Factorial Structure and Psychometric Assessment of the Brief Self-Control Scale among Arab Universities' Students[*]

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Abstract

The present study investigated the factorial structure and psychometric characteristics, particularly reliability and validity, of the brief self-control scale amongst Arab university students (N = 525) utilizing exploratory and confirmatory factor analyses. The construct validity was gauged by examining the scale relationship with ambiguity tolerance. The findings of the exploratory factor analysis suggested that a two-factor structure was the optimal factorial solution, accounting for 30.93% of the variance in the study sample. Factor 1 had nine items and was named impulsivity. Factor 2 had four items and was called self-discipline. Both factors had good and acceptable reliability coefficients. The findings of confirmatory factor analysis provided supporting evidence of the estimated two-factor structure after applying modification indices of the model. The construct validity was substantiated by estimating a significant positive moderate association between self-control and ambiguity tolerance. These findings showed that the brief self-control scale is a reliable and valid measurement tool to evaluate students' self-control in the academic context of Arabic culture.

البنية العاملية والتقييم السيكومتري لمقياس الضبط الذاتي المختصر لدى طلبة الجامعة العرب*

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ملخص

هدفت الدراسة الحالية إلى الكشف عن البنية العاملية والخصائص السيكومترية لمقياس الضبط الذاتي المختصر لدى طلبة الجامعة العرب (ن = 525) باستخدام التحليل العاملي الاستكشافي والتحليل العاملي التوكيدي. كما تم التحقق من صدق المفهوم من خلال تحديد العلاقة بين الضبط الذات ومستوى تحمل الغموض. أشارت نتائج التحليل العاملي الاستكشافي إلى قبول البنية العاملية ذات عاملين كأفضل تركيبة عاملية للمقياس، والتي تفسر 30.93% من التباين لدى الطلبة الجامعيين العرب. سمي العامل الأول بالاندفاعية. بينما تم تسمية العامل الثاني بالتحكم الذاتي. وتمتع كلا العاملين بثبات اتساق داخلي عال. في المقابل، أظهرت نتائج التحليل العاملي التوكيدي تأكيد البنية ثنائية العوامل بعد إضافة عدد من الارتباطات بين تغاير الأخطاء. كما أوضحت النتائج تمتع المقياس بصدق المفهوم من خلال علاقة إيجابية بين التحكم الذاتي وتحمل الغموض. تشير هذه النتائج بمجملها إلى أن امتلاك مقياس الضبط الذاتي المختصر لخصائص سيكومترية جيدة؛ مما يرجح إمكانية استخدامه كأداة قياس موثوقة لقياس الضبط الذاتي لدى الطلبة العرب في السياق الأكاديمي في مجمل الدول العربية.

الكلمـات المفتاحيـة: الضبط الـذاتي، الصدق العامـلي، التعامل مع الغمـوض، الشرق الأوسـط، طلبة التعليم العالي

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1. Introduction

There is a huge emphasis on the role of non-cognitive characteristics along with cognitive qualities in shaping university students' productive academic and personal endeavors (Alhadabi & Karpinski, 2020; Duckworth et al., 2007; Stadler et al., 2016). One of the principal affective qualities is self-control which has paramount influences in determining the quality of decisions, behaviors, and approaches adopted by university students in academic and personal contexts (Duckworth et al., 2019; Milyavskaya & Inzlicht, 2018; Tangney et al., 2004). Milyavskaya and Inzlicht (2018) define self-control as "the effortful inhibition of an immediately gratifying behavior or impulse," meaning, a person exerts effort when deciding to enjoy an immediate hedonic behavior (e.g., watching TV) versus completing less pleasurable tasks (e.g., studying) that facilitate accomplishing long-term goals (e.g., completing an academic degree). Self-control requires a conscious, deliberate, and effortful act, which according to Werner and Milyavskaya (2019) not necessarily results in achieving long-term goals. Rather, it associates with pessimistic outcomes like ego depletion (Friese et al., 2018).

Nevertheless, an influential line of research has emphasized the positive role of self-control. For instance, Tangney et al. (2004) revealed that self-control is positively associated with higher academic achievement, superior self-esteem, a healthier diet, optimal emotional response, and quality relationships. Several studies have echoed the productive impact of self-control on academic attainment, getting higher grades, autonomous learning, influential psychological traits such as grit, self-efficacy, doing academic tasks, well-being, and dealing with ambiguous academic circumstances (Duckworth et al., 2019; Opelt & Schwinger, 2020; Salazar & Meador, 2023; Tangney et al., 2004). Taha et al. (2014) confirmed the negative relationship between self-control and ambiguity intolerance, that is, individuals with higher intolerance to ambiguous situations were likelier to report lower self-control levels, particularly in complicated and unclear circumstances.

A comprehensive review of psychometric literature revealed numerous observations. First, several scales were found to assess self-control, including the self-control behavior inventory (Fagen et al., 1975), the self-control rating scale (Kendall & Wilcox, 1979), the self-control schedule (Rosenbaum,1980), Eysenck impulsiveness scale (Eysenck et al., 1984), the self-control questionnaire (Brandon et al., 1990), the bonding self-control scale (Gottfredson, 1990), the Grasmick's self-control scale (Grasmick et al., 1993), and the long and the brief self-control scale (Tangney et al., 2004). Nevertheless, these scales were heterogeneous regarding validating samples, item content, factorial structures, and scoring methods. Four scales (i.e., the self-control rating scale, the self-control schedule, the bonding self-control scale, and Grasmick's self-control scale) were utilized to assess self-control among irregular samples including clinical sample (Rosenbaum,1980; Tangney et al., 2004) and criminal sample (e.g., children and juvenile delinquents; Gottfredson, 1990; Grasmick et al., 1993; Fung et al., 2020). Eysenck Impulsiveness Scale has mainly been used with children (Eysenck et al., 1984). Only Tangney's et al. (2004) long and brief versions of the self-control scale (LSCS and BSCS) were validated and used among university students, which concurs with the current study scope.

The LSCS is a 36-item scale that consists of five factors, which are (1) General self-discipline (i.e., eleven items), (2) Inclination toward non-impulsive action (i.e., ten items), (3) Health habits (i.e., seven

items), (4) Work ethics (i.e., five items), and (5) Reliability (i.e., five items). The BSCS is a 13-item scale that has the same factorial structure (i.e., Dimension 1 with 5 items, Dimension 2 with 3 items, Dimension 3 with 2 items, Dimension 4 with 2 items, and Dimension 5 with 1 item). Nevertheless, Tangney et al. (2004) found that the five factors in BSCS did not enhance the prediction of several related outcomes (e.g., psychological adjustment and academic achievement), which motivates other researchers to consider BSCS as a unidimensional scale (Brevers et al., 2017; Manapat et al., 2021). Such a lack of clarity raises a red flag. In addition, psychometric literature has emphasized a rule about the minimum number of items (i.e., three) per factor to maintain a reasonable number of representative items and consider the factor as a valid dimension (Fabrigar & Wegener, 2012; Watkins, 2018). This rule raises an additional concern about the validity of factors 3, 4, and 5 that were offered by (Tangney et al., 2004). The remaining discussion is oriented to the brief self-control scale (BSCS) that is the scope of the current paper.

Second, the BSCS has been adopted, translated, and validated in numerous cultures. This prompted several versions, which are: Italian (Gürdere et al., 2022), Chinese (Fung et al., 2020), French (Brevers et al., 2017), Turkish (Nebioglu et al., 2012), German (Bertrams & Dickhäuser, 2009), and several US samples (De Ridder et al., 2011; Ferrari et al., 2009; Maloney et al., 2012; Manapat et al., 2021; Morean et al., 2014). None of the above-mentioned versions assessed the BSCS in the Arabic context, specifically in the Middle East, which highlights a research gap that the current study wanted to fill. Only one Arabic study used the LSCS (i.e., 36 items) to explore the association between emotional stability and self-control among university students (Alrabie & Eatia, 2016). As far as the author knows, no psychometric assessment of the scale factorial structure was conducted in the Arabic context.

Third, subsequent psychometric studies of BSCS appear to propose that one dimension may not be sufficiently representative. Despite two studies confirming the unidimensionality in the French (Brevers et al., 2017) and Italian samples (Gürdere et al., 2022), the remaining studies demonstrated alternative factorial structures. Preserving 13 items and keeping the scale intact, the two-factor solution was supported by Ferrari et al. (2009) in the U.S. sample (i.e., self-discipline and impulse control) and by Nebioglu et al. (2012) in the Turkish sample (i.e., Self-discipline and impulsivity). The two factors were obtained after eliminating three items (i.e., initiatory self-control and inhibitory self-control; De Ridder et al., 2011), five items (i.e., impulsivity and restraint; Maloney et al., 2012), and six items (i.e., impulse control and self-discipline; Morean et al., 2014). Manapat et al. (2021) found that one-and two-factor structures were the most plausible in the two samples (heterogeneous sample of U.S. adults and undergraduates). A four-factor solution was supported in the Chinese sample (i.e., self-discipline, impulsivity, healthy habits, and self-regulation; Fung et al., 2020). There is a dearth of sound-validated scales of self-control. In addition, previous studies on the brief scale have not reached an agreed-upon factor structure.

Therefore, the prime objectives of this research were: (1) Adopting and translating BSCS and assessing its factorial structure among Arab universities students using exploratory factor analysis (EFA), (2) Verifying the obtained factorial solution utilizing confirmatory factor analysis (CFA), and lastly, (3) Obtaining evidence of the construct validity by investigating the correlation between self-

control and ambiguity tolerance. Such an attempt can be illuminating and informative, establishing new psychometric evidence about the Arabic BSCS form. The next section reviews self-control and ambiguity tolerance.

2. Literature Review

2.1. Self-Control

Tangney et al. (2004) defined self-control as "the ability to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them." In other words, self-control expresses a dispositional quality that enables students to achieve desirable long-term goals by practicing effortful inhibition and avoidance of immediately gratifying behaviors, impulses, or expected rewards. Nevertheless, the definitions of self-control might vary considerably depending on the overarching theory (e.g., psychodynamic, biological process, and cognitive self-regulation; Carver, 2005). Duckworth et al. (2019) discuss the jingle jangle problem when defining self-control. In other words, there is an overlap between several psychological and cognitive neuroscience concepts and self-control such as self-regulation (i.e., a set of psychological and motivational processes including self-efficacy, learning strategies, Zimmerman, 1990), conscientiousness (i.e., a personality trait that includes the facet of orderliness, grit, complying to social norms; Park et al., 2017), and core executive function (i.e., top-down inhibitory control, working memory, and the cognitive flexibility that is required to accomplish a task; Zhou et al., 2012).

Correspondingly, a long list of scales has been used (e.g., the self-control behavior inventory, the self-control schedule, the self-control questionnaire, the bonding self-control scale, the Grasmick's self-control scale, LSCS, and BSCS; Duckworth & Kern, 2011; Tangney et al., 2004). A couple of scholars raised a valid question of whether or not these scales are measuring the same underlying construct (Duckworth & Kern, 2011). The literature demonstrated that these scales were heterogeneous regarding validating samples, responding and scoring methods, and the items about content, quantity, and factorial structure.

In respect of validating samples, some scales were used to assess self-control among irregular samples including clinical samples, participants with eating irregularity, and criminal samples (Maloney et al., 2012), whereas a limited number of scales were validated among university students (e.g., LSCS and BSCS; Tangney at al., 2004). Related to responding and scoring methods, a meta-analysis study of 282 studies showed paramount diversity in tools measuring self-control that can be categorized into four distinct approaches (i.e., executive function tasks, self-report questionnaires, informant-report questionnaires, and hindering of gratification experiments; Duckworth & Kern, 2011). Overall, the results articulated that convergent validity was moderate in these scales, in which the correlation coefficients were the strongest among self-report and informant-report surveys and the weakest among executive function tasks. For the third category (i.e., scale length and factorial structure), there is a striking inconsistency between scales. For instance, the Grasmick's et al. (1993) scale is a 24-item scale, which has six factors (i.e., impulsivity, simple tasks, self-centered, physical activities, temper, and risk-seeking. In contrast, the Eysenck impulsiveness scale has three factors (i.e., impulsiveness,

venturesomeness, and empathy) that are assessed by 63 items (Eysenck et al., 1984). For university students, the LSCS is a 36-item and five-factor scale whereas BSCS is a 13-item and unidimensional scale (Tangney et al., 2004).

Notwithstanding the dilemma of definitions and the diversity of measurement tools, self-control has essential influences on students' academic outcomes. Duckworth et al. (2019) emphasized that self-control has positive effects on academic achievement, academic attainment, course grades, standardized tests, accomplishing academic goal-congruent tasks, and dampening academic goal-incongruent tasks. Stadler et al. (2016) found that self-control accounted for a substantial amount of variance in grade point average and subjective academic achievement even when controlling cognitive ability among university students. Salazar and Meador (2023) provided additional support about the mediating role of self-control in the academic context (i.e., the association between grit and autonomous learning) among undergraduates. Self-control also mediated the relationship in the personal context (i.e., the relationship between grit and well-being) among undergraduates. Recent studies have substantiated a positive moderate correlation between self-control and well-being, implying that highly self-controlled students are more likely to express having well-being and making better decisions (Hofmann et al., 2014; Opelt & Schwinger, 2020). A meta-analysis of 104 studies revealed a significant positive relationship between self-control and a set of desired behaviors surrounding school, work, eating habits, weight, interpersonal functioning, well-being, and adjustment with small to medium effect sizes (de Ridder et al., 2012). In addition, this study found a significant correlation between low self-control and a set of undesired behaviors, which are deviant behaviors (e.g., nonviolent crime, cheating, over-speed while driving), unhealthy lifestyle (e.g., eating disorder symptoms, unsafe sexual behavior), and addictive behaviors (e.g., smoking and marijuana use), reflecting medium effect sizes.

2.2. Ambiguity Tolerance (AT)

Budner (1962) articulates ambiguity tolerance as a propensity to perceive ambiguous and demanding situations as appealing and not a source of threat. For instance, students who tolerate ambiguity tend with greater extent to engage effectively in challenging learning experiences; they are more open to exploring new and complicated learning tasks, and practice more creative and critical thinking in such ambiguous learning experiences. Related to the current study's scope, students who tolerate ambiguity show a greater likelihood to achieve long-term goals, adopting future orientation, practicing self-control, and delaying impulsive gratifying of momentary rewards. Yang et al. (2021) demonstrated that self-control mediated the relationship between the lack of AT and future time perspective among college students. Tangney et al. (2004) articulated that individuals who show higher self-discipline are better at tolerating ambiguity and successfully overcoming unproductive affective responses (e.g., anxiety and distress). A recent neuroimaging study has shown a significant positive correlation between AT and GMV in DLPFC (i.e., the brain area that relates to the executive function of evaluating choices and making decisions during cognitive control processing), which necessitates practicing self-control (Tong et al., 2015).

Various studies have indicated that AT is correlated with novelty (Weissenstein et al., 2018), higher academic motivation (Tapanes et al., 2009), positive feelings and life satisfaction (Bardi et al., 2009), students' engagement (Yu et al., 2022), and intellectual curiosity and assertiveness (Jack & Smillie,

2019) among university students. Another study revealed that students with moderate levels of AT had higher reading comprehension scores compared to students with high and low AT, suggesting the presence of a relationship between AT and learning strategies (El-Koumy, 2003).

Conversely, lack of AT is associated with higher levels of anxiety when receiving unstructured learning material (DeRoma et al., 2003), less motivation to participate in online learning (Tapanes et al., 2009), negative personality traits (e.g., lower mental flexibility, higher conformity, and prejudice; Tatzel, 1980), higher obsessive-compulsive response (Tolin et al., 2003), direct effects on negative emotions and anxiety as well as indirect effects on life satisfaction and positive emotions that are mediated by challenge and threat appraisals (Bardi et al., 2009).

3. Study Aim

The current study sought to adopt and evaluate the factorial structure and reliability of the BSCS scale among Arab university students by implementing EFA and CFA. Furthermore, it aimed to investigate the construct validity by estimating the association between self-control and ambiguity tolerance. Therefore, this research sought to answer the following three questions:

1. What are the psychometric properties (i.e., the exploratory factorial solution and reliability coefficient) of BSCS among Arab university students?

2. Can the estimated factorial structure estimated in question 1 be validated among a different sample of university students?

3. Is there supporting evidence of BSCS's construct validity?

4. Method

4.1. Participants

University students were invited to participate online in the study via emails and social media posts after Institutional Review Board's (IRB) approval, particularly from two countries (i.e., Oman and Egypt). A sample of 525 university students was obtained. There were 133 males (25.3%) and 392 females (74.7%). Considering the country, 28% of the students were Omani ($n = 148$) and 72% of students were Egyptian ($n = 377$). The mean age of the sample was 22.64 ($SD = 4.89$). Many students studied in scientific colleges ($n = 372$, 70.9%) and remained in art/humanities colleges ($n = 153$, 29.1%). Related to study level, 78% of students were undergraduates ($n = 411$) and 13% were graduates ($n = 114$).

4.2. Measures

The data was collected during the academic year of 2021/2022 using an online questionnaire, which consists of: (1) Demographic information, (2) Brief Self-Control Scale (BSCS; Tangney et al., 2004), and (3) Short Multiple Stimulus Types Ambiguity Tolerance (MSTAT-II; McLain, 2009). In the first section, several demographic variables were obtained, including gender, country, college, and study level.

The main scale in the second section, the BSCS (Tangney et al., 2004), has 13 items reflecting the overall capability of self-discipline. Nine items are negatively coded (i.e., 2, 3, 4, 5, 7, 9, 10, 12, 13). Examples of items include: "People would say that I have iron self-discipline" and "I am good at resisting temptation." All items were rated on a 5-point scale, which ranges from "Strongly Disagree" (Coded 1) to "Strongly Agree" (Coded 5). In the current paper, the scale had good internal consistency reliability ($\alpha = .79$), which is consistent with prior studies (i.e., .83 and .80; Fung et al., 2020; Tangney et al., 2004).

The MSTAT-II (McLain, 2009) in the third section is a 13-item scale that assesses ambiguity tolerance toward several stimuli including ambiguous stimuli in general, novel stimuli, uncertain stimuli, complex stimuli, and insoluble stimuli. Like BSCS, all items were rated on a 5-point scale. "I don't tolerate ambiguous situations very well" is an example of the MSTAT-II item. The Cronbach's α of the scale was .70, implying an acceptable reliability coefficient, which was to some extent similar to the reliability coefficient presented by (McLain, 2009).

4.3. Data Analysis

THE dataset was inspected for missing data, normality, and outliers using SPSS Version 24.0 (Tabachnick & Fidell, 2007). The clean data was randomly split into two data sets. The first dataset ($n = 200$) was analyzed using EFA. In particular, principal axis factoring (PAF) was used. Costello and Osborne (2005) recommend the use of an oblique rotation when there are high inter-correlation coefficients (i.e., $r > .32$) between dimensions. In contrast, when the inter-correlation coefficients between dimensions are smaller than .32, Varimax rotation is implemented.

Several assumptions were evaluated (i.e., multicollinearity, sampling adequacy, existence of identity matrix, and singularity). The multicollinearity is avoided when correlation coefficients are within the acceptable range (i.e., $.08 > r > .03$). In addition, the size of KMO determines the sampling adequacy. That is, "Good to Great" sampling adequacy is obtained when values of KMO are $\geq .80$, fair sample adequacy is inferred when KMO equals .70, and moderate to bad sample adequacy when KMO values equal .60 to .50 (Pett et al., 2003). Furthermore, an identity matrix does not exist when Bartlett's Test is significant (Thompson, 2004). Lastly, singularity is prevented when the determinant is small but greater than zero (i.e., $> .00001$; Tabachnick & Fidell, 2007). Three criteria were investigated to decide the optimal factorial structure, which are: eigenvalues greater than one according to Kaiser's rule, the Parallel Test, and scree plots (Patil et al., 2008). Also, item loadings greater than .40 on the relevant factor are acceptable (Field, 2009). Nevertheless, factor loadings of .32 were adequate too (Costello & Osborne, 2005). A minimum of three items per dimension is advised (Watkins, 2018). The coefficient (Cronbach's) Alpha was calculated to verify the internal consistency reliability. Pearson correlation coefficient between self-control and ambiguity tolerance was obtained to authenticate construct validity.

The second dataset ($n = 325$) was utilized to verify the obtained factorial structure by fitting the CFA model using Mplus (Muthén, & Muthén, 2017). Schumacker and Lomax (2016) summarized several fit indices that should be examined including Chi-Square, Root-Mean-Square-Error of Approximation (RMSEA), Standardized Root-Mean-Residual (SRMR), Comparative Fit Index (CFI), and Tucker-

Lewis Index (TLI). A non-significant χ^2 is suggestive of good model fit. RMSEA and SRMR ≤ 0.05 indicate optimal fit. RMSEA within a range (0.05- 0.08) implies an acceptable fit. The fit is considered marginal when RMSEA values range from 0.08 to 0.10. Models with CFI and TLI ≥ 0.90 and ≥ 0.95 infer acceptable and good fit, respectively.

5. Results

5.1. Study 1, Findings:

Descriptive Statistics and Correlation Matrix-Means, standard deviations, skewness, Kurtosis, outliers ($z \pm 2.58$), and minimum and maximum values were examined, as summarized in Table 1. Findings demonstrated no alarming floor and ceiling effects nor the violation of normality.

Table 1: Descriptive Statistics of the Brief Self-Control Scale Items

Variables	M	SD	Skewness	Kurtosis
1. I am good at resisting temptation	3.52	1.19	-0.59	-0.55
2. I have a hard time breaking bad habits	3.57	1.18	-0.48	-0.65
3. I am lazy	3.68	1.16	-0.52	-0.54
4. I say inappropriate things	4.00	1.12	-0.86	-0.26
5. I do certain things that are bad for me, if they are fun	4.35	.94	-1.47	1.71
6. I refuse things that are bad for me	4.11	1.10	-1.32	1.13
7. I wish I had more self-discipline	2.56	1.34	0.36	-1.08
8. People would say that I have iron self-discipline	3.59	1.05	-0.53	-0.19
9. Pleasure and fun sometimes keep me from getting work done	3.31	1.27	-0.20	-1.01
10. I have trouble concentrating	3.29	1.13	-0.28	-0.59
11. I am able to work effectively toward long-term goals	3.42	1.18	-0.46	-0.61
12. Sometimes I can't stop myself from doing something, even if I know it is wrong	3.61	1.18	-0.53	-0.61
13. I often act without thinking through all the alternatives	3.58	1.21	-0.35	-0.94

Note: The Max = 5.00 and Min = 1.00 for all items.

The results of the preliminary investigation of EFA indicated all assumptions were met. The inter-items relationship coefficients were under .80, implying multicollinearity is prevented, as presented in Table 2. In addition, the sample adequacy was good because KMO test = 0.80 (Pett et al., 2003). Bartlett's Test of Sphericity ($\chi^2[78] = 564.54$, $p < 0.001$) was significant, implying no concern about an identity matrix. The determinant value was 0.05, indicating no issue with singularity.

Table 2: Correlation Matrix of the BSCS Items (N = 13)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	-	0.20**	0.29***	0.23***	0.40***	0.14**	0.07	0.34***	0.27***	0.18**	0.37***	0.20**	0.13*
2		-	0.33***	0.30***	0.30***	-0.01	0.26***	0.06	0.13*	0.27***	0.07	0.39***	0.25***
3			-	0.37***	0.37***	0.05	0.25***	0.30***	0.27***	0.41***	0.34***	0.28***	0.31***
4				-	0.34***	0.03	0.27***	0.22**	0.19**	0.23**	0.44***	0.40***	0.41***
5					-	0.12	0.15*	0.27***	0.33***	0.23**	0.16*	0.48***	0.26***
6						-	-0.16*	0.14*	0.13*	0.09	0.17**	0.07	-0.02
7							-	0.04	0.28***	0.26***	0.02	0.20**	0.19**
8								-	0.21**	0.13*	0.35***	0.15*	0.09
9									-	0.31***	0.15*	0.22**	0.14*
10										-	0.16*	0.26***	0.38***
11											-	0.19**	0.19**
12												-	0.41***
13													-

Note: *p <0.05, **p < 0.01, ***p <0.001.

EFA Finding-At the start, principal axis factoring (PAF) with Direct Oblimin rotation was run to assess the magnitude of association between the extracted dimensions. Inter-correlation coefficients between dimensions were small (i.e., < 0.32), necessitating changing the rotation method from Direct Oblimin to Varimax. Thus, EFA was rerun, specifically PAF with varimax rotation, as advised by Thompson (2004). The findings showed four factors with eigenvalues greater than 1. Nevertheless, the parallel test and scree plot showed greater support as the structure with two factors (see Figure 1). The rotated factor matrix demonstrated no cross-loading of items in the two factors that are above 0.35 (Costello & Osborne, 2005). All items had adequate factor loadings (i.e., > 0.32; Tabachnick & Fidell, 2007).
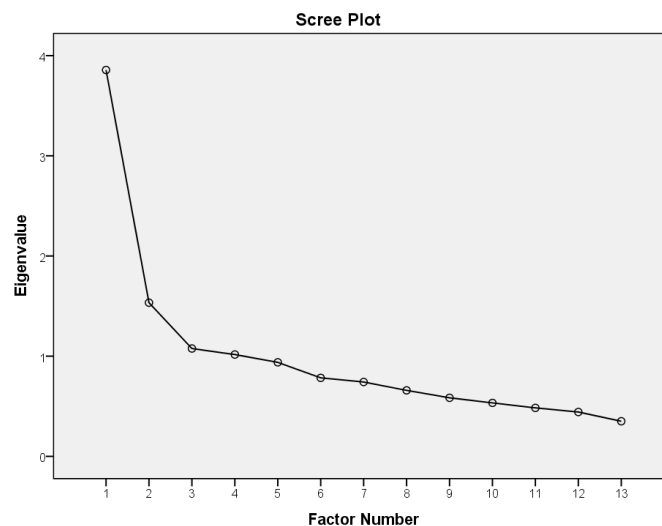
Fig. 1: Scree Plot of Extracted Factors

Factor 1 had nine items, explaining 24.59% of the variance (see Table 3). The items with the highest two loadings are: "I often act without thinking through all the alternatives" and "Sometimes I can't stop myself from doing something, even if I know it is wrong." This factor was named "impulsive behavior" because it describes a set of value behaviors and emotions reflecting poor self-control. Factor 2 had four items, accounting for 6.34% of the variance. This factor was named "self-discipline," reflecting a set of behaviors that students do to demonstrate self-control (e.g., I am good at resisting temptation"). The two factors had high Cronbach Alpha, implying good reliability. On the whole, the author determined that a two-factor structure with a total of 13 items was the finest factorial solution.

Table 3: Exploratory Factor Analysis Results and Factor Loadings with PAF with Varimax Rotation for MSTAT-II Scale

	Items	Factor1: Impulsivity	Factor2: Self-discipline
12	Sometimes I can't stop myself from doing something, even if I know it is wrong	**0.61**	0.17
13	I often act without thinking through all the alternatives	**0.59**	0.07
2	I have a hard time breaking bad habits	**0.56**	0.04
4	I say inappropriate things	**0.53**	-0.05
10	I have trouble concentrating	**0.51**	0.14
3	I am lazy	**0.50**	0.30
7	I wish I had more self-discipline	**0.50**	-0.07
5	I do certain things that are bad for me, if they are fun	**0.46**	0.04
9	Pleasure and fun sometimes keep me from getting work done	**0.32**	0.27
8	People would say that I have iron self-discipline	0.11	**0.56**
11	I am able to work effectively toward long-term goals	0.18	**0.55**
1	I am good at resisting temptation	0.21	**0.54**
6	I refuse things that are bad for me	-0.06	**0.34**
	Cronbach's Alpha	0.78	0.62
	Eigenvalue	3.86	1.53
	Variance explained	24.59%	6.34%

CFA Findings. In the initial step, preliminary investigation of CFA showed a poor model fit (see Table 4.A). The chi-square test was significant. The RMSEA value was 0.09 and SRMR values were $\geq$ 0.05, indicating an improper fit. GFI was relatively acceptable (i.e., $\geq$ 0.90) whereas AGFI was below 0.90, indicating poor fit. These findings entailed modifying the model by adding six error covariance terms, as shown in Figure 2. The modified model showed a better fit (see Table 4). The chi-square test was significant, which commonly occurs due to sample size. However, SRMR was 0.05, illustrating an acceptable fit. Concerning The RMSEA, the value indicated an acceptable fit because RMSEA (0.06) is within the range (0.05-0.08). CFI and TLI implied an acceptable model fit.

Table 4: Confirmatory Factor Analysis Results and Comparison of Standardized Estimates of the Initial and Modified Models

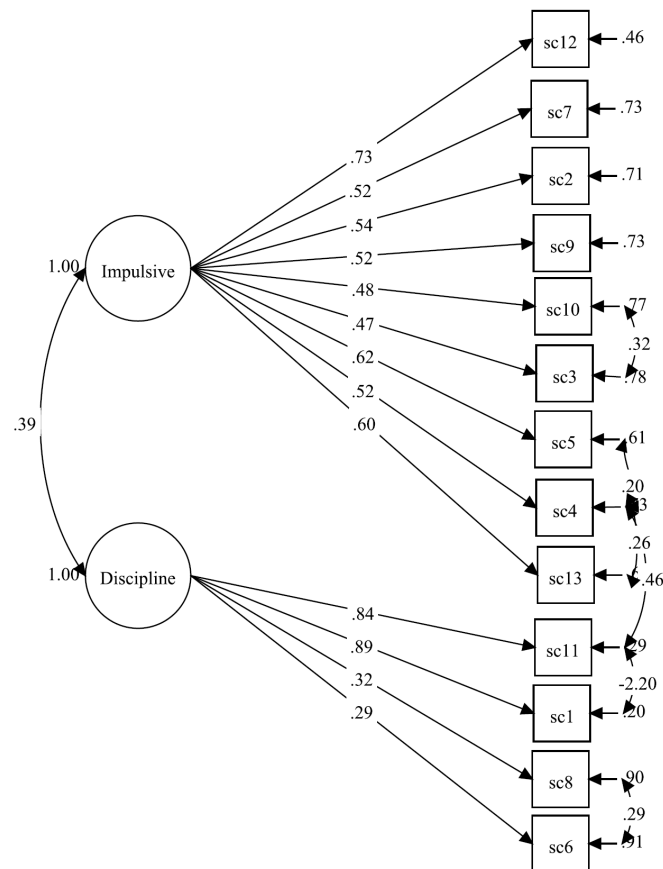| Fit Statistics	Initial Model		Modified Model	
	Factor 1: Impulsivity	Factor 2: Self-discipline	Factor 1: Impulsivity	Factor 2: Self-discipline
Factor loadings				
SC_12	0.71		0.73	
SC_13	0.64		0.60	
SC_2	0.52		0.54	
SC_4	0.60		0.52	
SC_10	0.51		0.48	
SC_3	0.50		0.47	
SC_7	0.50		0.52	
SC_5	0.63		0.62	
SC_9	0.51		0.52	
SC_8		0.59		0.32
SC_11		0.53		0.84
SC_1		0.49		0.89
SC_6		0.49		0.29
Fit Indices				
$\chi^2(df)$	237.61(64)		123.59(58)	
p value	0.00		0.00	
RMSEA	0.09		0.06	
SRMR	0.07		0.05	
CFI	0.82		0.93	
TLI	0.76		0.91	

Fig. 2: Confirmatory Factor Analysis of the Modified Model with Standardized Values

Validity Evidence based on Relations to Other Variables Findings. The newest standards for educational and psychological testing (American Educational Research Association, 2014) stated that "the construct should be related to some other variables, and, as a result, analyses of the relationship of test scores to variables external to the test provide another important source of validity evidence" (p. 16). Underpinning the literature, the present study hypothesized that self-control is positively associated with ambiguity tolerance. Pearson correlation coefficient showed that self-control had a moderate positive relationship with ambiguity tolerance ($r = 0.32$, $p < 0.001$).

6. Discussion

Self-control is one of the affective dispositional qualities that had significant influences on students' academic and personal pathways. The self-control scale, BSCS, is considered the most efficient, the most valid, and the top reliable measure of self-control among university students. BSCS has been originally constructed and validated in the U.S. background and was adopted by manifold cultures (e.g., Turkish, French, Italian, Chinese, and German; Bertrams & Dickhäuser, 2009; Brevers et al., 2017; Fung et al., 2020; Gürdere et al., 2022; Nebioglu et al., 2012). This scale, though, has not been embraced in the Arabic context. In addition, prior psychological measurement studies echoed several concerns related to the inconsistency concerning the BSCS factorial solution in the U.S. context (De Ridder et al., 2011;

Maloney et al., 2012; Manapat et al., 2021; Morean et al., 2014) and other cultures (Nebioglu et al., 2012). Thus, this study had three goals: (1) Adopting BSCS and evaluating its psychometric properties among Arab students using EFA, (2) Validating BSCS's factorial structure by fitting the CFA model, and (3) Investigating the construct validity of BSCS by estimating Pearson Correlation Coefficient between self-control and ambiguity tolerance.

EFA findings found the two-factor structure (i.e., impulsivity and self-discipline) in the Arab sample. Factor 1 has nine items (i.e., Items 2, 3, 4, 5, 7, 9, 10, 12, 13) whereas Factor 2 has four items (i.e., Items 1, 6, 8, 11). This factorial solution is consistent with the structure that was estimated by Ferrari et al. (2009) in the U.S. sample and Nebioglu et al. (2012) in the Turkish sample. The two factors had good reliability. However, impulsivity explained more variance (i.e., 24.59%), whereas self-discipline explained a smaller amount of variability (i.e., 6.34%). The current study's finding echoes the idea of rethinking the unidimensionality of BSCS. In contrast, this factorial solution was inconsistent with several studies in the U.S. samples (Maloney et al., 2012; Morean et al., 2014) and the Chinese sample (Fung et al., 2020). This divergence can be attributed to differences in the scale length. The current study retained and preserved 13 items, aligning with the original scale by Tangney et al. (2004), whereas these studies eliminated three items (De Ridder et al., 2011), five items (Maloney et al., 2012), and six items (Morean et al., 2014).

The findings of the initial CFA displayed poor model fit. Modifying the model by adding several reasonable error covariance terms leads to a good model fit. For instance, several sensible error variances were added between Item 4 (i.e., I say inappropriate things) and two items, which include: Item 13 (i.e., I often act without thinking through all the alternatives), Item 5 (i.e., I do certain things that are bad for me, if they are fun), meaning, students might say inappropriate things because they have not thought carefully about a specific topic or because they perceive it as a funny thing, which increases the likelihood of doing unethical academic behaviors (e.g., cheating and plagiarism; Curtis et al., 2018). In addition, two error variances were added between Item 11 (i.e., I am able to work effectively toward long-term goals) and Item 1 (i.e., I am good at resisting temptation), implying resisting frequent and spontaneous temptations enable students to focus and achieve long-term goals (Milyavskaya et al., 2015). One error variance was inserted between Item 8 (i.e., People would say that I have iron self-discipline) and Item 6 (i.e., I refuse things that are bad for me), which is a reasonable judgment by others when the individual firmly refuses to do inappropriate things. Another error variance was included between Items 3 (i.e., I am lazy) and 10 (i.e., I have trouble concentrating), implying that lazy students are more likely to face academic problems (e.g., difficulty concentrating and more likely to procrastinate; Kumaraswamy, 2013; Ugwuanyi et al., 2020). According to Kline (2010), specifying correlation among error terms (i.e., error covariance) is common, given the nature of measured outcomes in the social sciences, particularly when there are substantive and justifiable reasons for the error covariance. Sensible sources of such covariance that aim to explain construct-irrelevant variance include item format, item wording, item order, and systematically different item response formats. Failing to specify error covariance might result in biased model estimates (Cole et al., 2007).

Validity was substantiated by a significant positive moderate correlation between self-control and

ambiguity tolerance ($r = 0.32$, $p < .001$). Findings are coherent with prior studies (e.g., Tangney et al., 2004); Tong et al., 2015; Yang et al., 2021) results, which boost the construct validity of BSCS. Given that, students who had higher self-control have lower intolerance to uncertainty and are more eager to pursue future orientation and long-term goals that are surrounded by higher levels of ambiguity (Yang et al., 2021). In addition, disciplined students are better at overriding obsessive-compulsive responses (Tolin et al., 2003) and excessive emotional responses (Tangney et al., 2004). They are more likely to use the brain area that relates to the executive function of evaluating choices and making decisions during cognitive control processing (i.e., GMV) when they are faced with ambiguous situations (Tong et al., 2015).

7. Implications and Limitations

The present study revealed several theoretically valuable results. First, it validated BSCS to the Arabic culture, which makes it a useful tool that can be administered in all countries in the Middle East. It demonstrated that BSCS has a decent factorial structure. The Arabic BSCS can be a baseline for forthcoming studies that can widen the investigation of the influence of self-control on academic and personal outcomes among students in higher education institutions. The present study, also, confirms alarming indicators related to the BSCS unidimensionality, encouraging future psychometric and educational studies to reconsider the two-factor solution in their analyses. As well, the present study findings have applied implications. Establishing a brief version of the self-control scale (i.e., BSCS) that is sound and solid psychometrically would be a beneficial contribution to instructors' toolbox, facilitating the assessment of students' traits that may result in a better learning environment and overriding the overwhelming workload. It decreases any concerns that preclude students from answering the scale because of scale length and preserves the respondents' cognitive resources and time (Burisch, 1984; Arquero & McLain, 2010). Acquisition of vibrant comprehension of the influences of self-control would empower students' performance and permit instructors to identify fruitful interventions.

Nevertheless, the present study has a couple of limitations. The four levels of measurement invariance (configural, metric, scalar, and strict invariance) were not tested in the current study. The generalizability of this study's findings is limited because the sample consisted of traditional college students from public universities in Oman and Egypt only. Therefore, this study recommends: (1) Testing measurement invariance across several demographic variables (i.e., gender, school type, colleges, and countries), (2) Gathering more samples, covering public and private universities, and (3) Conducting experimental studies assessing self-control on students' learning.

In conclusion, the BSCS scale is a valid and reliable scale to measure two dimensions of self-control (i.e., impulsivity and self-discipline) in the Arabic culture, mainly university students. Although this study raised a red flag about the unidimensionality of BSCS, aligning with several prior studies. Additional psychometric investigation of the scale, particularly measurement invariance, is demanded.

References:

Alhadabi, A., & Karpinski, A. (2020). Grit, self-efficacy, achievement orientation goals, and academic performance in university students. *International Journal of Adolescence and Youth, 25*(1), 519–535. https://doi.org/10.1080/02673843.2019.1679202

Alrabie, F. & Eatia, R. (2016). The relationship of emotional stability with self-control among Yarmouk University students. *Educational Science, 43*(3), 1117-1136.

American Educational Research Association (2014). *Standards for educational and psychological testing*. https://www.testingstandards.net/uploads/7/6/6/4/76643089/standards_2014edition.pdf

Arquero, J., & McLain, D. (2010). Preliminary validation of the Spanish version of the multiple stimulus types ambiguity tolerance scale (MSTAT-II). *The Spanish Journal of Psychology, 13*(1), 476-484. https://doi.org/10.1017/S1138741600004029

Bertrams, A., & Dickhäuser, O. (2009). Messung dispositioneller Selbstkontroll-Kapazität. *Diagnostica 55*, 2–10. https://doi.org/10.1026/0012-1924.55.1.2

Brandon, J., Oescher, J., & Loftin, J. (1990). The self-control questionnaire: An assessment. *Health Values, 14*, 3–9.

Brevers, D. et al. (2017). Examination of the validity and reliability of the French version of the Brief Self-Control Scale. *Canadian Journal of Behavioural Science*, *49*(4), 243–250. https://doi.org/10.1037/cbs0000086

Burisch, M. (1984). You don't always get what you pay for: Measuring depression with short and simple versus long and sophisticated scales. *Journal of Research in Personality, 18*(1), 81-98. https://doi.org/10.1016/0092-6566(84)90040-0

Carver, C. (2005). Impulse and constraint: Perspectives from personality psychology, convergence with theory in other areas, and potential for integration. *Personality and Social Psychology Review, 9*, 312–333. https://doi.org/10.1207/s15327957pspr0904_2

Cole, D., Ciesla, J., & Steiger, J. (2007). The insidious effects of failing to include design-driven correlated residuals in latent-variable covariance structure analysis. *Psychological Methods, 12*(4), 381-398. https://doi.org/10.1037/1082-989X.12.4.381

Costello, A., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1-9. https://doi.org/10.7275/jyj1-4868

Crocker, L., & Algina, J. (2008). *Introduction to classical & modern test theory* (2nd ed.). Cengage Learning.

Curtis, G. et al. (2018). Self-control, injunctive norms, and descriptive norms predict engagement in plagiarism in a theory of planned behavior model. *Journal of Academic Ethics, 16*(3), 225–239. https://doi.org/10.1007/s10805-018-9309-2

de Ridder, D. et al. (2012). Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. *Personality and Social Psychology Review, 16*(1), 76–99. https://doi.org/10.1177/1088868311418749

DeRoma, V., Martin, K., & Kessler, M. (2003). The relationship between tolerance for ambiguity and need for course structure. *Journal of Instructional Psychology, 30*(2), 104-109.

Duckworth, A. et al. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087-1101. https://doi.org/10.1037/0022-3514.92.6.1087

Duckworth, A. et al. (2019). Self-control and academic achievement. Annual Review of Psychology, *70*, 373–399. https://doi.org/10.1146/annurev-psych-010418-103230

Duckworth, A., & Kern, M. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality, 45*(3), 259–268. https://doi.org/10.1016/j.jrp.2011.02.004

Eysenck, S., Easton, G., & Pearson, P. (1984). Age norms for impulsiveness, venturesomeness and empathy in children. *Personality and Individual Differences, 5*(3) 315- 321.

Fabrigar, L., & Wegener, D. (2012). *Exploratory factor analysis*. Oxford University Press.

Fagen, S., Long, N., & Stevens, D. (1975). *Teaching children self-control: Preventing emotional and learning problems in the elementary school*. Charles E. Merrill.

Ferrari, J., Stevens, E., & Jason, L. (2009). The relationship of self-control and abstinence maintenance: An exploratory analysis of self-regulation. *Journal of Groups in Addiction & Recovery*, *4*(1/2), 32–41. https://doi.org/10.1080/15560350802712371

Friese, M. et al. (2018). Is ego depletion real? An analysis of arguments. *Personality and Social Psychology Review*, *23*(2), 107-131. https://doi.org/10.1177/1088868318762183

Fung, S., Kong, C., & Huang, Q. (2020). Evaluating the dimensionality and psychometric properties of the brief self-control scale amongst Chinese university students. *Frontiers in Psychology, 10*, 2903. https://doi.org/10.3389/fpsyg.2019.02903

Gottfredson, M. (1990). *A General Theory of Crime*. Stanford University Press.

Grasmick, H. et al. (1993). Testing the core empirical implications of Gottfredson and Hirschi's general theory of crime. *Journal of Research in Crime and Delinquency, 30*(1), 5–29. https://doi.org/10.1177/0022427893030001002

Gürdere, C. et al. (2022). The Italian validation of the brief self-control scale: A preliminary analysis. *Journal of Evidence - Based Psychotherapies, 22*(2), 103-114. https://doi.org/10.24193/jebp.2022.2.15

Hofmann, W. et al. (2014). Yes, but are they happy? Effects of trait self-control on affect well-being and life satisfaction. *Journal of Personality, 82*(4), 265– 277. https://doi.org/10.1111/jopy.1205

Kendall, P., & Wilcox, L. (1979). Self-control in children: Development of a rating scale. *Journal of Consulting and Clinical Psychology, 47*(6), 1020–1029. https://doi.org/10.1037/0022-006X.47.6.1020

Kline, R. (2010). *Principles and practice of structural equation modeling* (3rd ed.). Guilford Press.

Kumaraswamy, N. (2013). Academic stress, anxiety, and depression among college students-A brief review. *International Review of Social Sciences and Humanities, 5*(1), 135–143.

Maloney, P., Grawitch, M., & Barber, L. (2012). The multifactor structure of the Brief Self-Control Scale: Discriminant validity of restraint and impulsivity. *Journal of Research in Personality, 46*, 111–115. https://doi.org/10.1016/j.jrp.2011.10.001

Manapat, P. et al. (2021). A psychometric analysis of the brief self-control scale. *Assessment*, *28*(2), 395–412. https://doi.org/10.1177/1073191119890021

Mclain, D. (1993). The Mstat-I: A new measure of an individual's tolerance for ambiguity. *Educational and Psychological Measurement, 53*(1), 183–189. https://doi.org/10.1177/0013164493053001020

McLain, D. (2009). Evidence of the properties of an ambiguity tolerance measure: The multiple stimulus types

ambiguity tolerance scale–II (MSTAT–II). *Psychological Reports, 105*(3), 975–988. https://doi.org/10.2466/PR0.105.3.975-988

Milyavskaya, M. et al. (2015). Saying "no" to temptation: Want-to motivation improves self-regulation by reducing temptation rather than by increasing self-control. *Journal of Personality and Social Psychology, 109*(4), 677–693. https://doi.org/10.1037/pspp0000045

Milyavskaya, M., & Inzlicht, M. (2018). Attentional and motivational mechanisms of self-control. In D. de Ridder, M. Adriaanse, & K. Fujita (Eds.), *The Routledge international handbook of self-control in health and well-being* (p. 11–23). Routledge/Taylor & Francis Group.

Morean, M. et al. (2014). Psychometrically improved, abbreviated versions of three classic measures of impulsivity and self-control. *Psychological Assessment, 26*(3), 1003–1020. https://doi.org/10.1037/pas0000003

Muthén, L., & Muthén, B. (2017). Mplus: Statistical analysis with latent variables: User's guide. Authors.

Nakhostin-Ansari, A., Maghbouli, N., & Shayestefar, M. (2021). Ambiguity tolerance among medical students and its relationship with personality and participation in the mentoring program: A cross-sectional study. *Annals of Medicine and Surgery, 62*, 425–430. https://doi.org/10.1016/j.amsu.2021.01.068

Nebioglu, M., Konuk, N., Akbaba, S., & Eroglu, Y. (2012). The investigation of validity and reliability of the Turkish version of the brief self-control scale. *Klinik Psikofarmakoloji Bülteni-Bulletin of Clinical Psychopharmacology, 22*(4), 340–351. https://doi.org/10.5455/bcp.20120911042732

Opelt, F., & Schwinger, M. (2020). Relationships between narrow personality traits and self-regulated learning strategies: Exploring the role of mindfulness, contingent self-esteem, and self-control. *AERA Open, 6*(3), 1–15. https://doi.org/10.1177/2332858420949499

Osborne, J. (2015). What is rotating in Exploratory Factor Analysis? *Practical Assessment, Research & Evaluation, 20*(2), 1-7. https://doi.org/10.7275/hb2g-m060

Patil, V., Singh, S., Mishra, S., & Donovan, D. (2008). Efficient theory development and factor retention criteria: Abandon the 'eigenvalue greater than one' criterion. *Journal of Business Research, 61*(2), 162-170. https://doi.org/10.1016/j.jbusres.2007.05.008

Pett, M., Lackey, N., & Sullivan, J. (2003). *Making sense of factor analysis: The use of factor analysis for instrument development in health care research*. Sage Publications, Inc.

Ramos Salazar, L., & Meador, A. (2023). College students' grit, autonomous learning, and well-being: Self-control as a mediator. *Psychology in the Schools, 60*, 53– 77. https://doi.org/10.1002/pits.22760

Rosenbaum, M. (1980). A schedule for assessing self-control behaviors: Preliminary findings. *Behavior Therapy, 11*(1), 109–121. https://doi.org/10.1016/S0005-7894(80)80040-2

Schumacker, R., & Lomax, R. (2016). *A beginner's guide to structural equation modeling* (4th ed.). Taylor & Francis Groups.

Stadler, M. et al. (2016). Choosing between what you want now and what you want most: self-control explains academic achievement beyond cognitive ability. *Personality and Individual Differences, 94*, 168–172. https://doi.org/10.1016/j.paid.2016.01.029

Tabachnick, B., & Fidell, L. (2007). *Using multivariate statistics* (5th ed.). Allyn & Bacon.

Taha, S. et al. (2014). Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic. *British Journal of Health Psychology, 19*(3), 592–605. https://doi.org/10.1111/bjhp.12058

Tangney, J., Baumister, R., & Boone, A. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*(2), 271–324. https://doi.org/10.1111/j.0022-3506.2004.00263.x

Tapanes, M., Smith, G., & White, J. (2009). Cultural diversity in online learning: A study of the perceived effects of dissonance in levels of individualism/collectivism and tolerance of ambiguity. *Internet and Higher Education, 12*(1), 26-34. https://doi.org/10.1016/j.iheduc.2008.12.001

Tatzel, M. (1980). Tolerance for ambiguity in adult college students. *Psychological Reports, 47*(2), 377–378. https://doi.org/10.2466/pr0.1980.47.2.377

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications.* American Psychological Association

Tong, D. et al. (2015). Association between regional white and gray matter volume and ambiguity tolerance: Evidence from voxel-based morphometry. *Psychophysiology, 52*(8), 983–989. https://doi.org/10.1111/psyp.12433

Ugwuanyi, C. et al. (2020). Efficacy of cognitive behaviour therapy on academic procrastination behaviours among students enrolled in physics, chemistry and mathematics education. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 38*(4), 522–539. https://doi.org/10.1007/s10942-020-00350-7

Watkins, M. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology, 44*(3), 219–246. https://doi.org/10.1177/0095798418771807

Werner, K., & Milyavskaya, M. (2019). Motivation and self-regulation: The role of want-to motivation in the processes underlying self-regulation and self-control. *Social and Personality Psychology Compass, 13*(1), 1–14. https://doi.org/10.1111/spc3.12425