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Factorial Structure of the California Measure of Mental Motivation

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Abstract---The aim of the present research aims to examine the construct validity and reliability of the California measure of mental motivation in a culturally diverse distinct environment from the original environment. Mental motivation is a construct consisted 72 items distributed over 4 dimensional or factorial cognitions: mental focus, learning orientation, creative problem solving and cognitive integrity. Mental motivation data were collected from 631 Algerian university students (631) to investigate the multidimensional nature of the California mental motivation construct and the validity of the scale confirmatory factor analysis was conducted using AMOS. Results showed that mental motivation consisted 57 items over 4 factors, with a satisfactory fit between the data and the theoretical model and with acceptable reliability and sufficient validity

Keywords---construct factory, mental motivation, Algerian university students.

Introduction

Lying at the core of many psychological subjects, motivation is one of the most complex topics in the field of psychology; it englobes to understand the reasons behind humans behavior and the processes triggering their actions. This is a complex process because it. The study of motivation reveals what people want and why they want it, literally uncovering the contents of human nature. The topic of motivation relates to what is aspired to, what we desired, needed, and feared (Al-Faraj et al., (2016), p. 24).

The theories of studying motivation and creative thinking, as well as its measurement, have increased due to the growing interest from educators and decision-makers in the teaching and learning process.

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The latter is no longer limited confined to the availability of existing information in the learner's cognitive structure alone. Instead, it now also considers the learner's motivation and diverse thinking skills, which aid them in encountering with all the life situations they encounter (Morrison, (1998), p. 218).

Developed by Giancarlo and Facione (1998), the California Measure of Mental Motivation is widely implemented to measure creative thinking for university students . This instrument aims to assess the various facets of creative thinking among university students through measuring their mental motivation. However, since the factor structure of psychological measures varies from one culture to another is context bound, relying on direct translation without establishing factorial validity, reliability, and norms creates erroneous measurement leading to unreliable results (Habib, 2007, p. 306).

It has become commonly accepted among specialists in psychological and educational fields have commonly affirmed that tests and measures designed in specific environments may not be valid in other environments externally valid, despite potential similarities in certain circumstances, for This is because there are always cultural effects indicators that leave their imprint, necessitating a verification of the suitability of these tests for the environment in which the phenomenon is to be measured (Ziyad, (2011), p. 9)

Measure of Mental Motivation at the university level. This will be achieved by clarifying the alignment between the measure's factor structure and the theoretical foundation of mental motivation. The mental motivation measure will provide an assessment tool to gauge motivation among a large proportion of society significant segment of society, who constitutes a large proportion of it—namely, university students. Subsequently, it will be possible to identify their level of mental motivation and, based on that, develop suitable training programs tailored to their specific levels of mental motivation. This has motivated the researcher to apply the measure in the Algerian context, hoping to verify its factor structure to ensure its validity and reliability. To address this problem, the following two questions were raised: does the structure of the California Measure of Mental Motivation have a good fit with the data?
Hypotheses: Based on these two questions:

- The factor structure of the California Measure of Mental Motivation is valid for Algerian university students.
- The California Measure of Mental Motivation possesses a good level of validity and reliability.

I.Study Objectives:
The current research aims to verify the following objectives:

- To verify the factor structure of the California Measure of Mental Motivation among university students and to confirm its good fit with the data.
- To ascertain the validity and reliability indicators of the California Measure of Mental Motivation among university students.

II. Study Significance:
The significance of the current research lies in establishing the factor structure of the Algerian version of the California Measure of Mental Motivation for the university study stage. This is achieved by clarifying the congruence between the factor structure of the measure and the theoretical foundations of mental motivation. This mental motivation measure will provide an assessment tool to measure the mental motivation of university students, thereby enabling the identification of their mental motivation levels and the development of suitable training programs for them based on their specific levels of mental motivation.

III.Study concepts:
With regards to the purposes of this research, the following operational definitions are established:

1. Factor Structure: represents the components or traits that the measure is intended to assess. It reflects the validity of the measure, as these components vary depending on the culture for which the measures were developed (AbdRahim, (1989), p. 252).
1.1 Operational Definition: is a set of relationships linking a group of factors to a larger set of variables according to specific rules.

2. Factor Analysis: is a mathematical technique involving numerous mathematical operations and procedures to analyze correlations between variables; The correlations are subsequently interpreted and reduced to a smaller number of variables (Al-Jabri, (2012), p. 22).
2.1 Operational Definition: is the process of analyzing a set of correlation coefficients into a smaller number of factors used to describe the factor structure of the California Measure of Mental Motivation.

3. Confirmatory Factor Analysis: is a procedure for testing hypotheses about the relationships between specific variables belonging to common hypothetical factors, the number and interpretation of which are predetermined during the formulation of the research's theoretical framework and problem definition, prior to data collection (Abou Hatab & Sadiq, (1991), p. 604).
3.1 Operational Definition: A type of advanced statistical analysis used to fit a dataset to its corresponding proposed model to achieve the best possible match between them.

4. Mental Motivation: Defined by Giancarlo and Facione (1998) as equipping an individual to accomplish serious creative tasks and to employ multiple methods to stimulate this state or to solve presented problems in diverse ways, which may sometimes appear illogical. Mental motivation is contrasted with mental rigidity, which suggests that current ways of doing things are the best or perhaps the only way (Giancarlo & Facione, (1998), p. 28).
4.1 Operational Definition: The total score achieved by a student on the California Measure of Mental Motivation, expressed as the sum of the scores obtained in its four factors: Mental Focus, Learning Orientation, Creative Problem-Solving, and Cognitive Integration.

IV.Methodology:

1. Study Population:

The study population encompasses all elements and units of the problem or phenomenon under investigation; it is the entire group to which the results can be generalized. Our study population consists of all individuals belonging to the Algerian context, specifically university students from several Algerian universities, mainly from University of Bejaia, University of Algiers 2, and University of Jijel. The main study sample consisted of 631 male and female students from different academic levels at the University of Algiers 2, Bejaia, and Jijel, with an age range from 18 to 40 years.

Table 1: Description of the sample

Characteristics of the sample	sex		Total
	female	male	
bachelor	167	193	360
master	145	126	271
total	312	319	631

V.5.Study tool: California Mental Motivation Scale:

1. Description of the Mental Motivation Scale:

The Mental Motivation Measure (CM3 Level 3) was developed by Facione and Giancarlo (1998) and published by The California Academic Press. Its purpose is to measure mental motivation among university students. The initial form of this measure's Level three consisted of (72) items. Nawfal (2004) subsequently adapted and developed the measure to suit the Jordanian environment. The items of the measure are distributed into two types: positive items, numbering (46), and negative items, numbering

(26). Responses to the items are selected from the following alternatives: (Strongly Agree, Agree to Some Extent, Disagree to Some Extent, Strongly Disagree).

VI.Factor model design:

Based on the results of the exploratory factor analysis, the researcher developed a first-order factorial model comprising four factors: mental focus, learning orientation, creative problem-solving, and cognitive integration. To confirm the statistical fit between the model derived from the exploratory factor analysis and the data obtained from the study sample, confirmatory factor analysis was employed on a sample of 631 students. The validity of the proposed factorial model is assessed using fit indices, which indicate the extent to which the model represents the data upon which the researcher based the analysis.

VII.Confirmatory factor analysis of the California Mental Motivation Scale:

The appropriate analysis for testing the hypotheses is Confirmatory Factor Analysis (CFA) using the AMOS software package, to verify the validity of the theoretical framework upon which the study is based (Tighezza, M'hamed, 2012).

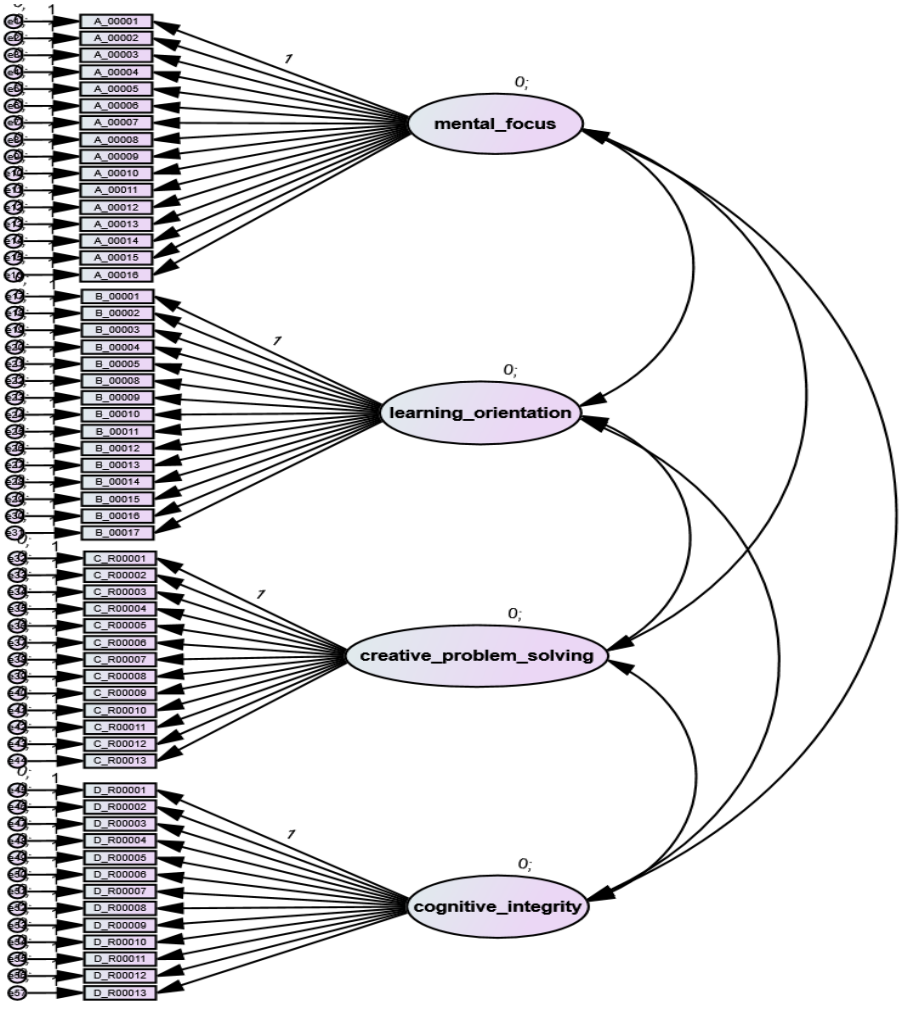

Figure 1. The model illustrates motivation within exploratory factor analysis

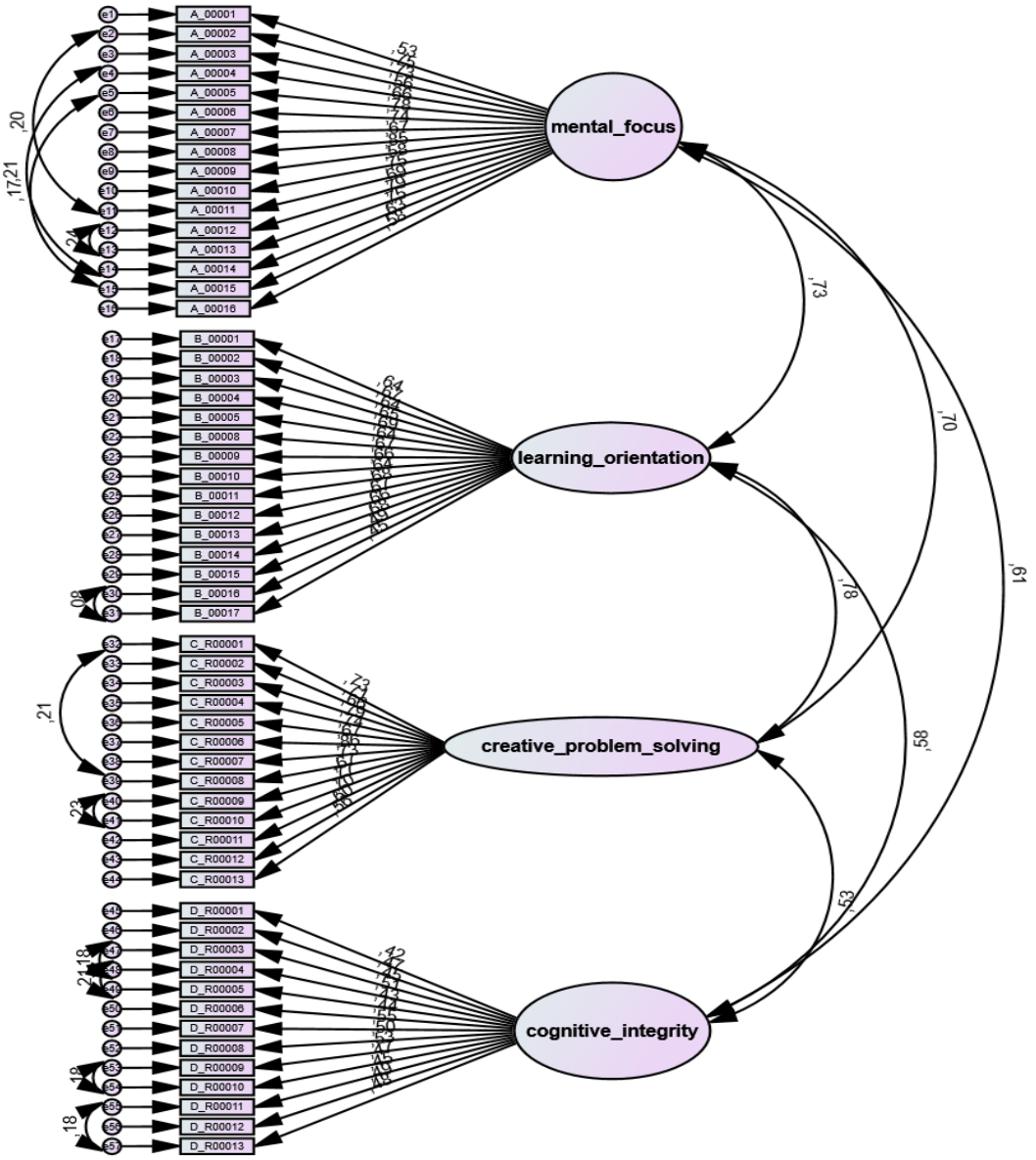

Figure 1. The Model of Confirmatory Factor Analysis based of CM3 after adjusting

VIII.Discussion and analysis of results:

The results will be are presented according to the main research questions, which focus on verifying the factor structure of the California Measure of Mental Motivation and on examining the validity and reliability evidence of the measure when applied to a sample from the Algerian context.

Hypothesis 1: The factor structure of the California Measure of Mental Motivation for Algerian university students, as designed by Facione and Giancarlo and consisting of four factors—mental focus,

learning orientation, creative problem-solving, and cognitive integration—demonstrates a good fit with the data in the Algerian environment.

Table 2 : Conformity indicators of the mental motivation model.

Fit Criterion	Model's Fit Index Value	Full Name	Abbreviated Fit Index Name
Statistical method based solely on statistical significance			
Should be statistically non-significant	475 (statistically sig.)	**Chi-Square**	**CMIN**
absolute fit indices			
Less than or equal to 0.08	**0.032**	**Standardized Root Mean Square Residual**	**SRMR**
Greater than or equal to 0.90	**0.881**	**Goodness of Fit Index**	**GFI**
Less than or equal to 0.08	**0.030**	**Root Mean Square Error of Approximation**	**RMSEA**
incremental fit indices			
Greater than or equal to 0.90	**0.945**	**Incremental Fit Index**	**IFI**
Greater than or equal to 0.90	**0.943**	**Tucker-Lewis Index**	**TLI**
Greater than or equal to 0.90	**0.945**	**Comparative Fit Index**	**CFI**
parsimony fit indices			
Values between 1 & 5		**Normed Chi-Square**	**NC**
Greater than 0.50	**0.818**	**Parsimony Goodness of Fit Index**	**PGFI**
Greater than 0.50	**0.828**	**Parsimony Normed Fit Index**	**PNFI**
Greater than 0.50	**0.909**	**Parsimony Comparative Fit Index**	**PCFI**
information indices			
Value for current model < Value for null/independent model	**719.534**	**Akaike Information Criterion**	**AIC**
	384.105	**Consistent Akaike Information Criterion**	**CAIC**
	744.746	**Browne-Cudeck Criterion**	**BCC**
	262.105	**Bayesian Information Criterion**	**BIC**

Based on the results of the analysis shown in Table 2, it is evident that the mental motivation model retains good fit indices that are sufficient for its acceptance. It can be observed that most of the fit indices were reasonable. An opportunity was available There could be a better possibility to make modifications that would improve the fit quality of this model, which was carried out through adjustments. This resulted in a model characterized by good fit indices, which were sufficient to judge that the proposed model fits the mental motivation data of university students to a reasonable extent. From the table above, the extent of improvement in each of the model's fit indices can be observed. The following is a detailed explanation of the significance of each fit index presented in Table.

IX.Absolute Fit Indices:

1. **Chi-Square (χ^2):** This test assesses the statistical significance of the null hypothesis, which states that there is no difference between the proposed model and the corresponding true model in reality. A significant result simply indicates that there is a discrepancy between the researcher's proposed model and the true model, meaning that the data collected from the study sample do not match the proposed model. However, a statistically non-significant chi-square value is what the researcher desires or aims for, as it indicates the absence of substantial differences between the matrices in other words, it shows that the proposed model fits the data well (Tighezza, 2001). In the context of this research sample, referring to the mental motivation model, the chi-square value was found to be 475 and was statistically significant ($p = .000$). According to this indicator, the mental motivation model for students does not match the corresponding true model represented by the data from the research sample, since the chi-square value was statistically significant. However, a notable drawback of this indicator is its sensitivity to sample size.
2. **Root Mean Square Residual (RMR):** The RMR value for the students' mental motivation model was 0.032, which is a good value indicating an acceptable model fit. It should be noted, however, that this indicator's results are influenced by the unit of measurement of the observed variables. This makes the range of its results ambiguous due to the differences in the measurement units of the variables. Therefore, we supplemented the acceptable result of this indicator with another metric that overcomes this issue (SRMR).
3. **Standardized Root Mean Square Residual (SRMR):** This indicator converts the variance-covariance matrix of the proposed model into two correlation coefficient matrices according to Kline (2005). Generally, SRMR fit index values below less than 0.08 indicate a good fit (Tighezza, 2011). For the students' mental motivation model, the value of this indicator was 0.05, which is considered as an excellent a significant value.
4. **Goodness-of-Fit Index (GFI):** This indicator serves as evidence of the model's explanatory power; meaning the proportion of variance this illucidates that the proposed model can explain the proportion of variance. A value exceeding 0.90 for this index indicates a good fit. In this model, the value of the index was 0.88, which is slightly insufficient to fully express the model's explanatory power ~~in~~ accounting for a reasonable plausible proportion of the variance in ~~the concept of~~ mental motivation among students.
5. **Root Mean Square Error of Approximation (RMSEA):** It is considered as one of the best fit indices, and simulation studies have shown its ~~superiority~~ effectiveness and good performance (Tighezza, 2011). Referring back to the value of this index for the students' mental motivation model, it reached (0.030), from which we conclude that the model is characterized by a good fit.

Incremental Fit Indices**:** These indices operate on the principle of considering the relative improvement in fit demonstrated by the proposed model compared to a baseline model, also known as the independence model or the null model.

6. **Comparative Fit Index (CFI):** According to Kline (2005), this index is considered one of the best outsanding in the field of comparative fit. Its logic is based on comparing the chi-square of the research (or proposed) model with the chi-square value of the independent model (Tighezza, 2011). The value of this index must exceed 0.90 to judge the fit as reasonable, meaning that the proposed model is significantly different from the independent model. Referring to the CFI value for the students' mental motivation model, it reached 0.945, which is a good significant value. This allows us to conclude that the chi-square of the physical withdrawal model differs significantly from the chi-square of the independent model.
7. **Tucker-Lewis Index (TLI):** Also known as the Non-Normed Fit Index (NNFI), and as previously mentioned, Tighezza (2011) indicated that this index, in addition to being based on the logic of comparing the proposed model to the independent model (the null or baseline model), incorporates a penalty function for model complexity. It penalizes the addition of free parameters that do not lead to a corresponding improvement in the model's fit quality (Tighezza, 2011). This index does not have a fixed scale but is interpreted similarly to the Comparative Fit Index (CFI). Referring to the students'

mental motivation model, the value of the TLI reached 0.943, which is a good value indicating an acceptable model fit.

8. Parsimony Fit Indices: The Bayesian Information Criterion (BIC) is used to determine the best model among a set of competing models. The model with the smallest BIC value is considered the best representation of the phenomenon compared to other competing models. A value of 262.105 indicates a good fit when compared to the null model and the independent model.

Hypothesis 2: The California Measure of Mental Motivation possesses a good level of validity and reliability. To examine the evidence for the validity and reliability of the measure within the study sample, the researcher calculated validity and reliability using different methods, as follows:

X.Convergent Validity:

Factor Loadings Based on the results presented in the table showing unveiling the factor loadings of items on their respective dimensions, it is evident that all loadings exceeded 0.40, ranging from moderate to high, and were all statistically significant at $p < 0.001$. The item with the highest loading was Item 9 from the first dimension, with a non-standardized loading of 1.727 and a standardized loading of 0.846. Conversely, the item with the lowest loading on its factor was Item 1 from the fourth dimension, with a non-standardized value of 1.000 and a standardized loading of 0.423. The standardized loadings for all other items were above 0.42, with a ~~good~~ significance level of 0.001. Therefore, it can be concluded that the item loadings are very good, which indicates an acceptable level of validity for the measure.

Table 3: Saturation results of items on their factors

Saturations of items	Estimate	S.R.W	S . R	C . R	P
item 1 Factor 1	1,000	0,527			
item 2 Factor 1	1,473	0,75	0,111	13,221	***
item 3 Factor 1	1,534	0,731	0,117	13,055	***
item 4 Factor 1	1,142	0,558	0,103	11,089	***
item 5 Factor 1	1,392	0,66	0,113	12,319	***
item 6 Factor 1	1,536	0,778	0,114	13,486	***
item 7 Factor 1	1,392	0,743	0,106	13,165	***
item 8 Factor 1	1,311	0,674	0,105	12,482	***
item 9 Factor 1	1,727	0,846	0,123	14,038	***
item 10 Factor 1	1,362	0,576	0,12	11,328	***
item 11 Factor 1	1,511	0,751	0,114	13,229	***
item 12 Factor 1	1,364	0,687	0,108	12,606	***
item 13 Factor 1	1,528	0,79	0,113	13,579	***
item 14 Factor 1	1,48	0,748	0,112	13,211	***
item 15 Factor 1	1,153	0,626	0,097	11,937	***
item 16 Factor 1	1,181	0,578	0,104	11,353	***
item 1 Factor 2	1,000	0,637			
item 2 Factor 2	1,065	0,666	0,073	14,569	***
item 3 Factor 2	1,013	0,642	0,072	14,137	***
item 4 Factor 2	1,029	0,654	0,072	14,36	***
item 5 Factor 2	1,108	0,691	0,074	15,02	***
item 6 Factor 2	0,988	0,639	0,07	14,081	***
item 7 Factor 2	1,053	0,671	0,072	14,659	***
item 8 Factor 2	1,032	0,663	0,071	14,511	***
item 9 Factor 2	0,987	0,639	0,07	14,086	***

Saturations of items	Estimate	S.R.W	S . R	C . R	P
item 10 Factor 2	1,086	0,685	0,073	14,903	***
item 11 Factor 2	1,039	0,669	0,071	14,616	***
item 12 Factor 2	1,021	0,659	0,071	14,435	***
item 13 Factor 2	1,044	0,67	0,071	14,637	***
item 14 Factor 2	0,708	0,472	0,066	10,785	***
item 15 Factor 2	0,555	0,448	0,054	10,308	***
item 1 Factor 3	1,000	0,732			
item 2 Factor 3	1,045	0,708	0,059	17,724	***
item 3 Factor 3	0,968	0,663	0,058	16,546	***
item 4 Factor 3	1,057	0,788	0,053	19,855	***
item 5 Factor 3	0,971	0,741	0,052	18,602	***
item 6 Factor 3	0,92	0,665	0,055	16,599	***
item 7 Factor 3	1,224	0,859	0,056	21,791	***
item 8 Factor 3	1,012	0,735	0,049	20,811	***
item 9 Factor 3	0,924	0,673	0,055	16,781	***
item 10 Factor 3	1,036	0,771	0,053	19,387	***
item 11 Factor 3	0,953	0,695	0,055	17,382	***
item 12 Factor 3	0,778	0,602	0,052	14,946	***
item 13 Factor 3	0,803	0,564	0,058	13,964	***
item 1 Factor 4	1,000	0,423			
item 2 Factor 4	1,003	0,469	0,129	7,803	***
item 3 Factor 4	1,047	0,449	0,138	7,595	***
item 4 Factor 4	1,211	0,51	0,149	8,12	***
item 5 Factor 4	0,927	0,428	0,125	7,389	***
item 6 Factor 4	0,948	0,438	0,126	7,514	***
item 7 Factor 4	1,224	0,55	0,145	8,45	***
item 8 Factor 4	1,024	0,5	0,127	8,07	***
item 9 Factor 4	1,098	0,53	0,133	8,282	***
item 10 Factor 4	1,081	0,468	0,139	7,756	***
item 11 Factor 4	1,001	0,447	0,132	7,567	***
item 12 Factor 4	0,994	0,494	0,124	8,017	***
item 13 Factor 4	1,022	0,482	0,129	7,895	***

Table 3: Construct Validity Indicators for the Mental Motivation Model.

Factors	CR	AVE	mental focus	learning orientation	creative problem solving	creative problem solving	cognitive integration
mental focus	0.896	0.523	0.723				
learning orientation	0.851	0.446	0.230-***	0.667			
creative problem solving	0.889	0.546	0.456	0.201	0.738	0.738	
cognitive integration	0.752	0.282	0.115	0.062	0.331	0.331	0.531

It can be observed from the table of the Average Variance Extracted (AVE) that the AVE values for the four factors are as follows:

- The first dimension (Mental Focus) has a value of 0.523, which is an acceptable value.
- The second dimension (Learning Orientation) has a value of 0.446, which is unacceptable because it is less than 0.50.
- The third dimension (Creative Problem-Solving) has a value of 0.546, which is also acceptable as it is greater than 0.50.
- The fourth dimension (Cognitive Integration) has a value of 0.28, which is also unacceptable as it does not exceed 0.50. This does not support the current model under study.

XI.Construct Reliability:

This type of reliability measures the consistency of the instrument used in the study, as theorized. To examine the reliability indicators of the research instrument, the scale's reliability was calculated using different reliability methods tests.

Table: Construct Reliability

factors	Crombach Alpha	Construct Reliability
mental focus	**0.792**	**0.896**
learning orientation		**0.851**
creative problem solving		**0.889**
cognitive integration		**0.752**

Based on Table (05), it is noted that Cronbach's alpha reliability coefficient yielded a result of (0.792), indicating that the scale, with its four dimensions, possesses a good reliability within the study sample. As for construct reliability, it is a type of reliability that measures the consistency of the scale used in the study as theorized. All the construct reliability results for its four dimensions, as shown in the table, indicate that the scale has an excellent reliability, as its results were above 0.70. Consequently, these results support the acceptance of the hypothesis stating that the California Measure of Mental Motivation possesses a high level of reliability.

Results

The current research aimed to verify the factor structure of the California Measure of Mental Motivation among Algerian university students and to confirm the fit of the proposed model for this measure with the data derived from the study sample. To validate this model, it was applied to a sample of 631 university students. Using the principal axes method with oblique rotation, the results revealed a four-factor structure with 57 statistically significant items, while the other 15 items were not statistically significant and were therefore excluded. To ensure that the model achieved sufficient fit indices for its adoption in the Algerian context, the model was subjected to first-order confirmatory factor analysis based on the results of the exploratory factor analysis. By following a series of steps using the AMOS program to assess the model's fit to the data, the results showed that the California Measure of Mental Motivation possesses sufficient goodness-of-fit indices for its adoption and acceptable psychometric properties (validity and reliability).In light of the findings of the current study, the researcher recommends conducting further studies on the California Measure of Mental Motivation, particularly focusing on the two dimensions of Learning Orientation and Cognitive Integration.

Conclusion

Psychological and educational tests and measures are crucial tools for data collection and decision-making. However, a significant problem in Algeria is the lack of standardized tests adapted to the Algerian context. In Algeria, the lack of standardized tests adapted to its context has become an issue. Specialists often apply tests imported from abroad, which were developed in cultural environments different from Algeria's, without verifying their validity in the respective environment. This can lead to misleading results, as the content of many of these tests does not align with the culture of our society. In conclusion, this study recommends conducting further research involving different contexts and samples, as the findings are inherently constrained by the specific human and temporal context in which the measure was applied. It is essential to verify the validity of the factor structure across diverse environments and to explore the possibility of establishing a unified structure that would allow for the consistent application of the measure.

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