humiliation, while tendencies to suppress emotions were not associated with any of the studied emotion.

In order to examine the unique contribution of personality traits, cognitive appraisals and emotion regulation strategies for experiences of negative academic emotions of unhappiness, anger, anxiety and humiliation, four hierarchical regression analyses were performed. Although four negative academic emotions were highly intercorrelated, we decided to perform four separate hierarchical regression analyses because these emotions could have different emotional and behavioural consequences in the educational context. For example, students who experience anger and students who experience humiliation during chemistry learning would probably differ in their subsequent learning motivation and consequently in their academic achievement. In this way, even if we could expect similar relationships between these emotions and the examined antecedent variables, we are also interested in potential minor differences in these relationships.

Table1. *Descriptive Data and Correlations between Examined Variables*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Gender	-														
2. Age	.06	-													
3. Extraversion	.06	-.02	-												
4. Agreeableness	.28**	-.13**	.19**	-											
5. Conscientiousness	.14**	.03	.07	.23**	-										
6. Emotional Stability	-.07	.00	.21**	.11*	.30**	-									
7. Intellect	.10*	-.16**	.34**	.26**	.18**	.12**	-								
8. Self-efficacy	.06	-.10*	.13**	.21**	.22**	.24**	.25**	-							
9. Learning Value	.17**	-.09*	.06	.20**	.23**	.19**	.10*	.57**	-						
10. Reappraisal	.14**	-.04	.10*	.24**	.02	.02	.10*	.05	-.06	-					
11. Suppression	.14**	.04	-.16**	.11*	.16**	-.02	.01	.06	.08	.21**	-				
12. Unhappiness	-.11*	.18**	-.06	-.20**	-.22**	-.27**	-.12*	-.52**	-.59**	.10*	.06	-			
13. Anger	-.16**	.16**	-.08	-.21**	-.22**	-.30**	-.11*	-.41**	-.55**	.05	.01	.81**	-		
14. Anxiety	.02	.17**	-.09*	-.02	-.13**	-.36**	-.10*	-.38**	-.41**	.12*	.08	.69**	.75**	-	
15. Humiliation	-.11*	.18**	-.10*	-.19**	-.19**	-.35**	-.12**	-.46**	-.52**	.10*	.06	.84**	.88**	.82**	-
M	1.68	16.20	3.38	3.82	3.25	3.06	3.65	3.58	3.14	3.51	3.14	2.21	1.99	2.43	1.95
SD	0.47	0.71	0.71	0.66	0.70	0.68	0.59	0.86	0.04	0.82	0.77	0.99	0.91	1.06	0.99

*p<.05; **p<.01.

Table 2. *Hierarchical Regression Analyses with Negative Emotions of Unhappiness, Anger, Anxiety and Humiliation as Criterions and Personal Variables, Personality Traits, Cognitive Appraisals and Emotion Regulation Strategies as Predictors*

Emotions	Unhappiness	Anger	Anxiety	Humiliation
Predictors				
Step 1				
(Personal Variables)	Beta coefficients			
Gender	-.12**	-.17**	.01	-.12**
Age	.18**	.17**	.17**	.18**
R^2	.05**	.05**	.03**	.05**
Step 2				
(Personal Variables + Personality Traits)	Beta coefficients			
Gender	-.09*	-.14**	-.03	-.11**
Age	.17**	.16**	.17**	.17**
Extraversion	.02	.02	-.01	.01
Agreeableness	-.10*	-.10*	.06	-.09
Conscientiousness	-.12**	-.10**	-.03	-.06
Emotional Stability	-.23**	-.28**	-.36**	-.33**
Intellect	-.01	.00	-.04	-.02
R^2	.15**	.17**	.17**	.19**
R^2- change	.10**	.12**	.14**	.14**
Step 3				
(Personal Variables + Personality Traits + Cognitive appraisals)	Beta coefficients			
Gender	-.03	-.09*	.02	-.06
Age	.12**	.11**	.14**	.13**
Extraversion	.02	.02	-.00	.00
Agreeableness	-.04	-.05	-.11*	-.03
Conscientiousness	-.03	-.03	.03	.01
Emotional Stability	-.13**	-.20**	-.29**	-.25**
Intellect	.03	.02	-.01	.02
Self-efficacy	-.24**	-.10*	-.16**	-.19**
Value of learning	-.40**	-.41**	-.28**	-.34**
R^2	.43**	.37**	.30**	.38**
R^2 - change	.28**	.20**	.13**	.19**

Table 2. - Continued

Emotions	Unhappiness	Anger	Anxiety	Humiliation
Predictors				
Step 4				
(Personal Variables + Personality Traits + Cognitive Appraisals + Emotion Regulation Strategies)	Beta coefficients			
Gender	-.05	-.10*	.00	-.08*
Age	.12**	.11**	.14**	.13**
Extraversion	.04	.02	.00	.01
Agreeableness	-.06	-.06	.08	-.06
Conscientiousness	-.04	-.04	.02	.00
Emotional Stability	-.13**	-.19**	-.29**	-.25**
Intellect	.03	.02	-.01	.01
Self-efficacy	-.25**	-.11*	-.17**	-.20**
Value of learning	-.39**	-.40**	-.27**	-.32**
Reappraisal	.09*	.05	.08*	.10**
Suppression	.11**	.06	.07	.09*
R^2	.45**	.38**	.31**	.40**
R^2- change	.02**	.01	.01**	.02**

Note. Gender coding: 1-boys, 2-girls. *R²*=total proportion of variance explained; Δ*R²*=proportion of variance explained by each group of predictors.

$^*p<.05$; $^{**}p<.01$.

The order of introducing separate groups of predictors in the regression model was determined by the theoretical assumptions – student's cognitive appraisals as proximal antecedents of academic emotions arise from personality traits, which represent their distal antecedents, and mobilize certain emotion regulation strategies. Furthermore, since girls and boys differ in their emotional experiences (e.g. Burić, 2010; Burić & Sorić, 2011; Frenzel et al., 2007; Pekrun et al., 2004), gender together with age was introduced in the first step of the analysis. Taking into account the aforementioned sequence, the Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional stability and Intellect), were entered in the model in the second step, variables of cognitive appraisals (self-efficacy and learning value) in the third step, and emotion regulation strategies (reappraisal and suppression) in the last step.

The hierarchical regression analysis revealed that at step 1, gender and age contributed significantly to the regression model and accounted for 5% in variation of unhappiness. Introducing personality traits in step 2 explained an additional 10%

in variation of this criterion variable. Adding cognitive appraisal variables in the model (step 3) explained an extra 28% of variance. Finally, in the step 4, emotion regulation strategies accounted for an additional 2% of criterion variance. All groups of predictors explained 45% of variance of students' experience of unhappiness. The obtained standardized regression coefficients in the last step of the analysis indicate that male and older students, less emotionally stable, with lower levels of self-efficacy and learning value and with higher use of reappraisal and suppression in order to regulate emotions, experience higher levels of unhappiness.

In the second analysis with anger as a criterion variable, at step 1, gender and age explained 5% in the variation of this variable. By introducing the personality related (Big Five) variables in the model, the proportion of the explained variance was increased by 12%. In the third step, cognitive appraisal variables accounted for an additional 20% of variance. Finally, emotion regulation strategies didn't contribute significantly to the regression model and accounted for only 0.7% in variation of anger. All groups of predictors explained 38% of variance of anger. Based on the obtained standardized regression coefficients, it can be concluded that male and older students, less emotionally stable, with lower perceptions of self-efficacy and learning value, are more prone to experiencing the negative emotion of anger.

The hierarchical regression analysis with the anxiety as a criterion variable in the first step revealed that students' age accounted for 3% of anxiety experience. Personality traits were entered in the second step explaining unique 14% of variance. By introducing the cognitive appraisal variables in the model, the proportion of the explained variance was increased by 13%. In the last step, emotion regulation strategies accounted for an additional 1% of variance. All groups of predictors explained 31% of variance of anxiety. According to significance and direction of beta weights, it can be concluded that older students, less emotionally stable, with lower levels of self-efficacy and learning value and higher tendency to implement reappraisal in order to regulate emotions, are experiencing higher levels of anxiety.

In the final hierarchical regression with humiliation as a criterion, gender and age contributed significantly to the regression model and accounted for 5% in variation of humiliation. Introducing personality traits in the step 2 explained an additional 14% in variation of this criterion variable. Adding cognitive appraisal variables in the model explained an additional 19% of variance. Lastly, emotion regulation strategies accounted for an additional 2% of variance. All groups of predictors explained 40% of variance of humiliation. The obtained results indicate that male and older students, less emotionally stable, with a higher perception of

self-efficacy and learning value and higher tendencies to use both reappraisal and suppression in order to regulate emotions, are more prone to experience humiliation in academic situations.

On the whole, the obtained analyses revealed that male and older students are prone to experience negative emotions in context of chemistry learning. Also, amongst the personality traits students' emotional instability seems to have a key role in the prediction of their negative emotional experience. On the contrary, perceptions of self-efficacy (appraisals of control) and learning value seems to decrease levels of experienced negative emotions. Besides, both types of emotion regulation strategies which students use in academic context additionally contributed to the intensity of their negative emotional experience, with the exception of experiencing anger.

Discussion

In this study, we examined relationships between distal personal antecedents of emotions (personality traits), proximal personal antecedents of emotions (cognitive appraisal), emotion regulation strategies and students' negative achievement emotions in context of chemistry learning. Specifically, the purpose of this study was to examine the unique contribution of personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional stability and Intellect), cognitive appraisals (self-efficacy and learning value), and students' tendencies to reappraise or suppress their emotions (as most important emotion regulation strategies) for their experience of negative emotions of unhappiness, anger, anxiety and humiliation.

The results of performed hierarchical multiple regression analyses revealed that gender and age, personality variables, cognitive appraisals and emotion regulation strategies make unique significant contributions to students' experience of negative achievement emotions. Specifically, these groups of predictors explained 45% variance of unhappiness, 38% of anger, 31% of anxiety and 40% of humiliation. Each group of predictors makes its own significant contribution to the explained variance for all emotions, with the exception of emotion regulation strategies for the explanation of anger. The inspection of standardized regression coefficients for specific predictors indicated that most of the significant predictors were the same in all four analyses. It is not surprising because of the high intercorrelations between the examined negative emotions. On the other hand, some differences in the patterns of significant predictors of different negative

emotions can have interesting implications for the explanation of experience of negative emotions and their antecedents in academic context.

Some relationships between the students' gender and age and their emotional experience should be interpreted at first. Firstly, boys experienced more negative emotions of unhappiness, anger and humiliation during chemistry learning than girls. This finding is quite inconsistent with the widely accepted assumption about the greater female emotionality. Empirical studies which measured emotional experience have produced fairly consistent results that women report experiencing emotions more frequently and more intensely than do men. One constraint of these studies is that most have relied upon self-report methods, which leave them vulnerable to the effects of gender stereotypes because they ask individuals to report their experiences retrospectively. In this way retrospective and stereotypical biases reinforce one another and can lead to incorrect conclusions (McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008). Hence, gender differences in self-report about emotion experience should be assumed as reflecting stereotypical beliefs about gender and emotion. Similarly, Pascual, Etxebarria, Ortega, and Ripalda (2012) warn that on the basis of studies on gender differences in relation to the intensity of emotions, it is impossible to find clear support for any hypothesis about these differences, although these studies mostly suggest that women feel both positive and the majority of negative emotions more intensely than men, particularly in case of powerless emotions. Powerless emotions are those that indicate vulnerability and are associated with positions of lower power. On the contrary, powerful emotions are those that imply dominance and are associated with positions of higher power. According to this view gender-emotion stereotypes originate from the belief that men express powerful emotions (such as anger and pride) while women express powerless emotions (such as sadness and fear). This interpretation could serve as an explanation of our consistent findings of greater anger in boys during learning. The explanation seems to have even more sense considering the adolescent sample in our study because boys in adolescence express the need to prove their autonomy and power as well as the resistance to authority. Girls are more obedient and more sensitive to the approval of significant adults. Accordingly, boys would probably be more prone to experience and confess anger in context of learning than girls. Maybe this explanation could be applied to greater boys' experience of negative emotions of unhappiness and humiliation during learning activities, also. Of course, this is only a hypothetical interpretation of the obtained results that should definitely be verified in future research.

The finding that older students experience more negative emotions during learning in comparison to younger ones is quite disturbing, but consistent with previous research findings. Wigfield, Eccles, and Pintrich (1996) commented on

the "decline" in the various indicators of academic motivation, self-perception and behaviour that lead to school failure and dropping out of school along with the length of schooling, and they offered several possible explanations. One explanation interprets these changes by intrapsychic restlessness which is assumed to be an essential part of the adolescent lives, while the other emphasizes the coincidence of multiple lifestyle changes (developmental and environmental). In light of the developmental needs, as particularly harmful typical characteristics of secondary school environments authors distinguish pronounced competitiveness, social comparison and self-assessment of abilities (because adolescents are very sensitive and self-directed), reducing the student's choice and decision-making (because adolescents have the heightened need for autonomy and control), focusing on superficial cognitive strategies (because adolescence is characterized with strong cognitive development) and changing the existing social networks (because adolescents have a strong need for intimate peer relationships). Previous research continually has proven that these harmful characteristics increase along with age of schooling, so it is not surprising that levels of students' negative emotion experiences have a tendency to increase also.

In general, present results in a certain way confirm theoretical predictions of the control-value theory of achievement emotions (Pekrun, 2006). Theory postulated that control appraisals and value appraisals are the proximal determinants of achievement emotions and, further, that more distal individual antecedents (e.g. achievement goals, motivational beliefs, genetic dispositions, temperament etc.) could, through control and value appraisals (mediators), influence emotional experiences. Also, emotions, together with their appraisal antecedents, distal individual antecedents, environmental antecedents and performance outcomes are assumed to be linked by reciprocal causation (Pekrun & Stephens, 2010). Our analyses have indicated that students' personality traits, after control of their gender and age as distal personal antecedents of emotions, significantly contributed to the experience of negative emotions. The less agreeable, conscientious and emotionally stable students were, more unhappiness and anger they experienced. In addition, students with a higher level of Emotional stability were less prone to experience anxiety and humiliation. Previous research has mostly linked Emotional (in)stability (neuroticism) with negative emotional experiences, while relationships of other personality traits with negative emotions were rarely investigated. Since the present research is placed in the educational context it is understandable that just Agreeableness and Conscientiousness have proved to be predictors (along with expected Emotional stability) of some negative emotions in this context. Since most of the previous research indicated that Conscientiousness and Agreeableness were positively associated with different

aspects of self-regulated learning and academic achievement (Bidjerano & Dai, 2007; Fayyaz & Kamal, 2011; Komarraju, Karau, & Schmeck, 2009; Larsen & Buss, 2008; Poropat, 2009), it is not surprising that these two personality traits seem to be predictive for emotional aspects of learning also.

In addition, it is interesting that after the introduction of cognitive appraisals in the third step of the analyses, Conscientiousness and Agreeableness lost their predictive significance for experiences of unhappiness and anger. That suggests some kind of the mediation role of cognitive appraisals in the relationship between distal personal antecedents and these emotional experiences, in accordance with theoretical assumptions of the control-value theory (Pekrun, 2006; Pekrun et al., 2002). Also, once cognitive appraisals were introduced into regression analyses, the beta weight for gender as predictor became insignificant in case of the negative emotion of unhappiness. That is probably a consequence of the positive correlation between gender and cognitive appraisal of learning value. Results of most research in this area consistently indicate that girls are more sensitive to social approval of adults (e.g. teachers, parents) than boys and, accordingly, they are more liable to adopt socially desirable values such as learning values (Wigfield & Eccles, 1989).

Specifically, when considered alone, learning value was negatively correlated, as expected, with students' negative emotions. Additionally, after controlling for the other variables (gender, age and personality traits) in the equation, learning value remained a significant negative predictor of students' negative achievement emotions. Students who believed that chemistry was interesting and important were less likely to experience negative emotions during learning chemistry. As well, students' self-efficacy for learning (considered alone as well as after controlling the effects of the other variables in the equation) was negatively correlated to students' negative emotions. Students who developed personal beliefs about their own capability or competence to learn chemistry were also less likely to experience negative achievement emotions. These findings provide support for Pekrun's assumption (2006) that two cognitive appraisals are the most important in achievement contexts: first, the subjective value of achievement activities (learning chemistry) and second, the perceived controllability of those activities, as designated by competence perceptions.

The most unexpected results are those about the role of the emotion regulation strategies in the experiencing negative emotions during chemistry learning. Previous research mostly emphasized the positive impact of reappraisal, and the negative impact of suppression on students' positive emotion experience and its consequences on their subsequent motivation and learning (Balzarotti et al., 2010; Gross, 2001; Gross & John, 2003; Mauss, Bunge, et al., 2007). Our results partially confirm previous findings regarding suppression as an emotion regulation strategy

(increase of negative emotions of unhappiness and humiliation), but they are quite inconsistent with these findings regarding reappraisal. Precisely, according to our results it seems that both reappraisal and suppression positively contributed to the students' negative emotions experience of unhappiness and humiliation during chemistry learning. Surprisingly, reappraisal as emotion regulation strategy (rather than expected suppression) contributed to the experience of anxiety. In case of students' experience of anger during learning chemistry neither of the used regulation strategies influenced this experience. In other words, students who were trying harder to regulate their emotions by using reappraisal and suppression strategies were more prone to experience these emotions. These observations are logical for the suppression because this type of regulation consists of attempts to inhibit or reduce on-going emotion-expressive behaviour and although it can decrease expressive behaviour, it cannot decrease emotion experience, but can even increase physiological responding (Gross, 2002). An explanation for the inconsistent findings on the role of reappraisal in this process is more difficult to offer. There are a few hypothetical explanations of these findings.

As described previously, a process model of emotion regulation (Gross, 2001) differentiates between response-focused and antecedent-focused emotion regulation strategies. Further, regulatory strategies focused on altering some components of the emotional response after they have arisen (response-focused regulation such as suppression) would have less adaptive effects because other components of the emotional response still persist. Opposite, regulation strategies which are aimed at altering the whole emotional response before it arises (antecedent-focused regulation such as reappraisal) would seem to have more adaptive effects. In the present research we tried to measure students' regulation strategies and link them with their emotional experience during learning periods. In this way, we examined students' typical emotions which they usually experience while learning chemistry. Hence, it seems that antecedent-focused regulation strategies, aimed to alter the whole emotional response before it arises, could be unsuitable in the conditions where these emotions have already been repeatedly experienced. As Urry (2009) pointed out, the evidence of the effects of reappraisal on on-going emotions is mixed and these inconsistencies may reflect differences when reappraisal was enacted relative to the emotion-triggering event. It was found that reappraisal which was made in advance and early in the emotion-triggering event was more effective in reducing reported negative emotion than when it was made late. Therefore, once students already feel unhappy, anxious and humiliated because they have to learn chemistry (such as in our study), attempts to regulate these emotions by the reappraisal of situation (e.g. thinking about the second chance, about other important things in life, etc.) reasonably doesn't seem to be an effective strategy. In

fact, because of wrong timing it is possible that such emotion regulation produces the opposite effect and decreases experience of negative emotions. Of course, this theoretical explanation should be tested in future research which should be so designed to better capture the process nature of the emotional episode.

Another possible reason of the observed relationships could be methodological; we measured the reappraisal strategy by the scale which is focused on students' general emotion regulation strategies, not specifically on emotion regulation during chemistry learning, while students' assessments of their emotion experience were strictly assessed due to the chemistry learning. Therefore, it is possible that students who generally use more reappraisal in educational context, experience more negative emotions in specific context of the chemistry learning regardless of which specific emotion regulation strategies they use in this domain-specific context.

Moreover, although suppression was not correlated with any of the examined negative emotions on the bivariate level, in the last step of the hierarchical regression analyses for unhappiness and humiliation it was revealed as significant positive predictor. That indicates the presence of *the classical suppression*. Further standard regression analyses (in which a particular combination of predictor variables was systematically discharged from the regression equation) have shown that the personality trait of Conscientiousness had the status of *suppression variable* in the relationship between suppression and negative emotion of unhappiness and humiliation. Accordingly, when the contribution of this personality trait is controlled, suppression becomes a positive predictor of students' unhappiness and humiliation during chemistry learning. These findings once again illustrate the complexity and dynamism of relationships between personal antecedents of emotions, emotion regulation strategies and emotion experience in the educational context.

On the whole, the present research has mainly confirmed theoretical predictions of the control-value theory of achievement emotions (Pekrun, 2006; Pekrun et al., 2007) that more distal personal antecedents (gender, age, personality traits) could, through control and value appraisals (proximal personal antecedents as mediators), influence students' emotional experiences. Also, all examined groups of variables: gender and age, personality traits, cognitive appraisals and emotion regulation strategies have had their own unique contribution to the students' emotional experience. Indicators of some, theoretically expected, mediator and suppressor variables in these relationships were also shown and pointed out the complex process nature of emotional aspects of learning. Moreover, our results have once again confirmed the assumption that a single strategy of emotion regulation is neither inherently good nor bad (Gross, 2002). Therefore, these

findings warn of the risk of reckless determining reappraisal strategy as the best way of emotional regulation in general, regardless of the specific context in which emotions arise.

In the end, it is necessary to warn that this study has certain limitations. Above all, it should be noted that all the findings of this study were based upon cross-sectional data (they do not reflect causal relationships among the investigated constructs). Additionally, this study was conducted on a convenient sample of high-school students, which, to some extent, limits the possibility of generalization of its conclusions. An important methodological shortcoming of this study concerns the operationalization of the emotions themselves. Firstly, as already mentioned, this study examined the emotions that students usually experience during chemistry learning. For this reason, the students were requested to recall how they typically feel when learning chemistry. This recall processes may lead to some kind of distortions and diminishing intensity of extreme emotions, which reduces their variability. The same problem was present at measuring emotional regulation strategies, also. Associated with these, potential shortcomings are the typical problems that occur when using self-report methods – such as giving socially desirable answers, insufficient awareness of one's own emotions and strategies applied for their regulation, etc. Finally, one substantial problem of this type of research is related to the emergence of method variance, which may cause artificially magnified correlations between self-report measures of different constructs (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In future research it should be interesting and important to test the observed relations in other academic domains and with different methods. In this sense, experimental approaches are required in order to gain a deeper understanding of the dynamics of the emotion generative process.

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