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Changes in cognitive autonomy during early adolescence

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Abstract

The aim of the study was to explore the developmental changes in the components of cognitive autonomy of adolescents in the period between 11th and 13th year of age. The research was carried out in 63 primary schools in one 6th grade class in each school. The pupils in 31 classes underwent the Unplugged program. The data were collected at five measurement points and 497 pupils participated in all of them (40.5% boys, T1: M age = 11.52, SD = 0.61). Statistical analysis was conducted in IBM SPSS 21. The basic descriptive statistics was computed for all factors of cognitive autonomy and for every measurement point for boys and girls and for the participants with and without the Unplugged program. To address changes over time a longitudinal approach was applied and linear mixed modelling was used, which uses multilevel hierarchical modelling. The first level addressed the within-subject change in measured variables over time. The second level addressed changes in measured variables between subjects. Through linear mixed modelling we have found that voicing opinions improve in the explored age group regardless of gender and participation in the program. Comparative validation was found to be higher among girls. Furthermore, it was found that a higher level of all factors of cognitive autonomy indicated a lower increase in these factors over time. Significant differences in the level of changes in individuals were found in all, except for decision-making in which an increase was observed in most of the respondents.

Key words: cognitive autonomy, evaluative thinking, opinion expression, decision-making, making comparisons

Introduction

The process of identity development, maturation and becoming an adult can be characterized by a growing consistency between one's attitudes and needs on the one side and behaviours and cognitions on the other. More generally, the importance of this consistency is often demonstrated in the ability to engage in autonomous behaviour for which one takes responsibility. Therefore, striving to achieve autonomy and fulfil this basic human need constitutes an important prerequisite necessary for a healthy psychosocial development particularly significant in adolescence (Mann-Feder & Goyette, 2019). Autonomy development and coping with its challenges enables adolescents to make important decisions which are likely to carry a decisive and significant influence for their upcoming adult life. In early adolescence, autonomy is usually related to exploration, experimentation and triggered by newly developed cognitive and social abilities and it is often manifested by testing one's own limits as well as the limits of the social environment (Dutra-Thomé et al., 2019). From a broader point of view, the context of these manifestations becomes important and there are often expectations of early adolescents to make decisions and opt for choices which would promote their healthy development. However, teens often choose to pursue undesirable, risky, asocial or antisocial behaviour which may often elicit disappointment in their social environment and especially in adults (Okpych & Courtney, 2019). Adults may often show unrealistic expectations regarding the behaviour of adolescents since they are often unfamiliar with the limits connected to the

development of cognitive processes and cognitive autonomy in the critical developmental stages of adolescence.

Cognitive autonomy and its components

Autonomy is a multidimensional construct perceived as an ability to make decisions, control important areas of one's life, being self-determined and pursuing one's choices, and exercising one's right for moral and intellectual independence (Goossens, 2006). The concept of autonomy is part of several scientific disciplines, in psychology it is part of various fields and theories (Ježek, 2014). We can look at autonomy in terms of individual differences, as well as in terms of the developmental psychology of adolescence.

From the point of view of development perspective, early adolescents themselves often understand autonomy as defiance, doing activities without their parents and engaging in activities connected with defying the rules and expectations of authority. This transitory period, often characteristic with an extreme demonstration of independence without taking direct responsibility for one's actions, eventually develops into a natural compromise between the requirements from the social environment and individual's needs (Okpych & Courtney, 2019). It is a natural part of the autonomy of both the separation process and the agency experience that adolescents strive for (Ježek, 2014).

Autonomy can be considered as an ability to think, feel and act according to one's own rules (Bernal Romero et al., 2020; Fang, 2020). Even though, there are many studies focused on behavioural and emotional autonomy, cognitive autonomy and its aspects have not been extensively explored (Beckert, 2018). Cognitive autonomy incorporates the ability for independent thinking as well as forming opinions on values and meaningful moral dimensions. The development of cognitive autonomy consists of the development of analytical thinking, ability to interpret abstract thoughts, rational selection, judgement development, evaluation and prediction of consequences following a choice or a decision. Qualitative analysis and analysis of existing research and theory has led Beckert (2007) to the generation of a model in which he defines specific components of cognitive autonomy: evaluative thought, voicing opinion and making decisions, which capitalize on comparative validation and self-assessment.

Rational decision is preceded by an evaluation of a situation, critical thinking driven by the ability to consider and assess opinions and perform logical deductions (Nippold et al., 2020). A sequence of goal setting, evaluation of negative and positive aspects of opportunities to achieve set goals, taking a role of an objective critic and reflecting on the results form the basis of a decision-making process (Bavol'ár & Bacikova-Sleskova, 2020). Critical thinking as a component of cognitive autonomy incorporates all parts of this sequence. Critical thinking tells us that adolescents use these skills connected to the metacognition of goal setting and pursue opportunities to achieve goals and this ability is an active component regardless of the actual context.

The ability of adolescents to voice their opinion and communicate effectively is an inseparable part of the development of cognitive autonomy because it is a demonstration of maturity, social and emotional intelligence and competence. Voicing opinion requires adolescent's ability to express and clarify his or her own wishes. Moreover, it is the ability that helps to clarify his or her own opinions, attitudes and beliefs more deeply. For example, the research has shown that adolescents who actively express their opinions tend to feel more active and responsible for the processes happening in a school environment and directly influence the relationship between peers and adults (Benlahcene et al., 2020).

Comparative validation indicates the number of people with whose behaviour an adolescent compares him or herself or how many people influence his or her thinking. Parallel processes represent the need to resist unwanted pressures from the social environment along with the ability to realize the significance of comparative validation of possible consequences of one's decisions about significant others who the adolescent trusts (Bjønness et al., 2020; Collibee et al., 2016).

Developmental and gender aspects of cognitive autonomy

During early adolescence physiological changes come first and are accompanied by an abrupt fluctuation of emotions. Today's adolescents reach the appearance of adults very early on and every new generation matures physically faster than the previous one (Vinell, 2020). This is the reason why adolescents appear to be more mature than they really are. One of the consequences of this accelerated physical development is that young people are confronted with situations requiring maturity of an older age category. They are confronted with a wide range of situations before reaching mental maturity and readiness to process the alternatives and consider consequences.

The research suggests an increase in factors of cognitive autonomy with age (Benlahcene et al., 2020). Adolescents with a well-developed cognitive autonomy tend to engage in prosocial behaviors, show good decision-making skills, have good interpersonal relationships, take responsibility for their actions and perform well in their academic roles and are capable of a healthy self-assessment. These abilities prepare adolescents for making meaningful life decisions and base their action on high quality cognitive autonomy (O'Rourke et al., 2020). An adolescent with a developed cognitive autonomy can negotiate and consider compromises in conflicting situations, voice his or her opinions, appreciate the views of others on different issues, which together leads to the development of autoregulation. However, when an adequate cognitive development is absent adolescents are not able to assess and engage in comparative validation and make decisions based on conscious use of their cognitive abilities based on the developing cognitive structures.

The research regarding gender differences in cognitive autonomy is unequivocal. On one hand, a faster physical and social maturation of girls provides them with more opportunities to gain experience in social skills which is a likely cause of a higher level of cognitive autonomy observed among girls in all factors of cognitive autonomy (Dutra-Thomé, 2019; Rahmayanthi et al., 2020). On the other hand, however, a traditional cultural view of their role and the stereotypes of gender differences emphasize the fact that particularly in families with such traditional views and attitudes of mothers are girls given fewer opportunities for autonomous functioning in comparison to boys (Hinton, 2017; Maas et al., 2019). Moreover, autonomous functioning was more stressful for girls and while girls reached higher identity, they reached lower intimacy and needed to argue their decisions more strongly and had more parental conflicts when forming relationships with partners (Jarymowicz & Bar-Tal, 2006). Similarly, the influence of peers as well as identification with groups is different among boys and girls (Little, 2020). One of the possible explanations of gender differences in cognitive autonomy may lie in different understanding of the term autonomy. In many cases, autonomy is understood as an opposite of interpersonal closeness and elements of empathy, interconnectedness as a part of social and emotional intelligence where women gain higher scores and consequently a lower level of autonomy (Jarymowicz & Bar-Tal, 2006).

The answer regarding the question concerning the development of skills improving cognitive autonomy can be found in the research on effectiveness of prevention programs. Berinšterová and Orosová (2014) found evidence for several factors which play an

important role in the process of effectiveness and efficiency of prevention programs. These are cognitive skills, management of emotions, attitudes toward drugs, social skills and ability to accept social support, refusal skills/resistance regarding pressures for drug use. These factors represent the way to improve not only the knowledge but also support the development of critical thinking and decision making by supporting logical deductions, expressing opinions, generating alternatives and using comparative validation regarding opinions and decisions which may help to clarify the attitudes of adolescents for themselves e.g., autonomy in the area of cognitive processes and in line with social competence (Do et al., 2017).

The aim

The aim of the study was to study developmental changes in individual components of cognitive autonomy (evaluative thinking, decision-making processes, voicing opinions, comparative validation) of young adolescents between 11 and 13 in relation to gender and participation in a preventive program.

Method

Research sample

The data collection was carried out as a part of a larger project on a representative sample of pupils studying in primary schools in Slovakia. A stratified random sampling was used. The criteria for selection were region and the population size of the municipality. In each of the selected schools one 6th grade class participated. Half of the classes underwent the Unplugged prevention program which consists of 12 lessons organized within 3 week intervals. The “Unplugged” program is a school program for prevention of substance use designed for adolescents aged 12-14, which meets the need for timely prevention. It is an interactive program, which provides the opportunity for the whole group (or a class) to actively participate in lessons, whether during the discussion or during other activities like role-playing. The main principle of the program is the CSI model (Comprehensive social influence model). It accounts for the overall influence of family, school and peers in prevention. The second principle of the program is the *KAB model (Knowledge-Attitude-Behavior)*, the aim of which is to provide the students with objective information concerning substance use and its consequences. The procedure consists of three basic steps: 1. providing the information, 2. influencing the quality of attitude, 3. changing the behaviour. The program is intended to reduce the number of adolescents that are beginning to use substances, to postpone their first experience with drugs as well as the transition from experimenting to regular use of drugs.

The data were collected at five measurement points. The first point (T1) took place before the implementation of the program and was attended by 1298 pupils, of whom 53.3% were girls (mean age was 11.52, $SD = 0.61$). The second point of data collection (T2) took place immediately after the implementation, T3 three months after implementation, T4 12 months after and T5 18 months after the program was implemented. 497 pupils took part in all five data collection points (40.5% boys). Due to this attrition the stratification of the sample had slightly changed and the Eastern region was significantly overrepresented (59.5% in comparison to the original 53.3%; $\chi^2 = 12.84$, $p \leq .001$). The representation according to the size of municipality remained unchanged. The teachers implementing the Unplugged program underwent a three-week training. The data collection was carried out by a trained assistant without the presence of the teacher and the participation of pupils was voluntary and conditioned by the agreement

of the parents. The research was approved by the Ethical Committee of the university (under the number FIL003018/2017).

Measures

Cognitive autonomy

The questionnaire Cognitive Autonomy and Self-evaluation (CASE) was used (Beckert, 2007). Double-sided translation has been used. This questionnaire consists of four factors of cognitive autonomy and one factor of self-assessment. In this study, the four factors of autonomy were used.

Evaluative thinking consists of eight statements (e.g., I think about the consequences of my decisions). Cronbach's alpha at T1 was 0.886. Voicing opinions (e.g., If I have something to add to a class discussion I speak up) consists of five statements. Cronbach's alpha at T1 was 0.718. The factor decision-making consists of six items (e.g., There are consequences to my decisions). Cronbach's alpha of this subscale at T1 was 0.829. Comparative validation reached Cronbach's alpha at T1 0.768 and consisted of four items (e.g., I need my views to match those of my parents; it is important to me that my friends approve of my decisions). Individual items were rated on a 5-point Likert-type scale from never to always. A higher score meant higher cognitive autonomy.

Statistical analysis

Statistical analysis was conducted in IBM SPSS 21. The basic descriptive statistics was computed for all factors of cognitive autonomy and for every measurement point for boys and girls and for the participants with and without the Unplugged program. To address changes over time a longitudinal approach was applied and linear mixed modelling was used, which uses multilevel hierarchical modelling. The first level addressed the within-subject change in measured variables over time. The second level addressed changes in measured variables between subjects (Shek & Ma, 2011). In the first step of the analysis an unconditional mean model was estimated for individual variables and inter-class correlation coefficient (ICC) was calculated. In the next step time, gender, group and interactions between gender and time, and group and time were added to the model as predictors.

Results

In table 1, the descriptive of the factors of cognitive autonomy at individual measurement points T1-T5 are presented separately for boys and for girls and separately for the participants/ non-participants of the Unplugged program.

In the first step of the analysis, unconditional mean models were estimated for individual dependent variables and then the inter-class correlation coefficients (ICC) were calculated to verify inter-individual variance of the dependent variable regardless of other variables, time, gender, group. The values of ICC for individual variables were: evaluative thinking 0.35, voicing opinions 0.38, decision making 0.38 and comparative validation 0.27. This means that inter-individual differences account for 35% in evaluative thinking, 38% in voicing opinions, 38% in decision-making and 27% in comparative validation. The critical value for suitability of this statistical procedure is the ICC 0.25 or higher (Shek & Ma, 2011).

Table 1 Descriptive statistics of the factors of cognitive autonomy in five waves of data collection separately for gender and control and experimental group

	T1	T2	T3	T4	T5
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Boys					
Evaluation	25.61(6.75)	23.77(7.15)	24.76(6.96)	24.43(6.60)	24.49(6.13)
Opinions	15.50(3.02)	15.01(3.47)	15.29(3.21)	15.40(3.35)	15.36(3.17)
Decisions	19.77(4.82)	17.81(5.51)	18.98(4.58)	19.27(4.40)	18.84(3.96)
Validation	12.67(3.52)	11.35(3.39)	12.29(3.53)	12.31(2.97)	11.89(3.07)
Girls					
Evaluation	25.09(7.30)	25.09(6.91)	25.26(7.40)	25.19(6.70)	25.28(6.70)
Opinions	15.29(3.70)	15.43(3.55)	15.32(3.74)	15.66(3.67)	15.76(3.68)
Decisions	19.17(5.24)	19.08(5.28)	19.30(4.89)	19.52(4.73)	19.35(4.62)
Validation	12.63(3.70)	12.48(3.76)	12.54(3.85)	12.62(3.54)	12.46(3.79)
Unplugged participants					
Evaluation	25.00(7.15)	25.06(6.38)	25.29(7.10)	24.62(6.71)	24.89(5.94)
Opinions	15.42(3.63)	15.65(3.55)	15.55(3.89)	15.59(3.74)	15.56(3.67)
Decisions	19.34(5.20)	19.02(5.13)	19.92(4.58)	19.76(4.57)	19.30(3.84)
Validation	12.59(3.84)	12.41(3.26)	12.58(3.63)	12.45(3.40)	11.98(3.47)
Unplugged non-participants					
Evaluation	25.59(7.02)	24.11(7.56)	24.86(7.35)	25.15(6.62)	25.02(6.69)
Opinions	15.34(3.26)	14.90(3.46)	15.19(3.19)	15.52(3.35)	15.63(3.29)
Decisions	19.48(4.97)	18.14(5.63)	18.50(4.84)	19.08(4.62)	19.00(4.82)
Validation	12.69(3.42)	11.69(3.96)	12.31(3.81)	12.54(3.25)	12.47(3.56)

Table 2 Changes in the individual factors of cognitive autonomy (within-person change)

	Regression coefficient estimate	SE	df	sig
Evaluative thinking				
Constant	25.02	0.49	631	< 0.001
Gender	-0.67	0.45	481	0.143
Group	-0.01	0.45	481	0.993
Time	0.06	0.10	418	0.559
Voicing opinions				
Constant	15.02	0.24	637	< 0.000
Gender	-0.17	0.24	485	0.478
Group	0.19	0.23	484	0.420
Time	0.12	0.05	449	0.016
Decision making				
Constant	18.76	0.35	592	< 0.000
Gender	-0.43	0.34	453	0.207
Group	0.61	0.33	450	0.068
Time	0.07	0.07	400	0.252
Comparative validation				
Constant	12.55	0.24	619	< 0.000
Gender	-0.43	0.22	479	0.050
Group	0.08	0.22	478	0.707
Time	-0.02	0.05	443	0.737

Table 2 displays the results of the first level of the model, which addressed the within-person change while controlling for gender and group (participating/not participating in the program). Throughout the 5 waves of data collection, a statistically significant increase in voicing opinions ($p = .016$) was found. An average increase was 0.12 points

between individual measurements. There were no gender differences nor difference between groups based on their participation.

Regarding the comparative validation, statistically significant gender differences ($p = .05$) were found with girls scoring higher than boys.

Within the mixed linear models, the interactions of individual factors of cognitive autonomy with time and gender and with time and participation in the program were investigated. The results showed that there was no evidence for the moderation role of gender nor for the moderation of participation in the program over time.

The results in table 3 show the second level of the linear mixed model and display the variance between the respondents (between-person differences). The variance of the constant indicates the variance in the dependent variable at T1. The variance over time shows differences in changes over time between the respondents. Covariance of the constant and time indicates the extent of differences in the development over time in reference to the baseline value of the dependent variable. The variance of the residuals is significant in all the models and relatively large in comparison to other variances, which means that a large portion of variance remains unexplained by the model.

Table 3 Variability in individual factors of cognitive autonomy (between person differences)

	Evaluative thinking	Voicing opinions	Decision making	Comparative validation
	Estimate (S.E.) sig	Estimate (S.E.) sig	Estimate (S.E.) sig	Estimate (S.E.) sig
Variance of the residuals	28.44 (1.24)***	6.99 (0.29)***	14.12 (0.63)***	8.57 (0.36)***
Variance of the constant ^a	32.49 (5.21)***	6.08 (1.09)***	14.75 (2.53)***	6.58 (1.32)***
Variance over time ^b	1.19 (0.36)**	0.26 (0.08)*	0.26 (0.16)	0.30 (0.10)**
Covariance of time and constant ^c	-4.33 (1.25)**	-0.59 (0.26)*	-1.31 (0.57)*	-0.94 (0.33)**

^aVariance of the constant –variance of the variable T1; ^bVariance over time –interindividual changes;

^cCovariance – the extent of difference over time in reference to the baseline level of the variable; * $p < .05$.

** $p < .01$. *** $p < .001$

The constant variates between the individual subjects in all explored variables on a statistically significant level, which means that the perception of the factors of cognitive autonomy at T1 differs between individual respondents.

Variance over time was statistically significant in all measured variables except for decision-making, which means that the extent of changes in the factors of evaluative thinking, voicing of opinions and comparative evaluation differs among respondents. The level of changes in decision-making is similar and the changes in this factor are similar among all the respondents.

The covariance of time and constant is significant in all the factors, which means that the level of change in the evaluation of factors of cognitive autonomy was dependent on the level of the baseline cognitive autonomy. In all the cases of cognitive autonomy it was found that a higher level of evaluative thinking, voicing opinions, decision-making, and comparative evaluation meant lower increase.

Discussion

The main goal of this study was to explore changes in individual components of cognitive autonomy (evaluative thinking, decision-making, voicing opinions and

comparative validation) of early adolescents between the 11th and 13th years of age in relation to gender and participation in a prevention program.

Throughout the 5 waves of data collection a significant increase in voicing opinions was found regardless of gender and whether they participated in the program or not. Similarly, Benlahcene et al. (2020) found cognitive autonomy to be increasing with age. The ability to formulate and express one's own opinions, to reflect on the needs, wants and beliefs comes with two processes. On the one hand, it is the knowing and understanding oneself and one's own needs, being in contact with oneself, respecting oneself. On the other hand, it comes with respecting one's social environment and once taking a decision being resilient enough to be able to cope with social pressures.

In the case of comparative validation statistically significant gender differences were found with girls showing higher values than boys. Comparative validation can be seen as a transient step for supporting one's opinions during the time when an adolescent is looking for directions in new social situations and relationships and may signify a responsible approach toward consequences of his or her decisions. The results of this research provide further support for the higher level of comparative validation among girls in comparison to boys (Collibee et al., 2016).

All the factors, voicing opinions, comparative validation, evaluative thinking and decision-making take place in a real social environment and along with cognitive abilities require equally importantly proficiency in various social skills. The authors Do et al. (2017) and their findings suggest that the maturing brain is very plastic and especially in its focus on social world, can be especially during adolescence very sensitive to social influences regarding the position which one holds or wants to hold within a social group. Parts of the brain involved in social cognitions, cognitive control and processing of rewards are closely related with the parts involved in social influence (Do et al., 2017). Ciranka & van den Bos (2019) explain the three most significant current models of social influence on adolescent behaviour in relation to health-related behaviour: the model of social motivation, the model of reward sensitivity and the distraction model. The first model addresses and emphasizes the importance of the development of the „social brain“. The distraction model and sensitivity to the reward model emphasize the relatively slow maturation of the cognitive control mechanisms. While the distraction model focuses exclusively on the development of cognitive control, reward sensitivity model focuses on the dual system information processing. This is a highly complicated and fast developing part of the brain which processes the sensitivity to rewards. This system becomes fully developed relatively early during the middle adolescence together with the frontal parts of the brain where evaluation, decision-making and awareness of the behavioural consequences in the future as well as cognitive control are located. However, these become fully developed much later during the final stages of maturation in young adulthood (age 18-24) and are potentially a source of certain imbalance in the maturation process.

Our findings have not found evidence for any changes in cognitive autonomy, which would be related to the participation of the adolescents in the preventive program (within-person change). However, the observed results regarding the variability between individual respondents (between-person differences) provide interesting pointers and ideas regarding active interventions in this respect in prevention activities. We have found that the initial level of the perception of the factors of cognitive autonomy is significantly different between individuals and the extent of the changes in the individual factors of cognitive autonomy depends on its baseline levels. The higher the level of cognitive autonomy the lower the increase in these factors over time. A change in

evaluative thinking, opinion voicing and comparative validation tends to be individually different. The significance of decision-making as a part of cognitive autonomy is emphasized in the context of research on decision-making styles, which has found that the rational and intuitive styles are indicators of good mental health, whereas avoidant and dependent types were related to poor mental health (Bavol'ár & Bacikova-Sleskova, 2020).

In our previous study, cognitive autonomy was related to less risky behaviour (Gajdošová, 2020). Furthermore, several elements of cognitive autonomy mediated the relationship between participation in the Unplugged preventive program and reduction in risky behaviour. Thus, it is important to develop, encourage and correctly guide the elements of cognitive autonomy even in early age period despite the fact that neurophysiological cognitive development is not finished.

A limitation of the study must be acknowledged. There is a narrow focus on the cognitive level of autonomy without addressing the emotional and behavioural components. In real conditions, these components are coactive. This study was limited to the single instrument on cognitive autonomy. This limitation was due to the fact that the data used in this study come from a larger project.

Conclusion

Out of the factors of cognitive autonomy (evaluative thinking, decision-making, voicing opinions and comparative validation) among adolescents aged 11-13, a significant increase was found in voicing opinions for both genders regardless of their participation in the prevention program. Girls showed higher level of comparative validation. The differences in the initial level of perception of the factors of cognitive autonomy were found on individual level and significant differences in changes in individual factors of cognitive autonomy for individuals. A higher initial level of evaluative thinking, voicing opinions, decision-making and comparative validation indicated a lower increase of these factors among adolescents over time. The decision-making factor was seen to increase during the age 11-13 similarly in most of the respondents.

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