Measuring the need for cognition: Structural analysis and measurement of invariance of the short version of the Need for Cognition Scale in Italian adolescents

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❧ ABSTRACT. Lo studio di validazione si propone di fornire una versione breve italiana per adolescenti della scala del *Need for Cognition*, strumento che misura le differenze individuali nella motivazione ad apprezzare e a impegnarsi in attività cognitive che richiedono uno sforzo. La scala è composta da 18 item ed è stata somministrata a 473 studenti italiani della scuola secondaria. L'analisi fattoriale confermativa ha dimostrato che la scala presenta due fattori correlati che misurano due diverse dimensioni di motivazione, ovvero l'avvicinamento e l'evitamento delle attività cognitive impegnative. La scala è invariante anche per il genere e per la modalità di somministrazione (online e carta-matita). Grazie alle sue buone proprietà psicometriche, la scala si mostra come uno strumento utile sia in ambito educativo che di ricerca.

❧ SUMMARY. This study aims to adapt and validate the Need for Cognition Scale – Short Version (NFCS; Cacioppo & Petty, 1982) in Italian adolescents. This instrument measures individual differences in the motivation and enjoyment in being involved in effortful cognitive activities. The Italian version of the scale, translated and adapted from the original version, is composed of 18 items and was administered to secondary school students. The confirmatory factorial analysis proved that the scale had two correlated factors measuring two different dimensions of motivations, namely approach and avoidance of effortful cognitive activities. The scale is also invariant for gender and for the administration measurement (on-line and paper-pencil). Results also indicated that the NFCS had good reliability indices and satisfactory convergent and discriminant validity. Thanks to its good psychometric properties, the Need for Cognition Scale has been proven to be a useful tool in both educational and research areas.

Keywords: *Need for cognition, Invariance measurement, Adolescence*

INTRODUCTION

The Need for Cognition (NFC) is a personality variable that reflects the extent to which individuals are inclined to demanding cognitive tasks (Cacioppo & Petty, 1982). The construct was first identified in 1955 by Cohen's research group (Cohen, Stotland & Wolfe, 1955) and, since then, research has extensively documented how the need for cognition influences various cognitive and behavioural factors (Petty, Briñol, Loersch & McCaslin, 2009).

In particular, it has been shown that - concerning problem-solving and decision-making activities - high scores in tests that evaluate NFC are predictive of a high search for additional information and a high generation of possible solutions before making a decision (Petty et al., 2009). Furthermore, subjects who show high levels of NFC, not only have a high chance of approaching problems through cognitively expensive but effective processes, but also demonstrate great awareness of their thought processes and are more likely to correctly evaluate the validity of reasoning (Petty, Briñol & Tormala., 2002). Finally, those with high scores in the construct tend to actively seek new information (Verplanken, Hazenberg & Palenewen, 1992), prefer complex tasks to simple ones (Cacioppo & Petty, 1982), and show good performance in various cognitive activities, such as comprehension of the text (Dai & Wang, 2007) or the decision-making processes (Levin, Hunekeb & Jasper, 2000).

Overall, the literature seems to agree that high levels of NFC are associated with an increased inclination to debate, reflection, thought/opinion pondering and problem-solving. Individuals who exhibit this characteristic are therefore inclined to use analytical/rational elaboration processes. Instead, individuals with a low NFC tend to exhibit opposite tendencies, processing information in a more heuristic way. The individuals low in the need for cognition elaborate on incoming information less than those with a high NFC (Petty & Cacioppo, 1986) and tend to engage in fallacies or biases. For example, framing biases in decision making would more strongly affect individuals with low levels of need for cognition: low NFC persons varied their responses based on the framing of the problem while high NFC persons gave consistent responses independent of framing (Smith & Levin, 1996). Cacioppo and Petty (1982) described the construct as a stable individual difference and developed the *Need for Cognition Scale* (*NFCS*), for its evaluation. More specifically, the two authors have developed, at first, a scale with 34 items. The psychometric

properties revealed a high internal consistency characterized by a single dominant factor as resulted from the Principal Component Analysis (PCA) with a Cronbach alpha of .84. Subsequently, Cacioppo and colleagues (Cacioppo, Petty & Feng Kao, 1984) developed a short version with 18 items, based on those items with the highest factor loadings. PCA extracted a single factor that explained the 37% of variance with a high level of consistency (Cronbach alpha of .90).

Many studies have used the *Need for Cognition Scale* either in the original version or in a translated version over the last fifteen years. Most studies used the short version. Many of these studies reported high reliability coefficients (between .75 and .90). The goals of the studies were quite various, as the scale has been used to investigate the construct in different research fields: in school and learning processes (Amichai-Hamburger, Kaynar & Fine., 2007; Bertrams & Dickhäuser, 2009; Bors, Vigneau & Lalande, 2006), in advertising and marketing field (Kuo, Horng, Lin & Lee, 2012), in social cognition and decision-making ability (Carnevale, Inbar & Lerner, 2011; Harman, 2011), in prejudice and stereotypes studies (Cárdaba, Briñol Turnes, Horcajo & Petty, 2013). The variety of applications of the Need for Cognition Scale shows how the need for cognition is relevant to detect psychological dimensions and to study behaviors in social life. Most of the studies reporting significant associations between need for cognition and constructs such as academic achievement, dogmatism, rational decisions, intellectual engagement, openness to experience, emotional stability, and goal orientation also highlights the convergent validity of the scale. Furthermore, a study has investigated the role of gender and geographic birthplace, showing that the scale is gender-neutral and shows similar monofactorial structures in both Europe and North America (Cacioppo, Petty, Feinstein & Jarvis, 1996).

Despite numerous data supporting the validity and reliability of the items (Cacioppo et al., 1996), there has been some controversy over the underlying factorial structure. In fact, while Petty and Cacioppo have always stated that there was only one dominant factor, the analyses of other authors seem to indicate the presence of further factors. Overall, the one-dimensional model has been supported by authors (Hevey et al., 2012; Sadowski, 1993), who have argued that the one-dimensional model is more parsimonious than other models with two or three factors. This evidence led to the introduction of a monofactorial version with 6 items (Lins de Holanda Coelho, Hanel & Wolf, 2020). Similar results were

reported for the translated versions of the scale. Culhane, Morera and Hosch (2004) found a single-factor solution for the Hispanic version of the scale and the Dutch scale translation also shows a one-dimensional structure with 15 final items (Verplanken et al., 1992). However, the fact that all items of the scale load positively on a first unrotated factor does not preclude the emergence of two or more interpretable factors, after rotation (Fabrigar, Wegener, MacCallum & Strahan, 1999). This solution has become widely accepted in recent years, starting from the study by Stark and colleagues (Stark, Bentley, Lowther & Shaw, 1991), which proposed a bi-factorial structure with an identification of two dimensions: one referred to items reflecting an approach to cognitive effortful activities, and the other including items reflecting the opposite attitude, i.e. an avoidance of the cognitive activities. Forsterlee and Ho (1999) performed a PCA with oblique rotation on the 18-item NFC and reported a two-factor solution with highly correlated dimensions ($r = .52$): the approach and the avoidance dimensions. More recently, literature (Bors et al., 2006; Zhang, Noor & Savalei, 2016) also reported a two-factor model differentiating the approach and the avoidance factors. Furthermore, Bors and colleagues (2006), in their validation of the French version, revealed that only the avoidance dimension was predictive of academic success, supporting the idea that the approach and the avoidance are separate constructs of the Need for Cognition. About the Italian context, the recent work by Aquino and colleagues (Aquino, Picconi & Alparone, 2018), that validated the *Need for Cognition Scale* for young adults and adults (19-36 years-old), proved that the scale had two correlated factors measuring two different kinds of motivations: approach and avoidance of effortful cognitive activities. The distinction between the approach and the avoidance dimensions has already been widely accepted in psychological research, so the literature supports the idea that these two kinds of motivations should be addressed separately (for a review, Maio, Verplanken & Haddock, 2018).

As for the administration of the scale to adolescents, the short version of *Need for Cognition Scale* was validated in a few samples of secondary school students. Although previous studies, which explored the underlying Need for Cognition structure with secondary school students (Bors et al., 2006; Preckel, 2014), suggesting that the underlying factor structure of the Need for Cognition could better be explained by a unidimensional model, it confirmed the need to explore a trait-method model with two factors for positively and for negatively worded items. More recently,

Georgiou and Kyza (2018) administered the scale to 177 Greek-Cypriot high school students (mean age = 15.35 years). They tested and compared 9 models and found the best fits in the unidimensional model with correlated errors among the positively worded items (final items were 14, $\chi^2 = 163.30$, $df = 56$, CFI = .959, RMSEA = .06, SRMR = .031). However, even the two-factor model with two correlated factors defined by the polarity of items showed a good fit indices ($\chi^2 = 132.63$, $df = 56$, CFI = .964, RMSEA = .051, SRMR = .031). In sum, the factor structure of the *Need for Cognition Scale* is still debated. The literature reported the factor structures relate to i) a unidimensional Need for Cognition factor model, which in most cases sacrifices some items; ii) a trait-method model, which consider the effect of the positively and negatively worded items; and iii) two factors model which defines two kinds of motivation through the polarity of items.

Thus, despite these various approaches to measuring this construct, the need for cognition has rarely been studied in adolescence despite its relationship to learning and school performance (Luong et al., 2017), as well as its relevance to the motivational aspects of learning (Wigfield & Eccles, 2000) Therefore, the urge for knowledge that drives the need for cognition seems very important when considering the age of adolescence, which is a fundamental phase of life for the developmental acquisition of thinking that underlies the appropriate decision-making and judgment formation (De Haan, 2010; Lombardi, Di Dio, Castelli, Massaro & Marchetti, 2017; Taimur & Sattar, 2019). Moreover, this would appear significant when considering that adolescents, even as they face adulthood, still often employ imprecise and superficial logical processes when analyzing a problem or understanding complex phenomena, including socially relevant ones (Berti et al., 2017). Thus, starting from the work by Aquino and colleagues (2018) on an Italian sample of young adults and adults and considering the few studies on adolescents, the present study intends to provide the Italian validation of the questionnaire for adolescence, which will also contribute to the literature about the underlying factor structure of the *Need for Cognition Scale*.

The goal is to explore the psychometric characteristics of the short version of *Need for Cognition Scale* for Italian secondary school students (14-18 years). For this purpose, we intend to:

– verify the factorial structure of the NFCS for Italian adolescents by confirmatory factor analysis;
– investigate measurement invariance regarding gender and

the administered measurement (paper-pencil *vs* online) by employing multigroup confirmatory factor analysis.

METHOD

Participants and procedure

In order to assess the factor structure of the scale, 473 Italian students (261 males) participated in the study, from schools in the Northern of Italy. The age is between 14 and 18 years (mean age = 15.6 years, *SD* = .9). Of the participants, 74% have a family of Italian origin, the remaining is distributed between European and extra-European countries. Additionally, a sub-sample of 318 participants also completed the scales necessary to assess the convergent and divergent validity of the *Need for Cognition Scale*. After receiving the school-manager's approval to carry out the research, the caregivers and the students were informed on the aim and procedure of the study. Parents provided a written consent for their children's participation in the study and students gave informed written consent to the study, according to the General Data Protection Regulation (GDPR 2016/79, 25/05/2018). The present study was approved by the Scientific and Ethics Committee of the Department of Psychology of Catholic University of Milan, in accordance with the Helsinki Declaration. The Italian version for adolescence of the NFCS was assessed both via an online procedure and a pen-pencil procedure. The questionnaires were presented to the students through face-to-face meetings in the classroom (*N* = 390, 82.5% of the total, 55% are males, mean age = 15.3), or online (*N* = 83, 17.5% of the total, 60% are males, mean age = 15.7). On such occasions there have been given careful instructions on mode for compilation, delivering the questionnaires in a unique moment. All participants completed the Italian translation version of 18-items of the *Need for Cognition Scale* (Cacioppo et al., 1984), provided by the Department of Education and Psychology - University of Florence and is similar to the version proposed for young adults by Aquino et al. (2018).

Measures

The following three questionnaires were administered:
– The *Need for Cognition Scale – Short Version* (*NFCS*; Cacioppo et al., 1984), originally composed of 18 items,

which investigates the need for cognition. Bilinguals performed back-translations, blind to the content of the original English words. The original English items and the Italian adaptation of the NFCS are reported in the Appendix. Based on the empirical data in the literature and the theoretical reference model, the items are distributed on two factors, which measures the approach (e.g., "I find satisfaction in deliberating hard and for long hours", α = .82) and the avoidance (e.g., "I only think as hard as I have to", α = .72) dimensions. The proposed questionnaire consists of 18 statements for each of which must be answered on a 5-point Likert scale (from 1 = does not describe me at all, to 5 = It describes me very well). Higher scores reflect a higher adhesion with the statement. Items 3, 4, 5, 7, 8, 9, 12, 16,17 were kept as items reversed as in the original version. About the avoidance dimension, a higher score indicated a minor tendency to avoid cognitive situations. The items of NFCS, the descriptive statistics and reliability of the measure are shown in Table 1.
– The *Big Five Inventory* (*BFI*), which was proposed to verify the convergent validity of the NFCS. The Italian version (Ubbiali, Chiorri, Hampton & Donati, 2013), is a questionnaire for adults and young adults that investigates personality according to the 5-factor theory. The personality factors are: Extraversion (8 items), Agreeableness (9 items), Conscientiousness (9 items), Emotional stability (8 items), Open-mindedness (10 items). The proposed questionnaire consists of 44 statements on a 5-step Likert- type response scale (from 1 = strongly disagree to 5 = strongly agree).
– The *Need for Cognitive Closure Scale* was proposed to verify the divergent validity of the NFCS (Webster & Kruglanski, 1994). The Italian version measures the "desire on the part of the individual for a definitive and certain answer to a question/problem and reluctance to ambiguity" (Pierro et al., 1995). The proposed questionnaire consists of 42 items divided into five scales: 1) preference for order and structure in environment; 2) predictability of future contexts; 3) decisiveness of judgments and choices; 4) affective discomfort occasioned by ambiguity; 5) closed-mindedness. Each item must be answered on a 6-step Likert-type response scale (from 1 = strongly disagree to 6 = strongly agree). The final score was computed as the mean of the items.

Table 1 – Need for Cognition Scale (NFCS): Descriptive statistics and reliability (18 items)

	Mean	SD	Item-rest correlation	If item dropped Cronbach's α
NFCS1 - I prefer complex to simple problems	2.79	1.221	.473	.805
NFCS2 - I like to have the responsibility of handling a situation that requires a lot of thinking	3.01	1.160	.618	.796
NFCS3r - Thinking is not my idea of fun	3.24	1.084	.385	.810
NFCS4r - I would rather do something that requires little thought than something that is sure to challenge my thinking abilities	3.07	1.131	.494	.804
NFCS5r - I try to anticipate and avoid situations where there is a likely chance, I will have to think in depth about something	3.23	1.066	.367	.811
NFCS6 - I find satisfaction in deliberating hard and for long hours	2.93	1.076	.554	.801
NFCS7r - I only think as hard as I have to	3.34	1.133	.467	.806
NFCS8r - I prefer to think about small, daily projects to long-term ones	3.13	1.129	.360	.812
NFCS9r - I like tasks that require little thought once I've learned them	2.73	1.100	.308	.815
NFCS10 - The idea of relying on thought to make my way to the top appeals to me	3.76	.932	.432	.808
NFCS11- I really enjoy a task that involves coming up with new solutions to problems	2.88	1.202	.499	.803
NFCS12r - Learning new ways to think doesn't excite me very much	3.25	1.074	.234	.818
NFCS13 - I prefer my life to be filled with puzzles that I must solve	2.44	1.117	.414	.809
NFCS14 - The notion of thinking abstractly is appealing to me	3.10	1.197	.426	.808
NFCS15 - I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought	2.60	1.102	.423	.808
NFCS16r - I feel relief rather than satisfaction after completing a task that required a lot of mental effort	2.80	1.090	.154	.823
NFC17r - It's enough for me that something gets the job done; I don't care how or why it works	3.16	1.192	.299	.816
NFCS18 - I usually end up deliberating about issues even when they do not affect me personally	3.48	1.148	.349	.812

Data analysis

The preliminary analyses were performed with the support of IBS SPSS Statistics for Apple Macintosh OSX, Version 22.0, in order to check the normal distribution by calculating mean, standard deviation, and indices of skewness and kurtosis and verified the possible presence of outliers. The analysis of skewness and kurtosis indicated that the distance from normality was not severe (the indices were between −1.04 and 1.60), so no variable transformations were deemed necessary.

Confirmatory Factor Analysis (CFA) was conducted using SEM with Mplus 7.11 software (Muthén & Muthén, 1998-2015). To evaluate the CFA models and to test invariances, goodness of fit was estimated by Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR). A Robust Maximum Likelihood (MLR) method of estimation was applied to test the hypothesized model. The χ^2 should be non-significant in order to consider the CFA model as fitting the observed data; however, since it is largely affected by sample size (Hu & Bentler, 1999), we examined other fit indices (Hu & Bentler, 1998). Models with good fit present a RMSEA<.08 and CFI>.90 (Bentler, 1990), whereas models with excellent fit present a RMSEA<.05 and CFI>.95 (Hu & Bentler, 1998). Akaike Information Criterion (AIC) was used to compare the relative fit of models, with lower AIC values indicating superior model fit (Marsh, Hau & Wen, 2004).

Multigroup analyses (MGCFA) were carried out to verify the invariance of this factorial structure across gender and type of administration starting from the model supported by the CFA (Brown, 2015). Competing models were compared with regard to their model fit by performing i) χ^2 difference tests ($\Delta\chi^2$ and Satorra-Bentler scaled χ^2; Satorra & Bentler, 2001) and ii) the difference between comparative fit indices (ΔCFI). More specifically, we compared the scale structure (configural invariance), the items' factor loading (metric invariance), the items' intercepts (scalar invariance) as well as their residual variance (uniqueness invariance). If the chi-square obtained as difference among the two models' χ^2 is not significant, the two models are not significantly different and, thus, invariance is met. Because this test is "sensitive" to sample size (Cheung & Rensvold, 2002), we also tested the ΔCFI model comparison. A negative ΔCFI value lower than −.01 (e.g., ΔCFI = −.02) would indicate a lack of invariance (Cheung & Rensvold, 2002), while when CFI increases (i.e.,

ΔCFI>0) that may occur due to the changes in degree of freedom, there are no concerns about the invariance, because a larger CFI indicates better fit (Dimitrov, 2010).

The reliability was evaluated using Cronbach's alpha (Cronbach, 1951) and the convergent and divergent validity were assessed using the *Big Five Inventory* and the *Need for Closure Scale*. In particular, statistically significant positive relationships with the score on the Open-mindedness scale of the BFI and statistically significant negative relationships with the Need for Closure score were expected. Furthermore, descriptive statistics of the different dimensions and correlations for all variables of interest were calculated.

RESULTS

According to the literature suggesting a single dimension of the scale (e.g., Cacioppo et al., 1984; Hevey et al., 2012), a CFA was carried out, performed through the robust maximum likelihood method. Modification indices were also checked to assess the degree to which the hypothesized model was adequately described. Correlated errors are specified when items share a portion of variance. CFA revealed that the uni-dimensional model had acceptable fit indices but worse compared to the bidimensional model. The uni-dimensional model fit indices are acceptable: $\chi^2_{(136)}$ = 567.55; RMSEA = .082, 90% CI [.07;.09], CFI = .74; SRMR = .088; AIC = 24755.27. On the contrary, the bidimensional model showed a good fit: $\chi^2_{(135)}$ = 331.62; RMSEA = .056, 90% CI [.05;.06], CFI = .85; SRMR = .105; AIC = 24576.29 which is in line with the results shown by Aquino and colleagues (2018) (RMSEA = .058: 90% CI [.04;.07], CFI = .91; NNFI = .90; SRMR = .06). The modification indices analysis suggested adding covariance between the errors (freeing up errors covariances was allowed because they are part of the same latent variable) in order to improve fit indices, showing an excellent fit: $\chi^2_{(127)}$ = 199.37; RMSEA = .035, 90% CI [.02;.04], CFI = .95; SRMR = .054; AIC = 24431.10. The AIC index confirmed that this solution better fitted the data. As shown in Figure 1 that depicts the bidimensional solution, all factor loadings were statistically significant at p<.001 and ranged from .35 to .82. CFA upheld that the factors were related to each other, r = .55. Correlated errors are performed as suggested by the modification indices.

Measurement invariance refers to the ability of an instrument to measure the same construct across different

Figure 1 – Confirmative Factorial Analysis of the Italian Need for Cognition Scale – Short Version for adolescence with standardized regression weights
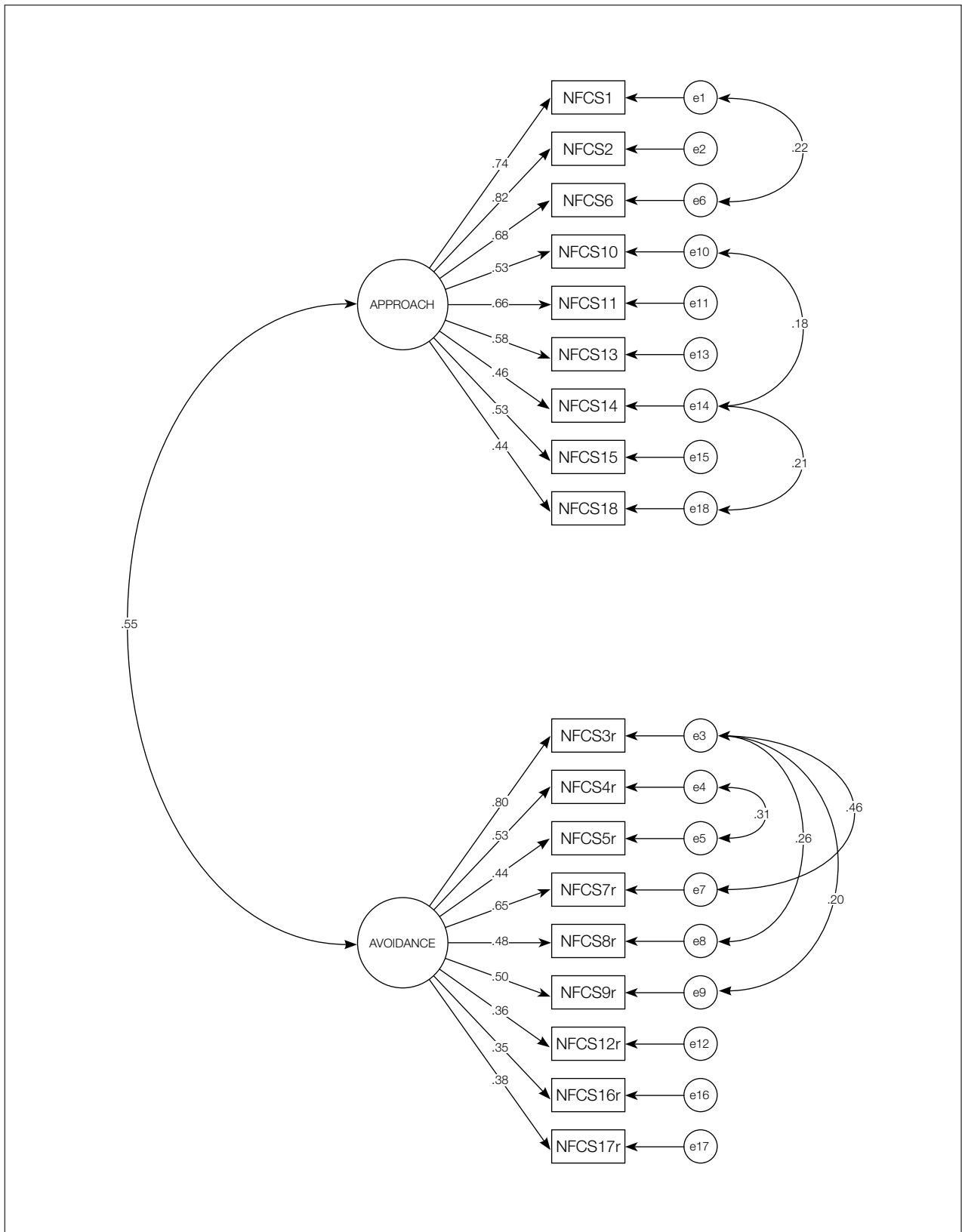
groups and offers confidence in the application of the construct across groups and also allows for verification that scores that have been derived from a measure of the construct can be directly compared (Brown, 2015). Structural equation modelling offers a robust and established methodological framework within which to assess measurement invariance. Multigroup invariance analyses (MGCFA) were performed in order to verify the NFCS equivalence across gender (male *vs* female) and type of administration (paper-pencil *vs* online). We firstly verified the validity of the baseline model both for gender and type of administration, as suggested literature (Brown, 2015). About type of administration, baseline models showed acceptable fit indexes both for on-line (RMSEA = .027, 90% CI [.00;.06], CFI = .96; SRMR = .094) and paper pencil administrations (RMSEA = .037, 90% CI [.026;.047], CFI = .94; SRMR = .081). About gender, baseline models showed a good fit indexes both for male (RMSEA = .060, 90% CI [.051;.081], CFI = .81; SRMR = .09) and female (RMSEA = .061, 90% CI [.052;.077], CFI = .82; SRMR = .07). Subsequently, using multi-group analysis, groups were compared according to four types of measurement invariance (configural, weak, strong, strict invariance). These steps of invariance testing have to be taken from weakest (configural) to strongest (strict invariance). Given the sample size (*N*>300), a decrease in CFI equal to or greater than .01, along with an increase in RMSEA equal to or greater than .015, is considered a substantial decrease in model fit (Chen, 2007). As shown in Table 2 and in Table 3, results from the analysis of the multi-group measurement invariance supported the presence of strict invariance across gender and type of administration, showing the evidence of generalizability of the NFCS across gender and modality of administration (paper-pencil *vs* online).

About the convergent and divergent validity, Table 4 shows the correlations of the approach and avoidance dimension of NFCS with other measures, namely *Big Five Inventory and Need for Closure Scale*.

The pattern of correlations between *Big Five Inventory* and *Need for Cognition Scale* shown in Table 4 is consistent with the literature. In particular, significant positive relationships have been demonstrated between the scores obtained at the NFCS and those obtained on the Open-mindedness and Conscientiousness scales. Table 5 shows the correlations with the *Need for Cognitive Closure Scale*, in particular the negative correlation of the Closed-mindedness scale with the 2 dimensions of the *Need for Cognition Scale*

confirms the different dimensions investigated by these two questionnaires. In particular, with respect the correlations about the open mindedness components of *Big Five Inventory* and Closed-mindedness as measured by the *Need for Cognitive Closure Scale*, show the validity of the *Need for Cognition Scale* dimensions.

DISCUSSION

In this study, we have developed the Italian version for adolescents of the *Need for Cognition Scale – Short Version* that can be used with students between 14 and 18 years. In particular, the aims of the present study were: i) to verify the factorial structure of the *Need for Cognition Scale – Short Version* for Italian adolescents, ii) to investigate measurement invariance regarding gender and the administered measurement.

About our first goal, the confirmatory factor analysis suggested an excellent fit of bifactorial solution with a differentiation between the approach to cognitive effortful activities and the avoidance of situations requiring a lot of thinking, as the previous studies show, both in the Italian context (Aquino et al., 2018) and with the secondary school students (Bors et al., 2006). Both the approach (Cronbach's alpha = .82) and the avoidance dimensions (Cronbach's alpha = .72) showed good internal consistency, preserving all items of the original short form. These findings contribute to the body of literature, which is still debated, regarding the structure of the scale, bearing important implications on the topic of data collection through rating scales with both negative and positive items, underlying the two factors model which defines two kinds of motivation through the polarity of items. Furthermore, related to our second objective, we show that the *Need for Cognition Scale – Short version* for Italian adolescents is invariant for gender and for the administration measurement, indicating that the items assess the same attitude factors for both female and male adolescents. Therefore, any differences between males and females can be attributed to actual variations in the responses to some items, and not to a differential functioning of the questionnaire, as claimed by other studies (Cacioppo et al., 1996; Lins de Holanda Coelho et al., 2020). Moreover, the results from online administration (used because of the pandemic Covid19) are similar to the results from paper-pencil administration, indicating that the items, even though

Table 2 – Measurement invariance for NFCS between male and female

Measurement Invariance - gender	df	χ^2	CFI	RMSEA			SRMR	Δdf	SB$\Delta\chi^2$	p	ΔRMSEA	ΔCFI
				Estimate	95% CI							
Configural	250	319.114	.952	.034	.022-.045	.054						
Weak (*vs* configural)	266	341.836	.947	.035	.023-.045	.064	16	22.85	.118	.001	.005
Strong (*vs* weak)	282	365.276	.936	.037	.026-.047	.068	16	23.81	.094	.002	.011
Strict (*vs* strong)	300	390.686	.919	.045	.036-.054	.072	18	25.79	.105	.008	.017

Legenda. df = degree of freedom; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation.

Table 3 – Measurement invariance for NFCS between paper-pencil and online administration

Measurement Invariance - administration	df	χ^2	CFI	RMSEA			SRMR	Δdf	SB$\Delta\chi^2$	p	ΔRMSEA	ΔCFI
				Estimate	95% CI							
Configural	250	295.696	.968	.026	.011-.040	.051						
Weak (*vs* configural)	266	311.058	.967	.027	.010-.039	.058	16	15.14	.514	.001	.001
Strong (*vs* weak)	282	324.933	.965	.028	.009-.039	.059	16	14.21	.583	.001	.002
Strict (*vs* strong)	300	337.193	.964	.029	.008-.041	.062	18	10.26	.923	.001	.001

Legenda. df = degree of freedom; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation.

Table 4 – Correlation coefficients between the NFCS and the factors of Big Five Inventory

	Conscientiousness	Open-mindedness	Emotional stability	Extraversion	Agreeableness
NFCS Approach	.195**	.480***	.063	.061	.100
NFCS Avoidance	.189**	−.316***	.137*	−.009	.099

Note. N = 318.
* *p*<.05, ** *p*<.01, *** *p*<.001

Table 5 – Correlation coefficients between the NFCS and the factors of Need for Cognitive Closure Scale

	Decisiveness	Predictability	Affective discomfort	Preference for order	Closed-mindedness
NFCS Approach	.097	−.121 *	.189***	.078	−.320***
NFCS Avoidance	.151**	−.076	.074	−.010	.345 ***

Note. N = 318.
* *p*<.05, ** *p*<.01, *** *p*<.001

administered in different modalities, assess attitude factors in a similar way. This finding has implications especially in light of the latest trends regarding online ways of administration.

Furthermore, we investigated the validity of the scale using scale statistics for internal consistency and correlations with conceptually related measures. The scale shows good psychometric properties with respect both to the reliability and to the measure of construct validity. In particular, the strong significant correlations with the scale of the Open-mindedness of the *Big Five Inventory* and the Closed-mindedness of the Need for Closure questionnaire prove that *Need for Cognition Scale – Short Version* can be considered a measure of the inclination to demanding cognitive tasks also in Italian adolescents. This result underlines the tendency of people with a high need for cognition that enjoys themselves in dealing with complex problems, be curious, and engage

in new ideas, showing to evaluate and process incoming information as do those that are highly open-minded (e.g. Mussel, 2010), as corroborates both positive and negative significant correlations with Open-mindedness factor (respectively with Approach and Avoidance dimension of *Need for Cognition Scale*). Furthermore, the correlations show that the need for cognition has correlated aspects with conscientiousness, which includes aspects, such as carefulness, organization, control, and dutifulness. This result underlines the overlapping and positively correlated elements between the two constructs, as shown by previous literature (e.g. Fleischhauer et al., 2010; Furnham & Thorne, 2013). Together, these findings confirmed the convergent and divergent validity of *Need for Cognition Scale*. Furthermore, none of the correlation coefficients was equal to or greater than .70, underlines there isn't overlap with other constructs.

CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS.

To sum up, the present study resulted in 18-item version of the *Need for Cognition Scale – Short Version* for Italian adolescents, as a validated measurement of cognitive motivation, which can be used with Italian-speaking students attending secondary school. The scale has characteristics of simplicity and speed in the compilation that make it particularly suitable for research in typical and atypical populations. Results showed that bi-dimensional model shows a good fit, which is improved to excellent after correlating the residuals. This is relevant in view of the fact that the factorial structure of the Need for Cognition is controversial. In order to better specify the structure of the model, the applied modifications should be confirmed in future studies. Regarding the limitations of this study, according to the literature (Bors et al., 2006), socio-economic status and school outcomes should be considered in future research. Moreover, other questionnaires investigating the convergent validity of the NFC should be explored for this age group; in fact, the low to moderate correlations we found suggest that the questionnaires used are probably weaker at capturing these dimensions in adolescence. Additionally, considering a sample only from Northern Italy could be considered a limitation of the study. Beyond these limits, the Need for Cognition questionnaire can provide useful data in studies concerning the interaction between personality characteristics and learning contexts in adolescence period of life. It can also be applied in longitudinal studies, aimed at investigating the relationship between the different aspects of personality with the choice of academic pathways and the academic performance in a prospective way.

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APPENDIX

Translated (and original items) of the Italian version of Need for Cognition Scale – Short Version for Adolescence

NFCS1 - Preferisco i problemi complicati ai semplici (I prefer complex to simple problems)

NFCS2 - Mi piace dover gestire una situazione che richiede molto da pensare (I like to have the responsibility of handling a situation that requires a lot of thinking)

NFCS6 - Io provo soddisfazione quando c'è da riflettere molto e a lungo (I find satisfaction in deliberating hard and for long hours)

NFCS10 - Mi attrae l'idea di fare affidamento sulla mia capacità di pensare per arrivare in alto (The idea of relying on thought to make my way to the top appeals to me)

NFCS11 - Mi piacciono i compiti in cui si devono trovare nuove soluzioni ai problemi (I really enjoy a task that involves coming up with new solutions to problems)

NFCS13 - Preferisco che la mia vita sia piena di dilemmi da risolvere (I prefer my life to be filled with puzzles that I must solve)

NFCS14 - Mi attrae l'idea di pensare in modo astratto (The notion of thinking abstractly is appealing to me)

NFCS15 - Preferisco compiti intellettuali, difficili ed importanti a quelli abbastanza importanti ma che non richiedono tanto da pensare (I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought)

NFCS18 - Di solito finisco col riflettere su problemi anche quando non mi riguardano personalmente (I usually end up deliberating about issues even when they do not affect me personally)

NFCS3r - Pensare non è l'idea che ho di divertimento (Thinking is not my idea of fun)

NFCS4r - Preferirei fare qualcosa che non richiede molto da pensare, piuttosto che qualcosa che sfidi le mie abilità di pensiero (I would rather do something that requires little thought than something that is sure to challenge my thinking abilities)

NFCS5r - Tendo a prevedere ed evitare situazioni in cui sia molto probabile dover pensare profondamente su qualcosa (I try to anticipate and avoid situations where there is a likely chance, I will have to think in depth about something)

NFCS7r - Io mi impegno a ragionare solo lo stretto necessario (I only think as hard as I have to)

NFCS8r - Preferisco pensare a piccoli progetti quotidiani piuttosto che a quelli a lungo termine (I prefer to think about small, daily projects to long-term ones)

NFCS9r - Mi piacciono i compiti che, una volta appresi, richiedono poco da pensare (I like tasks that require little thought once I've learned them)

NFCS12r – L'idea di imparare nuovi modi di pensare non mi eccita molto (Learning new ways to think doesn't excite me very much)

NFCS16r - Dopo aver completato un compito che richiede un grande sforzo mentale mi sento sollevato, piuttosto che soddisfatto (I feel relief rather than satisfaction after completing a task that required a lot of mental effort)

NFCS17r - Mi basta trovare un qualsiasi modo per terminare il lavoro; non mi importa come o perché funzioni (It's enough for me that something gets the job done; I don't care how or why it works)

Legenda. r = reverse items.
Note. Original items are in brackets.