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Behave yourself! NAS-50 as a reliable tool for assessment of adolescent self-control

Abstract: *Self-control is a complex and multifaceted construct that can be regarded as an individual trait that follows its own developmental trajectory. In the presented study we used NAS-50 for the assessment of self-control in adolescents and young adults. Since the questionnaire has not been used before in underage participants we tested its reliability in adolescent and adult samples. We also investigated possible age and gender differences in self-control abilities as well as relations between NAS-50 and behavioral measures of cognitive control and impulsivity. Although the sample was quite small, the reliability of the questionnaire was similar to the results achieved by its authors. According to the predictions in the literature we did not find relations between NAS-50 and behavioral measures of cognitive control and impulsivity. We also did not observe significant age differences in the assessment of self-control abilities. The theoretical relevance of our results is discussed.*

Keywords: *NAS-50, self-control, adolescents, cognitive control, impulsivity*

Introduction

Self-control is a complex and multifaceted construct reflecting the ability to initiate, maintain and regulate goal-oriented behavior (Baumeister & Tierney, 2011). It involves refraining from inappropriate reactions in favor of appropriate ones, suppressing one's emotions and impulses, and adjusting to social context (Casey, 2015). Although some authors tend to focus on one of its behavioral manifestations (e.g. the ability to delay gratification, Mischel, Shoda, & Rodriguez, 1989; Van den Bos, Rodriguez, Schweitzer, & McClure, 2015), others view it as a complex entity that consists of several components that can be captured introspectively (Tangney, Baumeister, & Boone, 2004; Nęcka et al., 2016). The ability to exert control over one's behavior is usually treated as a stable individual trait (Nęcka et al., 2016) that follows its own developmental trajectory (Crone & Dahl, 2012; Casey, 2015; Crone & Steinbeis, 2017). It improves from childhood to adulthood in a non-linear pattern that reflects imbalance in the maturation of limbic and prefrontal brain structures as well as their increasing connectivity. In adolescents, the efficiency of control processes is especially sensitive to motivational cues: incentives, peer presence or arousing situations can enhance or diminish their control abilities (Casey, 2015; Shulman et al., 2016). For example, some studies show that cognitive control can be enhanced in adolescents to a greater extent than in adults when rewarded (e.g. Geier, Terwilliger, Teslovich, Velanova, & Luna, 2010). Others indicate that efficient control can diminish (or not) adolescent risk-taking, depending on social context (e.g. Cascio et al., 2015). Contrary to older research that focused on immaturities of self-control in adolescence, current studies indicate that poor self-control characterizes a small subset of youth and can persist in subsequent periods of life. There is speculation whether adolescent self-control in the absence of incentivized conditions is adult-like (as efficient as in adults; Casey, 2015) or age-specific (adolescents may be generally more flexible and more easily adjust to novel situations than adults; Crone & Dahl, 2012).

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For the assessment of self-control both questionnaires and behavioral measures are used. Self- and informant-reports usually capture more components of the trait and are known to have greater convergent validity than behavioral measures (Duckworth & Kern, 2011). The latter usually focus on one underlying process (e.g. reaction or interference inhibition, delay of gratification) and are known to correlate weakly with each other (due to a substantial task-specific variance) and with self/informant-reports (Duckworth & Kern, 2011; Steimke et al., 2016). Disparities in results obtained with different types of measures indicate that they assess diverse control processes. Therefore, caution is required in tool selection and data interpretation.

In adolescents, control processes can be assessed with similar measures as in adults. Among the self-reports, the impulsivity questionnaires (e.g. the Eysenck's Impulsivity Inventory) or the Tangney's Self-Control Scale are commonly used. However, they do not allow assessing a wide range of control abilities in a single measure. Such a possibility is given by the Behavior Rating Inventory of Executive Function (BRIEF-SR) for adolescents (Guy, Isquith, & Giola, 2004), but it is not intended for adult responders. Therefore, there is a need for a measure that would assess various components of self-control in adult and adolescent population alike.

In the presented study we used NAS-50 (Nęcka et al., 2016) for the assessment of self-control abilities in adolescents and young adults. This new questionnaire measures five components of self-control: the setting and pursuing of goals (Initiative and Persistence – IP), planning and scheduling (Proactive Control – PC), switching between tasks and adjusting to new circumstances (Switching and Flexibility – SF), suppressing inappropriate actions or impulses (Inhibition and Adjournment – IA), and completing plans and goals (Goal Maintenance – GM). In validation studies, NAS-50 correlated highly with Tangney, Baumeister, & Boone's (2004) Self-Control Scale, and moderately with the Conscientiousness scale from the NEO-FFI questionnaire. A moderate negative correlation with the Neuroticism scale from NEO-FFI was also observed. Fluid and crystallized intelligence did not correlate with NAS-50 indicators. The authors found a weak positive correlation between age and overall NAS-50 score (in the sample aged 17–66). Older participants assessed their ability to set and pursue higher goals, while younger ones outperformed them in terms of their flexibility and ability to switch between tasks. Gender differences in the overall NAS-50 score were not significant, however the assessments of men's abilities to inhibit inappropriate reactions and complete their plans and goals were higher than of women.

Since, to our knowledge, the questionnaire has not been used before in underage participants, we aimed to test its reliability in adolescent and adult samples. We also investigated possible age and gender differences in the assessment of self-control abilities. Finally, we tested relations between NAS-50 indicators and behavioral measures of cognitive control (Go/Nogo task) and impulsivity (Kagan's Matching Familiar Figures test). Overall, we aimed to determine whether the questionnaire can be regarded reliable and suitable for the assessment of self-control in adolescent samples.

Method

Participants

Two hundred forty-four subjects (143 women) took part in the study, recruited from two groups: adolescents ($N = 120$, mean age = 14.45, $SD = 0.71$, range = [13, 16], 68 girls) and young adults ($N = 124$, mean age = 23.27, $SD = 2.09$, range = [20, 32], 75 women). Adolescents were recruited via parent-teacher conferences in secondary schools; adults were recruited via online advertisements. Parental consent was obtained for all underage participants. Participation was rewarded with vouchers (to a clothing store, a sporting goods store, a bookstore, or a cinema) valued from 20 to 60 PLN (mean 40 PLN) depending on the results obtained in the two incentivized tasks that are presented in another paper (see below).

Procedure

The assessment of self-control with NAS-50 and the measuring of cognitive control and impulsivity with behavioral tasks were part of a larger study that aimed to test predictors of adolescent propensity to risk. The research was conducted in schools (adolescents) or in a university laboratory (adults). The whole experiment lasted 80 minutes with a ten-minute break in the middle of a session. Participants completed four computer tasks in random order (Go/Nogo task, Matching Familiar Figures Test, Incentivized Visual Search task and Spaceride risk task). They were informed that they would be rewarded for their performance in the IVS and Spaceride tasks, but not for the performance in the Go/Nogo task and MFF test. At the end of the experiment participants completed NAS-50 and two other self-report measures (Shot Form of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire and Risk Behavior Questionnaire). In this paper results concerning Incentivized Visual Search task and Spaceride risk task are not reported.

Measures

NAS-50

A questionnaire created by Nęcka et al. (2016) for assessment of self-control as an individual trait and standardized on adults aged 17–66. The scale consists of 50 items divided into 5 subscales: Goal Maintenance, Proactive Control, Initiative and Persistence, Switching and Flexibility, and Inhibition and Adjournment. The answers are assessed on a 5-point scale, from 1 – "definitely not" to 5 – "definitely yes". The assessment of general self-control was the mean of all items.

Go/Nogo Task

This task is a popular measure of response inhibition (e.g. Logan, 1994). In "go" trials, participants categorize numbers that appear on the screen as even or odd, but

in "no go" trials (i.e. when a specific number that was indicated in the instructions appears on the screen) they have to refrain from reacting. The version of the task used in our study consisted of 10 blocks. In each block there were 10 trials (on average 1.67 "no go" and 8.33 "go" trials). Stimuli display time was 1 second. The go-cue changed with every block.

The measure of cognitive control in the task was the product of the accuracy in "no go" trials and the accuracy in "go" trials. The accuracy in "go" trials was included in order to adjust for possible individual differences in strategies (i.e. to include the fact that some participants may be more or less prone to reacting, regardless of the type of trial). Due to the fact, that research described herein was part of a larger study, only 184 of the 244 participants performed the Go/Nogo task.

Matching Familiar Figures Test (MFF)

The test was created by Kagan (Matczak & Kagan, 1992) for assessment of the reflexivity–impulsivity cognitive style. It consists of 12 trials. In each trial, participants are shown a black and white reference picture and six visually similar test pictures. The goal is to find the drawing that is identical to the reference picture. Both response time and accuracy are recorded.

A complex measure of impulsivity was used in the task. There are two simple measures of this variable: speed and accuracy, both of which are equally theoretically valid. Since they were correlated ($r = –.43$ 95% $CI = [–.52, –.32]$), the main principal component of these variables was used as a unified measure of impulsivity.

Additionally, as the assessment of self-control with NAS-50 was a part of a larger study that aimed to test predictors of adolescent propensity to risk, we were able to test relations between NAS-50 indicators and self-report measures of frequency of risky behaviors and sensitivity to rewards and punishments.

Risk Behavior Questionnaire (RBQ)

The questionnaire is an extended version of the first part of Adolescent Risk-Taking Questionnaire (ARQ; Gullone, Moore, Moss, & Boyd, 2000), used to assess the frequency of risky behaviors in adolescents between 11 and 18 years of age. To make it applicable to different age samples, we added 22 items describing risky actions typically displayed by adults. The RBQ was tested in a pilot study on 91 adolescents (13–15 years old) and 106 adults (19–38 years old). After removing 15 items, the final version of the RBQ consists of 29 risky behaviors, rated using 5-point response scale, from 1 – "never" to 5 – "very frequently". The Cronbach's α of the questionnaire was .86, 95% CI = [.83, .89]. The mean score of all items indicates participants' general frequency of risk-taking.

Short Form of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ-SF)

The questionnaire, adapted by Wytykowska, Białaszek & Ostaszewski (2014), assesses sensitivity of the Behavioral Inhibition System (BIS) and the Behavioral Approach System (BAS) separately. It includes 24 yes/no statements, divided into two subscales. The Cronbach's α of the questionnaire was .71, 95% CI = [.65, .77]. The measure of sensitivity to punishments as well as sensitivity to rewards is the mean response in all items in the subscale.

Results

Descriptive statistics of NAS-50

Descriptive statistics for the overall score of the questionnaire and all its subscales are presented separately for adolescents and adults in Table 1. The overall score in both adolescents and adults was normal. The subscale which was not normal in both groups was Goal Maintenance (the distributions were negatively skewed).

Results of correlation analysis within all the indicators of NAS-50 are shown in Table 2 for adolescents and for adults. In both age groups the subscales were highly or moderately correlated with the overall score and rather weakly correlated with each other. The lowest correlation of overall score was observed with the Switching and Flexibility subscale in adolescents (.41, 95% $CI = [.25, .55]$). The highest correlations between subscales were observed in Initiative and Persistence with Inhibition and Adjournment (.46, 95% $CI = [.31, .59]$) and with Proactive Control (.45, 95% $CI = [.29, .58]$).

Reliability analysis

Cronbach's alpha coefficients for overall NAS-50 score and its subscales are presented in Table 3 for adolescents and for adults. Additionally, the mean inter-item correlations within the subscales were tested. In both age groups the analysis did not reveal items that would significantly decrease the reliability of the NAS-50 indicators. The reliability of the Switching and Flexibility subscale in adolescents was lower than the others.

Age & gender differences

Multivariate analysis of variance revealed that there were no differences between adolescents and adults in the overall NAS-50 score and all its subscales ($F[1, 6, 235] = 1.29$, $p = .26$), nor between men and women ($F[1, 6, 235] = 1.65$, $p = .14$), but the interaction between these variables was significant ($F[1, 6, 235] = 2.41$, $p = .028$). The result was loaded by a significant interaction effect on the Initiative and Persistence scale ($F[1, 240] = 9.71$, $p = .0021$, $B_{age} = 0.17$, 95%$CI = [–0.081, 0.43]$, $B_{gender} = 0.21$ 95%$CI = [–0.073, 0.49]$, $B_{interaction} = –0.63$ 95%$CI = [–1.02, –0.23]$, see Figure 1). Figure 2 presents profiles of mean results of adolescents and adults in the NAS-50 subscales.

In addition to NAS-50, ANOVA revealed that impulsivity, measured with the MMF test, did not depend on age group ($F[1, 240] = 0.49$, $p = .48$), gender ($F[1, 240] = 0.57$, $p = .45$), nor interaction of these ($F[1, 240] = 2.57$, $p = .11$). On the other hand, cognitive control, measured with Go/Nogo task, differed both between age groups (mean

Table 1. Descriptive statistics of overall score of NAS-50 questionnaire and all its subscales

	M (*SD*)	*W* (*p*)	Skewness	Kurtosis
Adolescents (*N* = 120)				
NAS-50	3.4 (0.4)	.99 (.6)	.22	2.89
GM subscale	3.93 (0.57)	.97 (.0052**)	–.66	3.53
PC subscale	3.59 (0.63)	.98 (.11)	–.39	3.22
IP subscale	2.88 (0.71)	.97 (.013*)	–.046	2.15
SF subscale	3.74 (0.53)	.98 (.037*)	–.51	3.49
IA subscale	2.85 (0.63)	.99 (.28)	.39	3.20
Adults (*N* = 124)				
NAS-50	3.32 (0.43)	.99 (.75)	.25	3.30
GM subscale	3.8 (0.62)	.96 (< 0.001***)	–.78	3.53
PC subscale	3.62 (0.63)	.98 (.14)	–.23	2.77
IP subscale	2.8 (0.86)	.98 (.059)	.32	2.48
SF subscale	3.59 (0.69)	.98 (.14)	–.081	2.41
IA subscale	2.81 (0.65)	.99 (.71)	–.12	2.72

Note: *M* – median, *SD* – standard deviation, *W* – normality, GM – goal maintenance, PC – proactive control, IP – initiative and persistence, SF – switching and flexibility, IA – inhibition and adjournment.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Correlation matrix for overall score of NAS-50 questionnaire and all its subscales

	GM subscale	PC subscale	IP subscale	SF subscale	IA subscale
Adolescents (*N* = 120)					
NAS-50	.65***	.66***	.73***	.41***	.71***
GM subscale		.24**	.22*	.28**	.39***
PC subscale			.45***	.07	.29**
IP subscale				.05	.46***
SF subscale					.05
Adults (*N* = 124)					
NAS–50	.74***	.52***	.78***	.52***	.54***
GM subscale		.21*	.5***	.25**	.37***
PC subscale			.34***	.05	.05
IP subscale				.23*	.23**
SF subscale					.09

Note: GM – goal maintenance, PC – proactive control, IP – initiative and persistence, SF – switching and flexibility, IA – inhibition and adjournment.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Reliability analysis of overall score of NAS-50 questionnaire and all its subscales

	NAS-50	GM subscale	PC subscale	IP subscale	SF subscale	IA subscale
Adolescents (N = 120)						
Cronbach's α	.86	.72	.79	.81	.65	.75
Mean inter–item correlation	.11	.20	.28	.28	.16	.23
Adults (N = 124)						
Cronbach's α	.87	.70	.79	.87	.78	.73
Mean inter–item correlation	.12	.19	.28	.39	.27	.21

Note: GM – goal maintenance, PC – proactive control, IP – initiative and persistence, SF – switching and flexibility, IA – inhibition and adjournment

Figure 1. Interaction effect of age group and gender on Initiative and Persistence subscale. Bars indicate 95% confidence intervals.

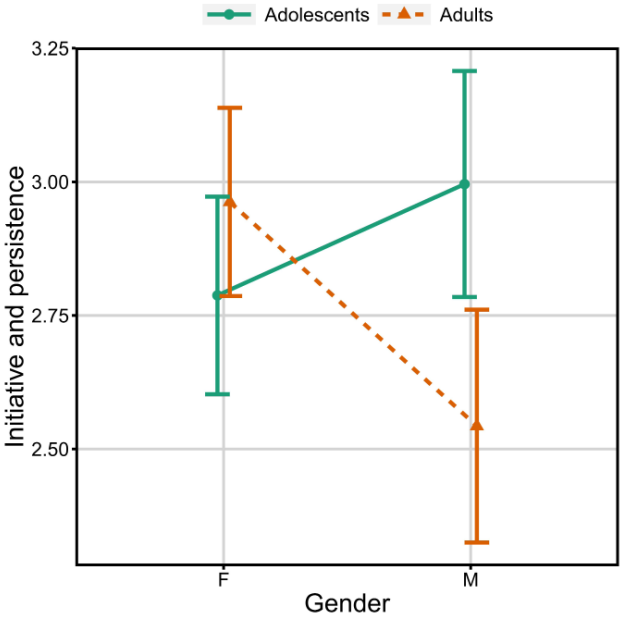
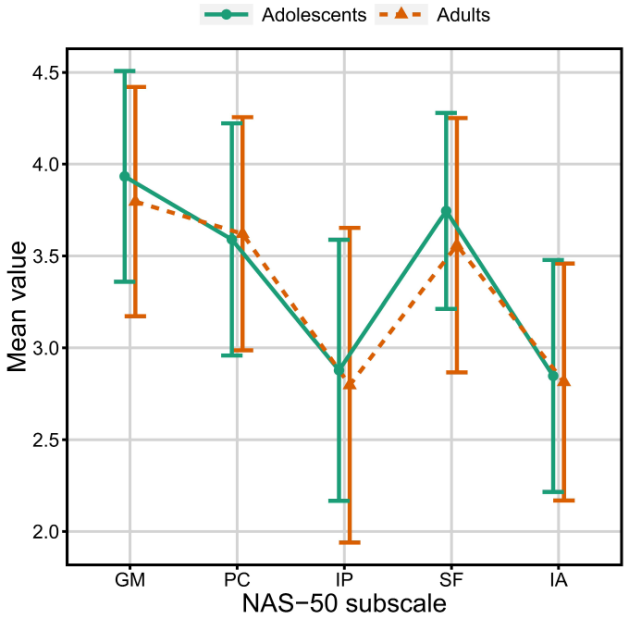


Figure 2. Profiles of mean subscale value for both adolescents (solid line) and adults (dashed line). Bars indicate standard deviations.



for adolescents: .848, for adults: .878, F[1, 170] = 11.86, p < .001) and genders (mean for men: .888, for women: .846, F[1, 170] = 24.43, p < .001), but the interaction of these variables had no significant impact (F[1, 170] = 1.28, p = .26).

Relation with behavioral measures

Results of correlation analysis between behavioral measures of cognitive control, impulsivity and all NAS-50 indicators are presented in Table 4, separately for adolescents and for adults. The only significant correlation was found between cognitive control and Goal Maintenance in adults.

Relation with self-report measures

Results of correlation analysis between sensitivity to punishments, sensitivity to rewards, risky behaviors and all NAS-50 indicators are presented in Table 5, separately for adolescents and for adults. In adolescents most of control scales correlated with sensitivity to rewards, while in adults most of the scales correlated with sensitivity to punishments. See table 5 for detailed comparison.

Discussion

Our results indicate that NAS-50 can be regarded reliable and suitable for assessment of self-control abilities in adolescents as well as in adults. In both age groups the overall score and subscales scores were roughly normally distributed, with the exception of Goal Maintenance, which was negatively skewed. It was also the subscale in which participants assessed their abilities the highest. Results of reliability analyses indicated a good level of NAS-50 internal consistency, as measured by Crobnach's alpha and mean inter-item correlations. The reliability of the Switching and Flexibility subscale

Table 4. Correlations between overall score of NAS-50 questionnaire and all its subscales with measures of impulsivity and cognitive control

	Adolescents				Adults			
	Impulsivity		Cognitive control		Impulsivity		Cognitive control	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
NAS-50	.042	.65	.13	.23	–.08	.38	.18	.086
GM subscale	.058	.53	.15	.18	–.057	.53	.26	.011*
PC subscale	–.059	.52	.19	.092	–.13	.14	.14	.17
IP subscale	.035	.70	.019	.86	–.073	.48	–.018	.86
SF subscale	.14	.13	–.099	.37	–.044	.62	.13	.2
IA subscale	–.015	.87	.15	.17	.063	.49	.098	.35

Note: GM – goal maintenance, PC – proactive control, IP – initiative and persistence, SF – switching and flexibility, IA – inhibition and adjournment.

* $p < .05$.

Table 5. Correlations between overall score of NAS-50 questionnaire and all its subscales with measures of sensitivity to punishments, sensitivity to rewards, and risky behaviors

	Adolescents						Adults					
	SP		SR		RB		SP		SR		RB	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
NAS-50	–.067	.47	–.27	.003**	–.061	.51	–.4	< .001***	–.037	.68	–.23	.011*
GM subscale	–.15	.11	–.22	.019*	.049	.6	–.32	< .001***	–.062	.49	–.22	.013*
PC subscale	.16	.081	–.065	.49	–.066	.48	.11	.9	.075	.41	–.16	.072
IP subscale	.066	.48	–.28	.0023**	–.13	.18	–.26	.0032**	–.076	.4	–.28	.002**
SF subscale	–.25	.0054**	.083	.37	.21	.026*	–.43	< .001***	.19	.039*	.068	.45
IA subscale	–.095	.31	–.34	< .001***	–.19	.036*	–.22	.013*	–.24	.0064**	–.11	.23

Note: SP – sensitivity to punishments (subscale of SPSRQ-SF questionnaire), SR – sensitivity to rewards (subscale of SPSRQ-SF questionnaire), RB – risky behaviors (Risk Behavior Questionnaire), GM – goal maintenance, PC – proactive control, IP – initiative and persistence, SF – switching and flexibility, IA – inhibition and adjournment.

* $p < .05$, ** $p < .01$, *** $p < .001$.

in adolescents was acceptable but lower than the others. It also correlated the weakest with the overall NAS-50 score. We suggest interpreting the results of the Switching and Flexibility subscale with caution in underage participants.

We found no significant differences between adolescents and adults in the assessment of their self-control abilities. The profiles of the mean results in the NAS-50 subscales were similar in both age groups, with the highest scores in Goal Maintenance and the lowest in Initiative and Persistence, and Inhibition and Adjournment. Also, the results of adolescents and adults deviated to a similar extent. Considering the fact that differences in self-control between adolescents and adults may appear in response to incentives (Crone & Dahl, 2012; Casey, 2015), it is possible that they are not visible in a questionnaire that deals with a wide range of deliberative actions (e.g. "When I have to do a lot of work, I am planning a detailed action plan"). On the other hand, the Inhibition and Adjournment subscale was created to measure impulse control (e.g. "During an argument I say something that I later regret"). Impulsivity as an individual trait is known to decrease linearly from childhood to young adulthood (Harden & Tucker-Drob, 2011). It is possible that NAS-50 is perceived more as a "self-organization" than an "impulse control" measure and that is why we did not observe the differences that usually appear when impulsivity questionnaires are used.

Gender differences were found neither in the overall NAS-50 score nor in the subscales, except for one that manifested differently in younger and older participants. Adult women assessed their initiative and persistence more highly than adult men, while in adolescents this pattern,

although less visible, was the opposite. It is difficult to explain this single finding, especially in comparison with the results of Nęcka et al. (2016), in which men scored higher than women in the Goal Maintenance and the Inhibition and Adjournment subscales. Women are known to outperform men in various measures of self-control, while men tend to assess their abilities in general less critically. While NAS-50 is a self-knowledge questionnaire that concerns abilities that are considered important for good adjustment (e.g. "I have always studied systematically"), it may be sensitive to differences in the self-esteem of subjects.

Finally, we found no significant correlations between NAS-50 indicators and behavioral measures of cognitive control and impulsivity, except for one between cognitive control and Goal Maintenance in adults. Such a finding is not surprising (Duskworth & Kern, 2011; Steimke et al., 2016) and confirms that NAS-50, similarly to other self-control scales, provides different knowledge about the phenomenon of control than behavioral measures do.

Overall, it seems that NAS-50 can be considered a useful option for measuring self-declared control in adolescent research. The parameters of the test (reliability, score distributions, inter-correlations between scales etc.) are similar in both underage and adult samples. Thus, NAS-50 can be successfully used in studies with mixed-age groups or where age is a key concern. Second, one of the unique features of NAS-50 is its non-clinicality. Many inventories that measure aspects of self-control in adolescents, such as previously mentioned BRIEF-SR, are dedicated for specific groups, such as ADHD individuals. NAS-50, on the other hand, focuses on everyday behavior and functioning outside of a clinical context and is adequate for studies in a general population. Third, NAS-50 attempts to capture various aspects of self-control, such as inhibition, goal maintenance or switching abilities, what constitutes an advantage over many existing scales for adolescents, such as Tangney's Self-Control Scale, that give only unidimensional, general score for self-control. Multidimensionality of the tool is of special importance, as self-control is generally perceived to be a multifaceted construct. Finally, the results we obtained with the test are also of interest on their own as they clearly show that adolescents aged 13–16 possess self-control similar to that of an adult. As it is generally believed that control abilities in teenagers are immature, such results are intriguing and warrant further studies on various aspects of self-control in adolescents and adults.

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