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Cross-cultural comparative examination of the Academic Motivation Scale using exploratory structural equation modeling

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Highlights

- The factor of the Academic Motivation Scale (AMS) was assessed.
- Hungarian and French high school and university students participated.
- Exploratory structural equation modeling (ESEM) supported the 7-factor model.
- The AMS was reliable based on three different indices.
- Gender invariance was high, age- and language invariances were low.

Abstract

The goal of the present research was to the cross-cultural examination of the factor structure of the Academic Motivation Scale (AMS) and its extensive invariance testing with exploratory structural equation modeling (ESEM). Three comprehensive samples were collected: a Hungarian high school (N = 1139), a Hungarian university (N = 1163) samples, and a French university (N = 1009) sample. Compared to confirmatory factor analysis, ESEM demonstrated better model fit and less inflated inter-factor correlations in all three samples. Among Hungarian high school students, intrinsic dimensions were less differentiated. Gender invariance was confirmed on the level of latent means. As for age- and language invariance, only configural invariance was supported. The AMS showed mostly adequate reliability and good temporal stability. Based on the present and prior studies, ESEM appears to be the most adequate analytic strategy for the deeper understanding of academic motivations measured by the AMS.

Keywords: academic motivation scale (AMS); confirmatory factor analysis (CFA); exploratory structural equation modeling (ESEM); measurement invariance; temporal stability

1. Introduction

According to the self-determination theory (SDT) of Deci and Ryan (1985, 2000), human behavior is driven by motivations that one wants to satisfy. Based on the levels of self-determination, three main forms of human motivation can be separated. First, *intrinsic motivation* (IM) suggests that one engages in a behavior or activity for internal reasons (enjoyment, pleasure). Three forms of IM can be distinguished (Vallerand et al., 1992): intrinsic motivation to know (IMTK) refers to gaining new knowledge about a certain topic. Intrinsic motivation toward accomplishment (IMTA) is related to the aim of overcoming goals or surpassing oneself. The third type of intrinsic motivation is connected to experiencing stimulation (IMES) where one is rewarded by the experienced subjective sensations of the activity (i.e., joy or arousal).

Second, *extrinsic motivation* (EM) manifests when an individual engages in an activity for reasons that are external. Deci and Ryan (2000) distinguished four forms of extrinsic motivation. Extrinsic motivation of external regulation (EMER) is generated by avoiding punishment or obtaining reward following the behavior. Extrinsic motivation of introjected regulation (EMIJ) characterizes those stances when the activity is internalized to a certain degree and one performs an activity due to internal pressures (e.g., anxiety). Extrinsic motivation of identified regulation (EMID) occurs when one identifies with the reasons behind the activity which becomes important for the individual. Extrinsic motivation of integrated regulation (EMIN) as the most self-determined form of EM supposes that the motivational drives are the most inner, but they still have external sources that are separate from the activity.

The third element is *amotivation* (AM). It manifests when one does not find the connection between his/her behavior and the experienced consequences. Therefore, the state of amotivation lacks any forms of intrinsic or extrinsic motivations and also lacks the intention for any kind of action related to a certain area.

1.1. The factorial structure of the AMS

One of the most frequently used instruments to measure different motivations of students is the AMS. The original version was created by Vallerand, Blais, Brière and Pelletier (1989) and was adapted to English (Vallerand et al. 1992, 1993). It includes seven dimensions[1]: three forms of intrinsic motivation, three forms of extrinsic motivation and an amotivation subscale. Regarding the psychometric properties of the AMS, previous results are mostly consistent. The originally hypothesized seven-factor structure was confirmed in the original (Vallerand et al., 1989) and the adaptation studies (Vallerand et al., 1992, 1993) as well. Moreover, this seven-factor solution has been supported in most of the adaptations (for more details, see Supplementary Material 1).

Although the results of previous validation studies appear to be mostly consistent, several concerns can be raised. First, regarding the factor structure, not all studies demonstrated adequate goodness-of-fit. Furthermore, in some cases, acceptable model fit was achieved by using ad hoc correlated uniquenesses which—as stated by Marsh et al. (2014)—could lead to

[1] The AMS does not measure the integrated regulation aspect of extrinsic motivation as it has been shown to manifest in later phases of psychological development (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007).

dubious results. Finally, correlations were noticeably high between adjacent motivational factors (i.e., three forms of intrinsic motivation) that could undercut the discriminant validity of the scale and question the tripartite model of intrinsic motivation (Carbonneau, Vallerand, & Lafrenière, 2012).

1.2. A New Approach for Scale Assessment: exploratory structural equation modeling

The factorial structure of the AMS was mainly assessed with confirmatory factor analysis (CFA) where items are restricted to load on their respective factors without allowing cross-loadings (Marsh et al., 2009). This method could result in (1) low goodness-of-fit indices and (2) inflated factor correlations, limiting the discriminant validity of the instrument (e.g., Marsh et al., 2014). ESEM has been suggested as a new flexible method, combining EFA and CFA methods as it integrates the less restrictive aspects of EFA (e.g., cross-loadings are possible) and the statistical advantages of CFA (e.g., invariance testing). ESEM showed better model fit and reduced inter-factor correlations than CFA, resulting in a more exact estimates of correlation values (Morin, Marsh, & Nagengast, 2013). Therefore, ESEM is reasonable as cross-loadings between the adjacent factors can be expected.

1.3. Measurement invariance for group differences

An important psychometric aspect of instruments such the AMS is whether it can be used to compare individuals from different subgroups (e.g., males vs. females, younger vs. older individuals) or over time. If the results can be replicated across-multiple subgroup, then the comparisons are meaningful and could be generalized. This can be done by performing measurement invariance testing (Meredith, 1993; Vanderberg & Lance, 2000).

Several levels of invariance can be differentiated: configural invariance tests whether the respondents of two subgroups apply the same conceptual framework (the same factor structure) without constraining any parameters. Weak (metric) invariance tests the factor loadings and supposes that the same construct is measured across the subgroups. Strong (scalar) invariance tests the item intercepts and supposes that individuals have comparable scores on the items representing a construct (e.g., different types of motivations) regardless of subgroup membership. Strict (residual) invariance tests item uniquenesses and suggests that the measurement errors are similar in the different subgroups. Additionally, latent variances-covariances and latent means can also be investigated. Multiple invariance tests were carried out on AMS by comparing groups based on gender, types of high school, academic years, or the abilities of students (e.g., Alivernini & Lucidi, 2008; Caleon et al., 2015; Guay et al., 2015; Smith et al., 2010). The present study intends to test the replicability of these results and include further subgroups in the analyses as well by comparing Eastern European and Western European contexts.

Several differences warrant the testing of invariance in different nations. First, France can be considered as a post-materialist country with an emphasis being put on individual values such as self-growth or self-fulfillment. On the other hand, Hungary can be considered as a materialist country where materialist values are still more prevalent with emphasis on financial and material gain (Inglehart, 1977). These cultural differences could also reflect in the motivations of students with post-materialist values being related to intrinsic motivation, while materialist values to extrinsic motivation.

1.4. The present study

The first goal of the present study was the cross-cultural examination of the factor structure and construct validity of the Academic Motivation Scale on Hungarian and French samples with different age groups. The second goal was to extensively test the invariance across different subgroups in order to investigate the comparability and the generalizability of the scale.

2. Materials and Methods

2.1. Participants

Three samples were used in the current research. Sample 1 consisted of 1139 Hungarian high school students (629 females) who were aged between 14 and 20 years ($M_{Sample1}$=16.75, $SD_{Sample1}$=1.22). Sample 2 consisted of 1163 Hungarian college and university students (676 females), aged between 18 and 59 years ($M_{Sample2}$=22.26, $SD_{Sample2}$=3.85). Sample 3 consisted of 1009 French college and university students (586 females), aged between 18 and 45 years ($M_{Sample3}$=19.83, $SD_{Sample3}$=1.99). For assessing temporal stability, a separate sample of 100 Hungarian university students (M_{age}=20.96, SD_{age}=1.89) filled out the questionnaire over a four-week period (similarly to Vallerand et al., 1992).

2.2. Measures

For high school students, the high school version of the AMS was used (Vallerand et al., 1989), whereas the college version was used for the university students (Vallerand et al., 1992, 1993). Students were asked the question of "Why do you go to school/college?", respectively. Three of the factors referred to intrinsic: *IMTK* (four items, e.g., "For the pleasure that I experience in broadening my knowledge about subjects which appeal to me."), *IMTA* (four items, e.g. "For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments."), *IMES* (four items, e.g. "For the pleasure that I experience when I read interesting authors."); another three to extrinsic motivation: *EMID* (four items, e.g. "Because I believe that a few additional years of education will improve my competence as a worker."), *EMIJ* (four items, e.g. "To show myself that I am an intelligent person."), *EMER* (four items, e.g. "In order to have a better salary later on."), and one measured *AM* (four items, e.g. "Honestly, I don't know; I really feel that I am wasting my time in school."). They responded on a seven-point Likert scale (1=doesn't correspond at all; 7=corresponds exactly). Both versions of the AMS were translated to Hungarian and back translated by following the protocol of Beaton, Bombardier, Guillemin and Ferraz (2000).

2.3. Procedure

The study was conducted in accordance with the Declaration of Helsinki and with the approval of the Institutional Review Board of the related university. Students were informed about the content of the questionnaire and volunteered for participation. In the case of Sample 1, the schools and parents were informed about the topic of the research through an opt-out passive consent. Furthermore, students were assured of their anonymity and that teachers would not be informed about their responses. The questionnaires were filled out during classes. In Sample 2, questionnaires were filled out online. In Sample 3, data was collected for four years (2010-2014) during lectures.

2.4. Statistical analyses

Statistical analyses were performed with SPSS 22 and Mplus 7.3 (Muthén & Muthén, 1998-2015). As for structural analyses, maximum-likelihood estimation was used with the oblique geomin rotation with an epsilon (ε) value of .5 as recommended by Morin et al. (2013). Analyses were performed in multiple phases based on Marsh, Liem, Martin, Morin, and Nagengast (2011): first, CFA and ESEM solutions were examined and compared in all samples. In CFA, all items were set to load on their respective factor, while cross-loadings were set to be zero. In ESEM, cross-loadings were allowed. Profile similarity index (PSI) was also calculated, allowing the comparison of the factor loadings throughout ESEM and CFA (Marsh et al., 2010).

Second, measurement invariance was tested on the final models (Meredith, 1993; Vanderberg & Lance, 2000) across meaningful subgroups: gender (male vs. female), age (Hungarian high school vs. Hungarian university students), and language (French university students vs. Hungarian university students). After the identification of the baseline models, the following sequence was applied from the least restrictive to the most restrictive one: configural invariance, weak invariance, strong invariance, strict invariance, invariance of the variance-covariance matrix, and latent mean invariance.

In the assessment of the models, apart from the chi-square test, several indices of goodness of fit were observed (Brown, 2015) with different cut-off values (Brown, 2015; Hu & Bentler, 1999): the Comparative Fit Index (CFI; ≥.95 good, ≥.90 acceptable), the Tucker–Lewis index (TLI; ≥.95 good, ≥.90 acceptable), the Root-Mean-Square Error of Approximation (RMSEA; ≤.06 good, ≤.08 acceptable) with its 90% confidence interval and the test of close fit (CFit; ≥.10 good, ≥.05 acceptable). As for measurement invariance, relative changes in the fit indices were observed (Chen, 2007; Cheung & Rensvold, 2002): ΔCFI≤.010; ΔTLI≤.010; ΔRMSEA≤.015.

Concerning internal consistency, Cronbach's alphas (Nunnally, 1978) were taken into account (.70 is acceptable, .80 is good). Due to the its potentially decreased appropriateness (e.g., Sijtsma, 2009), two additional indices were calculated. First, composite reliability (CR) which may better represent the construct as it takes into account the factor loadings with their respective measurement errors. It was computed based on the formula of Raykov (1997) and it can be considered acceptable above .60 and good above .70 (Bagozzi & Yi, 1988). Second, factor determinacy (FD) which describes the correlation between the true and the estimated factor scores, ranging from 0 (low reliability) to 1 (high reliability) (Muthén & Muthén 1998-2015).

3. Results

3.1. Structural analysis

Goodness-of-fit results can be seen in Table 1, showing that the CFA models were suboptimal in all samples (CFIs were around .90, TLIs were below .90). Although RMSEAs were near .06, their test of close fits were still significant, indicating unsatisfactory fit for all samples. Standardized parameter estimates revealed that all factors were well-defined with substantial main loadings (overall λ=.45-.90, *M*=.74). However, inter-factor correlations were inflated (overall *r*=|.01|-|.93|, *M*=.43), specifically between the adjacent factors, calling their discriminant validity into question.

Table 1

Goodness-of-Fit Statistics and Information Criteria for the Estimated Models on the Academic Motivation Scale

Model	χ^2 (df)	CFI	TLI	RMSEA	90% CI	CFit	Comparison	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	ΔRMSEA
M1a. Sample 1 – CFA	2058.343* (329)	.902	.887	.068	.065-.071	.000	—	—	—	—	—
M1b. Sample 1 – ESEM	**667.796* (203)**	**.974**	**.951**	**.045**	**.041-.049**	**.988**	—	—	—	—	—
M2a. Sample 2 – CFA	1935.877* (329)	.910	.896	.065	.062-.068	.000	—	—	—	—	—
M2b. Sample 2 – ESEM	**717.772* (203)**	**.971**	**.946**	**.047**	**.043-.050**	**.927**	—	—	—	—	—
M3a. Sample 3 – CFA	1677.086* (329)	.905	.891	.064	.061-.067	.000	—	—	—	—	—
M3b. Sample 3 – ESEM	**654.073* (203)**	**.968**	**.941**	**.047**	**.043-.051**	**.893**	—	—	—	—	—
Gender invariance											
MGa. Male	812.497* (203)	.971	.945	.046	.043-.049	.977	—	—	—	—	—
MGb. Female	1039.721* (203)	.968	.941	.047	.044-.050	.973	—	—	—	—	—
MG1. Configural	1852.218* (406)	.969	.943	.046	.044-.049	.997	—	—	—	—	—
MG2. Weak (loadings)	2133.624* (553)	.966	.954	.042	.040-.043	1.000	MG2-MG1	281.406 (147)	-.003	.011	-.004
MG3. Strong (loadings, thresholds)	2204.750* (574)	.965	.954	.041	.040-.043	1.000	MG3-MG2	71.126 (21)	-.001	.000	-.001
MG4. Strict (loadings, thresholds, uniquenesses)	2383.278* (602)	.962	.952	.042	.041-.044	1.000	MG4-MG3	178.528 (28)	-.003	-.002	.001
MG5. Latent variance-covariance	2606.360* (630)	.958	.949	.044	.042-.045	1.000	MG5-MG4	223.082 (28)	-.004	-.003	.002
MG6. Latent means	**2809.452* (637)**	**.954**	**.945**	**.045**	**.044-.047**	**1.000**	**MG6-MG5**	**203.092 (7)**	**-.004**	**-.004**	**.001**
Age invariance											
MAa. Hungarian high school	667.796* (203)	.974	.951	.045	.041-.049	.988	—	—	—	—	—
MAb. Hungarian university	717.772* (203)	.971	.946	.047	.043-.050	.927	—	—	—	—	—
MA1. Configural	**1385.568* (406)**	**.972**	**.948**	**.046**	**.046-.048**	**.996**	**—**	**—**	**—**	**—**	**—**
MA2. Weak (loadings)	2082.574* (553)	.957	.941	.049	.047-.051	.761	MA2-MA1	697.006 (147)	-.015	-.007	.003
MA3. Strong (loadings, thresholds)	2304.998* (574)	.951	.936	.051	.049-.053	.183	MA3-MA2	222.424 (21)	-.006	-.005	.002
MA4. Strict (loadings, thresholds, uniquenesses)	2867.913* (602)	.936	.920	.047	.055-.059	.000	MA4-MA3	562.915 (28)	-.015	-.016	-.004
MA5. Latent variance-covariance	3093.074* (630)	.930	.917	.058	.056-.060	.000	MA5-MA4	225.161 (28)	-.006	-.003	.011
MA6. Latent means	3700.945* (637)	.913	.897	.065	.063-.067	.000	MA6-MA5	607.871 (7)	-.017	-.020	.007
Language invariance											
MLa. French university	654.073* (203)	.968	.941	.047	.043-.051	.893	—	—	—	—	—

MLb. Hungarian university	717.772* (203)	.971	.946	.047	.043-.050	.927	—	—	—	—	—
ML1. Configural	**1371.845* (406)**	**.970**	**.944**	**.047**	**.044-.050**	**.973**	**—**	**—**	**—**	**—**	**—**
ML2. Weak (loadings)	2094.273* (553)	.952	.934	.051	.048-.053	.315	ML2-ML1	722.428 (147)	-.018	-.010	.004
ML3. Strong (loadings, thresholds)	2592.709* (574)	.937	.917	.057	.055-.059	.000	ML3-ML2	498.436 (21)	-.015	-.017	.006
ML4. Strict (loadings, thresholds, uniquenesses)	2979.814* (602)	.926	.907	.060	.058-.062	.000	ML4-ML3	387.105 (28)	-.011	-.010	.003
ML5. Latent variance-covariance	3332.674* (630)	.915	.899	.063	.061-.065	.000	ML5-ML4	352.860 (28)	-.011	-.008	.003
ML6. Latent means	3929.220* (637)	.897	.878	.069	.067-.071	.000	ML6-ML5	596.546 (7)	-.018	-.021	.006

Note. CFA=confirmatory factor analysis; ESEM=exploratory structural equation modeling; χ^2=Chi-square; df=degrees of freedom; CFI=comparative fit index; TLI=Tucker-Lewis Index; RMSEA=root-mean-square error of approximation; 90% CI=90% confidence interval of the RMSEA; CFit=RMSEA's test of close fit; $\Delta\chi^2$=Chi-square difference test; ΔCFI=change in CFI value compared to the preceding model; ΔTLI=change in the TLI value compared to the preceding model; ΔRMSEA=change in the RMSEA value compared to the preceding model; Bold letters indicate the final models and final levels of invariance that were achieved.; * p<.01.

In contrast, the results of the ESEM analyses revealed improved fit to the data: CFI exceeded .95, TLI was close to or exceeded .95, whereas RMSEA was below .05 and CFit was non-significant in all samples. Inter-factor correlations had similar patterns for all samples in that the estimated correlations in ESEM were much lower than in CFA (overall r =|.00|-|.50|, M=.23). However, other parameter estimates demonstrated differentiated results. In the case of Sample 1 (Supplementary Material 2), although most of the main factor loadings were substantial (λ=.00-.89, M=.52), not all factors were well-defined. The three aspects of intrinsic motivation had high cross-loadings on their adjacent factors, indicating that these dimensions might not be highly differentiable among Hungarian high school students. The three extrinsic dimensions were adequately separate with low to moderate cross-loadings. A relatively low PSI (r=.27) also supported that the seven-factor solutions were not similar in ESEM and CFA. In the case of Sample 2 (Supplementary Material 3), the factors were well-defined by their main loadings (λ=.06-.89, M=.58). While the intrinsic still had moderate cross-loadings, they were better defined than in Sample 1, suggesting that these are more differentiated among Hungarian university students. The PSI was moderate (r=.68), suggesting higher levels of similarity between ESEM and CFA than in Sample 1. In the case of Sample 3 (Supplementary Material 4), the high main loadings (λ=.16-.90, M=.62) and the relatively high PSI (r=.84) demonstrated that the hypothesized dimensions of academic motivations are well-defined and differentiated among French university students.

3.2. Measurement invariance

In the second phase of the analyses, measurement invariance was tested across different subgroups on the final ESEM solution (Table 1). In the case of gender invariance, all models were successfully estimated with the gradually imposed constraints. Although almost all χ^2 test were significant, other fit indices (ΔCFI, ΔTLI, ΔRMSEA) diminished less than the recommended cut-off values, indicating gender invariance on the level of latent means. Regarding age invariance, only configural invariance was achieved. Indeed, when equality constraints were imposed on the factor loadings, ΔCFI exceeded the suggested cut-off values (ΔCFI=-.015). The language invariance results were highly similar; only the configural invariance model was acceptable as both ΔCFI and ΔTLI decreased substantially (ΔCFI=-.018; ΔTLI=-.010). As the factor loadings are not sufficiently invariant, comparisons based on age and language groups might be biased and should be performed with caution.

3.3. Reliability and descriptive statistics

Reliability values and descriptive statistics can be seen in Table 2. All Cronbach alpha and factor determinacy values were adequate in all samples. On the other hand, composite reliability was higher in those cases when the factors were better defined, namely extrinsic dimensions and amotivation. In the Hungarian high school sample, none of the intrinsic dimensions showed acceptable model-based reliability, suggesting that these might not be well-differentiated among them. In the Hungarian university sample, only IMTK and IMTA were less reliable intrinsic factors. In the French university sample, all dimensions had satisfactory reliability. Finally, temporal stability was assessed over a four-week period using a sample of Hungarian university students. The average test-retest correlation was r=.69 (r_{IMTK}=.72;

r_{IMTA}=.68; r_{IMTES}=.70; r_{EMID}=.73; r_{EMIJ}=.77; r_{EMER}=.49; r_{AM}=.71), indicating moderate correlations between the two time-points.

Table 2

Reliability indices and descriptive statistics of the Academic Motivation Scale

Scales	Range	Sample 1 (N=1139)					Sample 2 (N=1163)					Sample 3 (N=1009)				
		α	CR	FD	M	SD	α	CR	FD	M	SD	α	CR	FD	M	SD
1. IMTK	1-7	.84	.37	.88	4.38	1.39	.84	.43	.90	5.08	1.31	.87	.74	.92	5.16	1.17
2. IMTA	1-7	.85	.57	.92	3.86	1.47	.85	.51	.89	4.45	1.48	.83	.63	.89	3.93	1.41
3. IMES	1-7	.75	.35	.89	3.46	1.32	.85	.73	.94	4.05	1.50	.80	.70	.94	3.27	1.45
4. EMID	1-7	.81	.63	.89	5.14	1.29	.75	.62	.88	5.39	1.16	.69	.60	.86	5.73	1.00
5. EMIJ	1-7	.81	.61	.90	4.46	1.46	.83	.76	.94	4.54	1.48	.84	.74	.93	4.54	1.53
6. EMER	1-7	.81	.73	.92	5.63	1.23	.79	.77	.94	5.34	1.27	.82	.79	.95	5.17	1.43
7. AM	1-7	.85	.84	.94	2.07	1.29	.85	.83	.95	1.91	1.25	.85	.82	.93	1.61	1.03

Note. IMTK=IM to know; IMTA=IM towards accomplishment; IMES=IM to experience stimulation; EMID=identified regulation; EMIJ=EM introjected regulation; EMER=EM external regulation; AM=amotivation; α=Cronbach's alpha; CR=composite reliability; FD=factor determinacy; M=mean score; SD=standard deviation.

4. Discussion

The primary goal of the present research was to examine of the factor structure of the AMS with ESEM in an Eastern European context and compare it to a Western European one. Using three comprehensive samples of Hungarian and French high school and university students, the seven-factor ESEM solutions clearly proved to be superior. The scale also demonstrated mostly adequate reliability based on different indices. The secondary goal was to investigate its measurement invariance across meaningful subgroups (e.g., gender, age, and language). High levels of gender invariance were achieved, but only configural invariance was supported for age and language groups.

The present findings contribute to the knowledge about AMS (see Supplementary Material 1) by being the first one to examine it in an Eastern European country. Similarly to Guay et al.'s (2015) recent findings, the seven-factor ESEM solutions represented the data better than the corresponding CFA solutions in all three samples in terms of improved model fit and reduced inter-factor correlations. Their results have been replicated with different samples and cultural backgrounds. Main loadings in ESEM differed from CFA due to the cross-loadings which were higher in the case of adjacent factors (i.e., the three intrinsic dimensions), suggesting potential conceptual overlaps between these dimensions. These relatively high cross-loadings might account for the high inter-factor correlations uncovered in CFA.

In the Hungarian high school sample, the three intrinsic factors were less well-defined due to the high cross-loadings. A potential explanation might be related to age: high school students might not have clearly separated representations of the three intrinsic dimensions that might become more differentiated in a later age, similar to the integrated regulation aspect of extrinsic motivation (Ratelle et al., 2007). This assumption is corroborated by previous validation studies where a five-factor model was identified with high school samples (e.g., Lim & Chapman, 2015). Moreover, Grouzet et al. (2006) also used a high school sample when examining the invariance of the AMS over a course of three years. However, they used a five-factor AMS with only one intrinsic dimension representing the construct. In sum, intrinsic motivation might become more differentiated with age. In the Hungarian and French university samples, cross-loadings were less substantial and in turn factors were better defined. Higher education is autonomy supportive: students are not obligated to be present in all lectures and they can decide what and how they want to study which might increase their intrinsic motivations. This notion might account for the structural differences between younger and older students' representations about academic motivations.

Language invariance testing resulted in configural invariance, indicating that Hungarian and French university students had the same conceptual framework when responding to the items. However, no higher levels of invariance (i.e., weak, strong, strict, latent variance-covariance, and latent means) were achieved, indicating that there might be cultural characteristics that influence one's interpretation of these constructs. While the constructs appear to be similar, the wording of the items can be different across languages which might result in slight differences in the loadings and which could affect language invariance. Due to the low level of language invariance, we cannot compare the mean scores of French and Hungarian students, but these results can support the materialist vs. post-materialist differences of the two countries (Inglehart, 1977). Finally, gender invariance was assessed. Previous studies indicated various levels of gender invariance (e.g., Guay et al., 2015; Smith et al., 2010). Our

results reinforce these and give strong support for the complete invariance of male-female groups on the level of latent mean invariance, further enhancing the cross-gender generalizability of the AMS.

Although the present research has many strengths (such as the diverse samples and the exhaustive statistical analyses), it is not without its limitations. The self-reported cross-sectional nature of the questionnaires needs to be taken into consideration. Also, convergent-, divergent-, and predictive validity of the AMS should be addressed in future studies. It would be fruitful to assess these motivational patterns in every year of high school and university to better understand the transitions between these periods. It would be useful to include postgraduate students in both longitudinal and cross-sectional settings.

5. Conclusion

The present cross-cultural examination demonstrated that ESEM is an adequate procedure for the examination of the multidimensional AMS. The seven-factor solution has been supported in the Hungarian and the French high school and university students. The scale also proved to be reliable. Complete gender invariance was achieved, but age- and language invariance only to certain degree. This research could further be expanded in the future with the inclusion of more countries, resulting in more exhaustive investigations in terms of both methodology and underlying theory.

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Supplementary Materials for:

Cross-cultural comparative examination of the Academic Motivation Scale using exploratory structural equation modeling

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Content:

Introductory notes for Supplementary Material 1

Regarding the psychometric properties of the AMS, previous results are mostly consistent (see table below). The original seven-factor structure was confirmed (Vallerand et al., 1989, 1992, 1993). This solution has been supported in the United States (Akoto, 2014; Cokley, Bernard, Cunningham, & Motoike, 2001; Cokley, 2015; Fairchild, Horst, Finney, & Barron, 2005; Smith, Davy, & Rosenberg, 2010), Ghana (Akoto, 2014), Greece (Barkoukis, Tsorbatzoudis, Grouios, & Sideridis, 2008), France (Blanchard, Vrignaud, Lallemand, & Dosnon, 1997), Singapore (Caleon et al., 2015), Turkey (Can, 2015; Haslofca & Korkmaz, 2015; Karagüven, 2012; Yurt & Bozer, 2015), Malaysia (Chong & Ahmed, 2012), Brazil (Davoglio, Santos, & Lettnin, 2016), Canada (Guay, Morin, Litalien, Valois, & Vallerand, 2015), Spain (Núñez, Martin-Albo, & Navarro, 2005; Núñez, Martin-Albo, & Navarro, & Suárez, 2010), Paraguay (Núñez, Martin-Albo, & Navarro, 2006), Chile (Orsini et al., 2015), Argentina (Stover, de la Iglesia, Boubeta, & Liporace, 2012), and China (Zhang, Li, Li, Li, & Zhang, 2015). Alternatively, a five-factor solution has also been proposed in Italian (Alivernini & Lucidi, 2008) and Singaporean (Lim & Chapman, 2015) samples. In these cases, the three intrinsic aspects usually merged into a single intrinsic dimension and were complemented by the three extrinsic dimensions and the amotivation factor. Likewise, four-factor solutions were also postulated in Germany (Wilkesmann, Fischer, & Virgillito, 2012) and the US (Smith, Davy, & Rosenberg, 2012). The similarity in these two studies is that the general intrinsic and amotivation factors were complemented by only two aspects of extrinsic motivation.

Apart from factor structure, the AMS demonstrated mostly acceptable levels of reliability on various indices (i.e., Cronbach's alpha, Hancock's H index and McDonald's composite reliability). Finally, similar to Vallerand et al. (1992), temporal stability was also assessed in many previous studies (Barkoukis et al., 2008; Can, 2015; Davoglio et al., 2016; Fairchild et al., 2005; Haslofca & Korkmaz, 2015; Lim & Chapman, 2015; Núñez et al., 2005; Núñez et al., 2010; Orsini et al., 2015; Zhang et al., 2015), giving further support for the reliability of the scale.

Supplementary Material 1

Prior validity and reliability characteristics of the Academic Motivation Scale[†]

Authors	Nation	Sample	Analysis	Characteristics	IMTK	IMTA	IMES	EMID	EMIJ	EMER	AM	Σ	CFI	TLI	RMSEA	Final model
Akoto (2014)	USA (university)	N = 267 M_{age} = 24.76	CFA	N of items	4	4	4	4	4	4	4	28	.97	—	.067	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	.85	.85	.84	.77	.86	.71	.77					
	Ghana (university)	N = 262 M_{age} = 27.76	CFA	N of items	4	4	4	4	4	4	4	28	.93	—	.050	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	.65	.61	.66	.60	.77	.65	.69					
Alivernini & Lucidi (2008)[a]	Italy (high school)	N = 603 M_{age} = 16.30	CFA	N of items	4	4	4	4	4			20	.94	.93	.06	5-factor
				Average loadings	.79	.72	.78	.75	.79							
				Cronbach's alpha	.87	.81	.85	.83	.86							
Barkoukis et al. (2008)	Greece (high school)	N = 911 M_{age} = 13.9	CFA	N of items	4	4	4	4	4	4	4	28	.911	.897	.057	7-factor
				Average loadings	.77	.71	.51	.71	.65	.68	.66					
				Cronbach's alpha	.79	.73	.55	.72	.74	.73	.73					
Blanchard et al. (1997)	France (high school)	N = 1540 M_{age} = —	CFA	N of items	4	4	4	4	4	4	4	28	—	.97	.047	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	higher than .77											
Caleon et al. (2015)	Singapore (high school)	N = 1482 M_{age} = —	CFA	N of items	4	4	4	4	4	4	4	28	.918	.906	.062	7-factor
				Average loadings	.76	.72	.70	.71	.73	.69	.69					
				Cronbach's alpha	.85	.80	.80	.79	.82	.77	.78					
Can (2015)[b]	Turkey (university)	N = 797 M_{age} = 20.1	CFA	N of items	4	4	4	4	4	4	4	28	.96	.96	.071	7-factor
				Average loadings	.73	.80	.77	.59	.76	.65	.79					
				Cronbach's alpha	—	—	—	—	—	—	—					
Chong & Ahmed (2012)	Malaysia (university)	N = 1919 M_{age} = —	CFA	N of items	4	4	4	4	4	4	4	28	.92	.909	.055	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	ranged from .71 to .80											
Cokley et al. (2001)	USA (university)	N = 263 M_{age} = 23.45	CFA	N of items	4	4	4	4	4	4	4	28	.90	—	.070	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	.83	.81	.85	.70	.86	.81	.86					
Cokley (2015)[c]	USA (university)	N = 578 M_{age} = 20.64	EFA-CFA	N of items	4	4	4	4	4	4	4	28	.64	.60	.120	7-factor
				Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	.60	.77	.73	.63	.70	.58	.75					
Davoglio et al. (2016)[d]	Brazil (university)	N = 715 M_{age} = 22	EFA-CFA	N of items	4	4	4	4	4	4	4	28	.93	.81	.07	7-factor
				Average loadings	.84	.76	.77	.76	.79	.81	.82					
				Cronbach's alpha	.88	.81	.80	.77	.83	.84	.74					
Fairchild et al. (2005)	USA (university)	N = 1406 M_{age} = 18	CFA	N of items	4	4	4	4	4	4	4	28	.967	—	.055	7-factor
				Average loadings	.78	.83	.78	.68	.77	.78	.77					
				Cronbach's alpha	.86	.90	.86	.77	.85	.85	.85					
Guay et al. (2015)[e]	Canada (university)	N = 1416 M_{age} = —	ESEM	N of items	4	4	4	4	4	4	4	28	.989	.979	.048	7-factor
				Average loadings	.63	.57	.66	.47	.63	.70	.80					

				Cronbach's alpha	—	—	—	—	—	—	—					
	Canada (high school)	N = 4498 M_{age} = 14.97		N of items	4	4	4	4	4	4	4					
				Average loadings	.59	.50	.56	.57	.57	.60	.74	28	.989	.979	.041	
				Cronbach's alpha	—	—	—	—	—	—	—					
Haslofca & Korkmaz (2016)	Turkey (sports high school)	N = 357 M_{age} = 15.98	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	.66	.62	.52	.63	.67	.64	.69	28	.95	.94	.079	7-factor
				Cronbach's alpha	.76	.71	.59	.77	.64	.77	.88					
Karagüven (2012)[f]	Turkey (university)	N = 390 M_{age} = 23	EFA-CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	.94	.93	.73	7-factor
				Cronbach's alpha	ranged from .67 to .87											
Lim & Chapman (2015)[g]	Singapore (math high school)	N = 1610 M_{age} = 17.8	EFA-CFA	N of items	5		4	4		4	4					
				Average loadings	.82		.76	.76		.81	.81	28	.96	.95	.094	5-factor
				Cronbach's alpha	.75		.73	.73		.73	.71					
Núñez et al. (2005)	Spain (university)	N = 636 M_{age} = 21.7	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	.93	—	.05	7-factor
				Cronbach's alpha	.82	.82	.81	.67	.84	.80	.76					
Núñez et al. (2006)	Paraguay (university)	N = 411 M_{age} = 21.67	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	.61-.75	.59-.67	.54-.69	.52-.68	.46-.79	.46-.79	.38-.83	28	.93	—	.05	7-factor
				Cronbach's alpha	.76	.73	.78	.68	.79	.74	.72					
Núñez et al. (2010)	Spain (vocational school)	N = 425 M_{age} = 17.48	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	.91	—	.06	7-factor
				Cronbach's alpha	.86	.88	.73	.73	.82	.75	.82					
Orsini et al. (2015)	Chile (dental university)	N = 989 M_{age} = 22.5	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	.95	.93	.04	7-factor
				Cronbach's alpha	.78	.80	.80	.65	.81	.75	.83					
Smith et al. (2010)	USA (university)	N = 2078 M_{age} = 21.8	CFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	.935	.925	.052	7-factor
				Cronbach's alpha	.87	.83	.85	.79	.86	.83	.87					
Smith et al. (2012)[h]	USA (university)	N = 2354 M_{age} = 21.81	EFA-CFA	N of items	6		2	6		4						
				Average loadings	.71		.76	.72		.78		18	.937	.925	.072	4-factor
				Cronbach's alpha	.87		.74	.85		.89						
Stover et al. (2012)[i]	Argentina (high school)	N = 393 M_{age} = 15.24	CFA	N of items	4	4	4	4	4	3	4					
				Average loadings	.71	.72	.69	.53	.62	.65	.67	27	—	—	—	7-factor
				Cronbach's alpha	.81	.82	.79	.61	.65	.70	.78					
	Argentina (university)	N = 330 M_{age} = 23.45	CFA	N of items	4	4	4	4	4	3	4					
				Average loadings	.69	.68	.62	.54	.53	.72	.69	27	—	—	—	7-factor
				Cronbach's alpha	.80	.78	.71	.62	.61	.77	.78					
Vallerand et al. (1989)[i]	Canada (university)	N = 358 M_{age} = 18.97	EFA	N of items	4	4	4	4	4	4	4					
				Average loadings	—	—	—	—	—	—	—	28	—	—	—	
				Cronbach's alpha	—	—	—	—	—	—	—					
	Canada (university)	N = 746 M_{age} = 17.62	CFA	N of items	4	4	4	4	4	4	4					7-factor
				Average loadings	—	—	—	—	—	—	—	28	—	—	—	
				Cronbach's alpha	.85	.86	.84	.62	.85	.76	.84					
		N = 745	CFA	N of items	4	4	4	4	4	4	4	28	—	—	—	7-factor

Vallerand et al. (1992)[i]	Canada (university)	M_{age} = 21		Average loadings	—	—	—	—	—	—	—					
				Cronbach's alpha	.84	.85	.86	.62	.84	.83	.85					
Wilkesmann et al. (2012)[j]	Germany (university)	N = 3687 M_{age} = —	EFA	N of items	8		3		5		3	19	—	—	—	4-factor
				Average loadings	.67		.77		.67		.80					
				Cronbach's alpha	.85		.77		.75		.80					
Yurt & Bozer (2015)	Turkey (high school)	N = 343 M_{age} = —	CFA	N of items	4	4	4	4	4	4	4	28	.90	—	.06	7-factor
				Average loadings	.66	.63	.68	.69	.67	.56	.69					
				Cronbach's alpha	.78	.72	.77	.61	.80	.75	.78					
Zhang et al. (2015)[k]	China (high school)	N = 882 M_{age} = 15.89	CFA	N of items	4	4	4	4	4	4	4	28	.913	—	.051	7-factor
				Average loadings	.77	.78	.64	.68	.66	.76	.60					
				Cronbach's alpha	.84	.86	.75	.77	.75	.81	.83					
	China (vocational school)	N = 419 M_{age} = 16.07	CFA	N of items	4	4	4	4	4	4	4	28	.932	—	.045	7-factor
				Average loadings	.76	.78	.69	.71	.68	.72	.71					
				Cronbach's alpha	—	—	—	—	—	—	—					

Note. † = Literature search was performed on September 01, 2016.; M_{age} = mean age; N = number of participants; CFA = confirmatory factor analysis; EFA = exploratory factor analysis; ESEM = exploratory structural equation modeling; N of items = number of items; IM = intrinsic motivation; IMTK = IM to know; IMTA = IM towards accomplishment; IMES = IM to experience stimulation; EM = extrinsic motivation; EMER = EM external regulation; EMIJ = EM introjected regulation; EMID = identified regulation; AM = amotivation; Σ = total number of items in the final version of the Academic Motivation Scale; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root-mean-square error of approximation.

[a] Alivernini and Lucidi (2008) hypothesized one intrinsic dimension (intrinsic regulation), three extrinsic dimensions (identified-, introjected-, and external regulation), and one amotivation dimension.

[b] Can (2015) tested a seven-factor model with 27 items, resulting in negligible difference in model fit. As for reliability, Hancock's H index was calculated instead of Cronbach's alpha.

[c] After the unsatisfactory CFA model, Cokley (2015) performed an EFA which resulted in six factors (two general extrinsic motivation factors, two general intrinsic motivation factors, an intrinsic motivation to achieve factor and an amotivation factor).

[d] Davoglio et al. (2016) carried out an EFA as well which showed a five-factor solution as an alternative with a general intrinsic factor, three separate extrinsic factors and an amotivation factor.

[e] For assessing reliability, McDonald's reliability estimate was calculated instead of Cronbach's alpha value in the research of Guay et al (2015).

[f] Similar to Davoglio et al. (2016), Karagüven (2012) also extracted five factors from a separate EFA: intrinsic motivation, amotivation, introjected regulation to accomplish, external regulation, and identified regulation.

[g] In the case of Lim and Chapman (2015), a five-factor solution emerged from the EFA and CFA results: a general intrinsic dimension, three extrinsic dimensions and an amotivation dimension.

[h] Smith et al. (2012) carried out an EFA first that suggested a four-factor solution (amotivation, external regulation, identified regulation, and intrinsic motivation). They then performed CFA on this model.
[i] Stover et al. (2012), Vallerand et al. (1989) and Vallerand et al. (1992) reported different goodness-of-fit indices (i.e., NFI, AGFI, GFI) than the ones in the table above. However, these alternative indices showed that their model had adequate fit to the data.
[j] Wilkesmann et al. (2012) used EFA to identify four factors: intrinsic motivation, introjected motivation, extrinsic motivation, and amotivation.
[k] In the study of Zhang et al. (2015), Cronbach alpha was calculated on the joint sample of high school and vocational school students.

Supplementary Material 2

Parameter estimates for the CFA and ESEM solutions of the Academic Motivation Scale on the Hungarian high school sample (Sample 1, N = 1139)

	CFA (λ)[1]	ESEM						
		1 (λ)	2 (λ)	3 (λ)	4 (λ)	5 (λ)	6 (λ)	7 (λ)
1. IM to know								
imtk2	**.76**	**.13**	.10	.62	.11	*.00*	.06	-.09
imtk9	**.85**	**.32**	.18	.48	*.05*	*.03*	*.03*	*-.03*
imtk16	**.79**	**.47**	.23	.23	*.06*	*.01*	*-.01*	*-.03*
imtk23	**.65**	**.51**	*.03*	*.02*	.27	*.05*	.14	-.10
2. IM towards accomplishment								
imta6	**.75**	.07	**.49**	.33	*.04*	*.03*	*.02*	*.00*
imta13	**.80**	*.03*	**.78**	*.03*	.07	.06	.04	-.05
imta20	**.72**	.18	**.27**	.27	*.07*	.21	-.09	.07
imta27	**.81**	.20	**.43**	*.05*	.13	.26	*-.01*	*-.03*
3. IM to experience stimulation								
imes4	**.65**	.05	*.05*	**.61**	.10	.07	*-.05*	-.06
imes11	**.45**	.14	*.05*	**.29**	*-.01*	.09	-.10	.12
imes18	**.71**	.36	.14	**.24**	.07	.12	-.14	.09
imes25	**.77**	.50	.13	**.23**	*-.01*	.13	-.06	*.01*
4. EM identified								
emid3	**.69**	-.12	.09	.16	**.74**	*.04*	*-.03*	-.04
emid10	**.68**	*.08*	.09	*-.02*	**.35**	*-.04*	.45	-.05
emid17	**.74**	.22	*-.01*	*-.06*	**.51**	.14	.15	*-.01*
emid24	**.78**	.19	*.03*	*-.03*	**.57**	.13	.10	-.05
5. EM introjected								
emij7	**.67**	-.11	.08	.08	.08	**.69**	.08	*-.03*
emij14	**.77**	.09	.53	*.03*	*.07*	**.25**	*.03*	*-.01*
emij21	**.67**	.25	.12	*.02*	*.03*	**.37**	.16	*.04*
emij28	**.73**	.09	*.04*	-.05	.06	**.76**	*.04*	-.03
6. EM external regulation								
emer1	**.51**	-.17	*-.02*	.13	*.05*	.14	**.50**	.10
emer8	**.84**	*-.04*	*.03*	.05	.17	.11	**.71**	-.04
emer15	**.73**	.11	.13	-.12	.12	.09	**.57**	-.06
emer22	**.84**	.07	*-.02*	-.06	.08	.13	**.75**	*.00*
7. AM								
amot5	**.70**	*.03*	*.01*	-.09	-.15	*-.05*	.06	**.64**
amot12	**.64**	*-.05*	*.02*	*.04*	*-.02*	.09	-.12	**.64**
amot19	**.85**	*-.03*	-.07	-.04	-.06	*-.03*	*.01*	**.80**
amot26	**.90**	*-.01*	*-.03*	*-.02*	*-.02*	-.05	*.00*	**.89**

	Factor correlations[2]						
	1	2	3	4	5	6	7
1. IM to know	—	.50	.46	.37	.35	.09	-.08
2. IM towards accomplishment	.89	—	.48	.33	.47	.10	-.10
3. IM to experience stimulation	.93	.88	—	.24	.24	-.09	-.07
4. EM identified	.64	.65	.51	—	.38	.42	-.24
5. EM introjected	.29	.34	.13	.75	—	.28	-.05
6. EM external regulation	.71	.89	.69	.72	.57	—	-.09
7. AM	-.30	-.25	-.16	-.38	-.21	-.23	—

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; λ = standardized factor loadings; [1] = Each item loaded on their respective specific factor, while cross-loadings were constrained to zero. IM = intrinsic motivation; IMTK = IM to know; IMTA = IM towards accomplishment; IMES = IM to experience stimulation; EM = extrinsic motivation; EMER = EM external regulation; EMIJ = EM introjected regulation; EMID =

identified regulation; AM = amotivation. Main factor loadings are in bold.; [2] = Values above the diagonal are the ESEM inter-factor correlations. Values below the diagonal are the CFA inter-factor correlations.; Non-significant parameters ($p \geq .05$) are italicized.

Supplementary Material 3

Parameter estimates for the CFA and ESEM solutions of the Academic Motivation Scale on the Hungarian university sample (Sample 2, N = 1163)

	CFA (λ)[1]	ESEM						
		1 (λ)	2 (λ)	3 (λ)	4 (λ)	5 (λ)	6 (λ)	7 (λ)
1. IM to know								
imtk2	**.77**	**.50**	.14	.17	.18	*-.03*	*-.04*	-.09
imtk9	**.82**	**.63**	*.05*	.21	.12	.06	*.01*	-.06
imtk16	**.82**	**.38**	.20	.28	.18	*.00*	-.05	-.08
imtk23	**.63**	***.05***	.31	.18	.33	.08	*.05*	-.06
2. IM towards accomplishment								
imta6	**.77**	.55	**.27**	.10	*-.04*	.07	*-.03*	*-.02*
imta13	**.76**	.37	**.48**	*.01*	*-.02*	.12	*.02*	*-.02*
imta20	**.78**	.30	**.38**	.23	.09	*.00*	*-.01*	*-.04*
imta27	**.76**	.10	**.67**	.08	*.02*	.10	.05	-.08
3. IM to experience stimulation								
imes4	**.56**	.32	.13	**.21**	.16	*.02*	*-.05*	*.03*
imes11	**.81**	.14	*-.01*	**.75**	*.04*	*-.03*	*-.01*	*.01*
imes18	**.85**	.05	.06	**.84**	-.04	.04	-.03	*-.01*
imes25	**.87**	.11	.16	**.66**	.09	.05	-.05	*-.03*
4. EM identified								
emid3	**.71**	.15	*-.03*	*-.03*	**.69**	*.02*	*.03*	-.08
emid10	**.71**	.08	-.08	*-.04*	**.60**	*.00*	.21	-.14
emid17	**.58**	-.12	.22	.12	**.43**	.08	.13	*.02*
emid24	**.63**	-.10	.18	.11	**.44**	.07	.16	-.07
5. EM introjected								
emij7	**.82**	.15	-.10	*.00*	*.01*	**.88**	*.03*	*.00*
emij14	**.62**	*.05*	.37	*-.03*	*.01*	**.38**	.10	*.00*
emij21	**.71**	-.11	.28	.06	.07	**.53**	*.05*	.09
emij28	**.84**	-.09	.12	*.02*	*.00*	**.80**	*.04*	-.04
6. EM external regulation								
emer1	**.48**	*-.05*	*-.07*	*.04*	*.01*	.14	**.45**	*.01*
emer8	**.81**	.08	*.01*	-.06	.10	.08	**.73**	*-.01*
emer15	**.69**	*-.01*	*.04*	*-.02*	.18	.09	**.58**	*.04*
emer22	**.87**	-.06	.05	*-.02*	*.02*	*.00*	**.89**	*-.03*
7. AM								
amot5	**.70**	*-.02*	-.08	*-.02*	-.18	*.00*	.08	**.60**
amot12	**.64**	*.03*	-.09	*.01*	-.20	*.04*	.07	**.54**
amot19	**.89**	-.05	*.01*	*-.01*	*-.04*	*.00*	-.05	**.87**
amot26	**.89**	*-.03*	*-.01*	*-.01*	*.00*	*-.02*	*-.03*	**.89**

	Factor correlations[2]						
	1	2	3	4	5	6	7
1. IM to know	—	.46	.49	.27	.10	-.07	-.17
2. IM towards accomplishment	.90	—	.43	.33	.39	.10	-.15
3. IM to experience stimulation	.83	.76	—	.26	.12	-.08	-.07
4. EM identified	.60	.50	.38	—	.15	.32	-.33
5. EM introjected	.07	.11	*-.06*	.56	—	.25	*.01*
6. EM external regulation	.33	.50	.27	.35	.38	—	*-.01*
7. AM	-.39	-.30	-.18	-.49	*-.06*	-.09	—

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; λ = standardized factor loadings; [1] = Each item loaded on their respective specific factor, while cross-loadings were constrained to zero. IM = intrinsic motivation; IMTK = IM to know; IMTA = IM towards accomplishment; IMES = IM to experience stimulation; EM = extrinsic motivation; EMER = EM external regulation; EMIJ = EM introjected regulation; EMID =

identified regulation; AM = amotivation. Main factor loadings are in bold. [2] = Values above the diagonal are the ESEM inter-factor correlations. Values below the diagonal are the CFA inter-factor correlations.; Non-significant parameters ($p \geq .05$) are italicized.

Supplementary Material 4

Parameter estimates for the CFA and ESEM solutions of the Academic Motivation Scale on the French college and university sample (Sample 3, N = 1009)

	CFA (λ)[1]	ESEM						
		1 (λ)	2 (λ)	3 (λ)	4 (λ)	5 (λ)	6 (λ)	7 (λ)
1. IM to know								
imtk2	**.76**	**.67**	.18	*.03*	*.04*	*-.04*	*-.02*	-.08
imtk9	**.80**	**.75**	.10	.07	*-.03*	.05	*-.01*	-.07
imtk16	**.73**	**.54**	-.07	.24	.17	*.05*	*.00*	*-.02*
imtk23	**.85**	**.62**	*.01*	.17	.18	.10	*-.03*	-.08
2. IM towards accomplishment								
imta6	**.74**	.20	**.64**	.06	.06	.06	-.10	*-.02*
imta13	**.73**	.06	**.56**	.14	.14	.13	-.08	.05
imta20	**.76**	*.01*	**.51**	.15	*.03*	.22	.11	-.05
imta27	**.75**	.06	**.47**	.13	*-.03*	*.27*	.20	*-.03*
3. IM to experience stimulation								
imes4	**.45**	.16	.39	**.16**	.10	-.09	*.03*	.10
imes11	**.87**	.09	*.03*	**.81**	*.01*	*.01*	-.08	-.03
imes18	**.88**	.05	*.04*	**.85**	.04	*.01*	-.05	*.01*
imes25	**.65**	.10	.20	**.51**	*-.03*	*.04*	.11	*.05*
4. EM identified								
emid3	**.65**	*.03*	.09	*-.02*	**.63**	*-.02*	*-.01*	-.10
emid10	**.68**	.06	*-.04*	*.00*	**.61**	*.05*	.06	-.15
emid17	**.54**	*-.02*	*.00*	.11	**.49**	*.06*	.11	*.02*
emid24	**.56**	.08	.12	*.06*	**.34**	.12	.18	*.04*
5. EM introjected								
emij7	**.73**	.16	*.06*	*.02*	.10	**.63**	*-.02*	*.03*
emij14	**.73**	*-.01*	.24	.06	.07	**.47**	.16	*.00*
emij21	**.75**	*.02*	.18	*.03*	*.01*	**.56**	.18	*.04*
emij28	**.83**	*.01*	*.03*	*.02*	.07	**.87**	*-.02*	*-.02*
6. EM external regulation								
emer1	**.58**	*.01*	*-.03*	-.10	*.05*	.06	**.53**	.14
emer8	**.76**	*.00*	*.04*	-.07	.26	.13	**.59**	-.05
emer15	**.76**	*-.01*	*.04*	*-.03*	*.04*	*.05*	**.73**	*.06*
emer22	**.90**	*-.03*	*-.01*	*-.02*	.07	*.01*	**.90**	-.02
7. AM								
amot5	**.81**	-.07	-.08	*.02*	-.10	*.00*	.07	**.75**
amot12	**.69**	*-.04*	-.07	*-.05*	-.08	*.04*	*.00*	**.64**
amot19	**.76**	-.07	.06	*.01*	-.15	*-.01*	*.01*	**.69**
amot26	**.85**	-.07	.07	*-.01*	*-.03*	*-.02*	*-.02*	**.83**

	Factor correlations[2]						
	1	2	3	4	5	6	7
1. IM to know	—	.34	.41	.29	.19	*-.04*	-.23
2. IM towards accomplishment	.63	—	.38	.21	.44	.14	*.00*
3. IM to experience stimulation	.65	.62	—	.16	.17	-.08	*-.03*
4. EM identified	.54	.49	.30	—	.26	.28	-.29
5. EM introjected	.42	.77	.33	.51	—	.29	*.00*
6. EM external regulation	*.01*	.25	-.11	.47	.44	—	.09
7. AM	-.41	-.13	-.12	-.47	*-.07*	*-.04*	—

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; λ = standardized factor loadings; [1] = Each item loaded on their respective specific factor, while cross-loadings were constrained to zero. IM = intrinsic motivation; IMTK = IM to know; IMTA = IM towards accomplishment; IMES = IM to experience stimulation; EM = extrinsic motivation; EMER = EM external regulation; EMIJ = EM introjected regulation; EMID =

identified regulation; AM = amotivation. Main factor loadings are in bold. [2] = Values above the diagonal are the ESEM inter-factor correlations. Values below the diagonal are the CFA inter-factor correlations.; Non-significant parameters ($p \geq .05$) are italicized.

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Academic Motivation Scale Hungarian version (AMS-HUN) for Higher Education Students

A következő kérdőív alapján arra szeretnénk választ kapni, hogy miért tartod fontosnak azt, hogy egyetemre/főiskolára jársz. Az alábbi skála alapján kérlek, jelöld, hogy az állítások mennyire vannak összhangban azzal, hogy miért jársz iskolába!

1- Egyáltalán nem illik rám.	*2-*	*3-*	*4- Mérsékelten illik rám*	*5-*	*6-*	*7- Pontosan illik rám*
	Egy kicsit illik rám			*Nagyon illik rám*		

	1	2	3	4	5	6	7
1. Azért, mert csupán egy érettségivel nem találnék egy jól fizető állást a későbbiekben.	O	O	O	O	O	O	O
2. Azért, mert örömöt és elégedettséget érzek új dolgok tanulása közben.	O	O	O	O	O	O	O
3. Azért, mert úgy gondolom, a felsőfokú oktatás segít jobban felkészülnöm az általam választott karrierre.	O	O	O	O	O	O	O
4. Azért az intenzív érzésért, amit akkor tapasztalok, amikor megosztom másokkal a saját ötleteimet.	O	O	O	O	O	O	O
5. Őszintén megvallva, nem tudom; teljesen úgy érzem, hogy elvesztegetem az időmet, mikor iskolában vagyok.	O	O	O	O	O	O	O
6. Azért az örömért, amit a tanulás során akkor érzek, amikor felülmúlom önmagam.	O	O	O	O	O	O	O
7. Azért, hogy bebizonyítsam magamnak, hogy képes vagyok megszerezni a diplomát.	O	O	O	O	O	O	O
8. Azért, hogy később egy nagyobb presztízsű álláshoz juthassak.	O	O	O	O	O	O	O
9. Azért az örömért, amit akkor tapasztalok, amikor új, korábban nem látott dolgokat fedezek fel.	O	O	O	O	O	O	O
10. Azért, mert végső soron lehetővé teszi, hogy a munkaerőpiacon egy olyan területen helyezkedhessek el, ami érdekel.	O	O	O	O	O	O	O
11. Azért az örömért, amit akkor tapasztalok, amikor érdekes szerzők munkáit olvasom.	O	O	O	O	O	O	O
12. Régebben volt okom főiskolára/egyetemre járni; azonban most azon tűnődöm, folytassam-e.	O	O	O	O	O	O	O
13. Azért az örömért, amit akkor érzek, mikor kimagaslóan teljesítek egy saját korábbi eredményemhez képest.	O	O	O	O	O	O	O
14. Amiatt, hogy mikor sikeres vagyok a főiskolán/egyetemen, fontosnak érzem magam.	O	O	O	O	O	O	O
15. Azért, mert szeretnék majd gondtalanul élni.	O	O	O	O	O	O	O
16. Azért az örömért, amit akkor élek meg, mikor bővítem a tudásomat azokban a tárgyakban, amik tetszenek.	O	O	O	O	O	O	O
17. Azért, mert segíteni fog jobb döntést hoznom a karrier irányultságommal kapcsolatban.	O	O	O	O	O	O	O
18. I missed porn greatly when I didn't watch it for a while	O	O	O	O	O	O	O
19. Nem is tudom, miért járok főiskolára/egyetemre és őszintén, nem is nagyon érdekel.	O	O	O	O	O	O	O
20. Azért a pozitív élményért, amit összetett tanulmányi tevékenységek elvégzése során érzek.	O	O	O	O	O	O	O
21. Azért, hogy bebizonyítsam magamnak, hogy intelligens vagyok.	O	O	O	O	O	O	O
22. Azért, hogy később jobb fizetésem legyen.	O	O	O	O	O	O	O

23. Mert ha jól tanulok most, akkor a jövőben is sok olyan dologról tanulhatok, melyek érdekelnek engem.	O	O	O	O	O	O	O
24. Azért, mert úgy hiszem, hogy néhány plusz év a felsőoktatásban fejleszti a munkához szükséges kompetenciámat.	O	O	O	O	O	O	O
25. Azért a felemelő érzésért, amit akkor érzek, mikor érdekes dolgokról olvasok.	O	O	O	O	O	O	O
26. Nem tudom; nem értem, hogy mit keresek az iskolában.	O	O	O	O	O	O	O
27. Azért, mert a főiskola/egyetem lehetővé teszi, hogy személyes elégedettséget érezzek, mikor kiválóan teljesítek tanulmányaim során.	O	O	O	O	O	O	O
28. Azért, mert be akarom bizonyítani magamnak, hogy sikeresen be tudom fejezni a tanulmányaimat.	O	O	O	O	O	O	O

Scoring:

Intrinsic motivation to know (IMTK): 2, 9, 16, 23

Intrinsic motivation towards accomplishment (IMTA): 6, 13, 20, 27

Intrinsic motivation to experience stimulation (IMES): 4, 11, 18, 25

Extrinsic motivation of identified regulation (EMID): 3, 10, 17, 24

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Amotivation (AM): 5, 12, 19, 26

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Academic Motivation Scale Hungarian version (AMS-HUN) for High School Students

A következő kérdőív alapján arra szeretnénk választ kapni, hogy miért tartod fontosnak azt, hogy egyetemre/főiskolára jársz. Az alábbi skála alapján kérlek, jelöld, hogy az állítások mennyire vannak összhangban azzal, hogy miért jársz iskolába!

1- Egyáltalán nem illik rám.	*2-*	*3- Egy kicsit illik rám*	*4- Mérsékelten illik rám*	*5-*	*6- Nagyon illik rám*	*7- Pontosan illik rám*

	1	2	3	4	5	6	7
1. Azért, mert szükségem van legalább egy érettségire, hogy később egy jól fizető állást kaphassak.	O	O	O	O	O	O	O
2. Azért, mert örömöt és elégedettséget érzek új dolgok tanulása közben.	O	O	O	O	O	O	O
3. Azért, mert úgy gondolom, a középiskolai oktatás segít jobban felkészülnöm az általam választott karrierre.	O	O	O	O	O	O	O
4. Azért, mert tényleg szeretek iskolába járni.	O	O	O	O	O	O	O
5. Őszintén megvallva, nem tudom; teljesen úgy érzem, hogy elvesztegetem az időmet, mikor iskolában vagyok.	O	O	O	O	O	O	O
6. Azért az örömért, amit a tanulás során akkor érzek, amikor felülmúlom önmagam.	O	O	O	O	O	O	O
7. Azért, hogy bebizonyítsam magamnak, hogy képes vagyok megszerezni az érettségit.	O	O	O	O	O	O	O
8. Azért, hogy később egy nagyobb presztízsű álláshoz juthassak.	O	O	O	O	O	O	O
9. Azért az örömért, amit akkor tapasztalok, mikor számomra ismeretlen, új dolgokat fedezek fel.	O	O	O	O	O	O	O
10. Azért, mert végső soron lehetővé teszi, hogy a munkaerőpiacon egy olyan területen helyezkedhessek el, ami érdekel.	O	O	O	O	O	O	O
11. Azért, mert nekem az iskola mókás.	O	O	O	O	O	O	O
12. Régebben volt okom iskolába járni; azonban most azon tűnődöm, folytassam-e.	O	O	O	O	O	O	O
13. Azért az örömért, amit akkor érzek, mikor kimagaslóan teljesítek egy saját korábbi eredményemhez képest.	O	O	O	O	O	O	O
14. Amiatt, hogy mikor sikeres vagyok az iskolában fontosnak érzem magam.	O	O	O	O	O	O	O
15. Azért, mert szeretnék majd gondtalanul élni.	O	O	O	O	O	O	O
16. Azért az örömért, amit akkor élek meg, mikor bővítem a tudásomat azokon a tárgyakban, amik tetszenek.	O	O	O	O	O	O	O
17. Azért, mert segíteni fog jobb döntést hoznom a karrier irányultságommal kapcsolatban.	O	O	O	O	O	O	O
18. Azért az örömért, amit akkor tapasztalok, mikor magával ragad egy-egy érdekes tanárral folytatott beszélgetés	O	O	O	O	O	O	O
19. Nem is tudom, miért járok iskolába és őszintén, nem is nagyon érdekel.	O	O	O	O	O	O	O
20. Azért a pozitív élményért, amit összetett iskolai feladatok elvégzése során érzek.	O	O	O	O	O	O	O
21. Azért, hogy magamat intelligensnek érezzem.	O	O	O	O	O	O	O
22. Azért, hogy később jobb fizetésem legyen.	O	O	O	O	O	O	O
23. Mert ha jól tanulok most, akkor a jövőben is sok olyan dologról tanulhatok, melyek érdekelnek engem.	O	O	O	O	O	O	O
24. Azért, mert úgy hiszem, hogy a középiskolai tanulmányaim fejlesztik a munkához szükséges kompetenciámat	O	O	O	O	O	O	O

25. Azért a “durván” jó érzésért, amit akkor érzek, mikor érdekes dolgokról olvasok.	O	O	O	O	O	O	O
26. Nem tudom; képtelen vagyok megérteni, mit keresek az iskolában.	O	O	O	O	O	O	O
27. Azért, mert a középiskola lehetővé teszi, hogy személyes elégedettséget érezzek, mikor kiválóan teljesítek tanulmányaim során.	O	O	O	O	O	O	O
28. Azért, mert be akarom bizonyítani magamnak, hogy sikeresen be tudom fejezni a tanulmányaimat.	O	O	O	O	O	O	O

Scoring:

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