Psychometric Validation of the Psychological Competitiveness Scale: A Study on Iranian University Students in Online Education

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ABSTRACT

Background: Competitiveness is an essential psychological concept that affects various aspects of life. As online classes transform the educational landscape, it is essential to explore their effects on student competitiveness. This study sought to validate the Competition Psychology Scale for College Students (CPS-CS) specifically for Iranian university students involved in online learning.

Methods: This cross-sectional survey utilized a psychometric approach and validation methods, targeting students at Tehran University during the first semester of the 2022-2023 academic year. A total of 1,231 students were selected through stratified sampling. The study employed the CPS-CS and the Hyper-Competitive Attitude (HCA) scale. The evaluation of content, concurrent, and construct validity, along with internal reliability, was conducted rigorously.

Results: The CPS-CS demonstrated excellent content validity. Its concurrent validity indicated a positive correlation with the HCA scale (r=0.763, P<0.001). Exploratory Factor Analysis (EFA) confirmed a three-factor structure—competitive learning, performance, and relationships—accounting for 63.829% of the variance. The Kaiser-Meyer-Olkin (KMO) measure was 0.908, indicating high common variance, which is suitable for factor analysis. Bartlett's test supported this with a Chi-Square of 4622.140 (df=120, P<0.001). Confirmatory Factor Analysis (CFA) validated the three-factor model with strong fit indices. Reliability assessments indicated high internal consistency, with an overall Cronbach's alpha of 0.865 and values ranging from 0.880 to 0.915 for each factor, along with significant test-retest reliability (r=0.714, P<0.001). No significant differences were found in competitiveness scores between groups (P=0.10).

Conclusion: The CPS-CS, with its tri-dimensional structure, has been validated for Iranian online students, proving to be a reliable tool for assessing competitiveness. Further validation in diverse settings is suggested.

Keywords: Competitiveness, Students, Education, Distance, Validation, Psychometric, Online Education

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Introduction

Online classes have revolutionized the educational landscape, offering students unparalleled access to diverse learning resources, flexible scheduling, and reduced commuting costs (1). Virtual classrooms, however, are not without their challenges. Students often face obstacles such as limited physical and social interaction, feelings of isolation, and difficulties staying motivated and engaged amidst distractions and technical issues (1, 2). Such challenges significantly affect their psychological well-being and academic success (3, 4).

In the wake of the COVID-19 pandemic, the adoption of online education has accelerated globally, becoming an essential and inescapable mode of learning (5, 6). This shift has underscored the need to address the challenges mentioned earlier to ensure that online learning remains a viable and effective educational option.

One of the psychological factors that can influence the students' experience and outcome in online classes is competitiveness. Competitiveness is the degree of willingness and ability of an individual to participate in competitive activities, which can be evaluated based on different dimensions such as attitude, motivation, behavior, and outcome (7, 8). Competitiveness can positively or negatively affect students, depending on the type and level of competitiveness. For example, competitiveness can create motivation, effort, creativity, and progress in students, but it can also lead to stress, tension, prejudice, and destruction in competitive educational activities (9, 10). Therefore, competitiveness as a psychological concept must be examined and measured in online classes.

Measuring and evaluating students' competitiveness in online classes is crucial for several reasons. First, it can help identify students' strengths and weaknesses and provide them with feedback and guidance. Second, it can help determine the desirable competitiveness level and design appropriate educational and counseling programs to enhance or reduce competitiveness. Third,

it can help to evaluate the effectiveness of these programs and interventions and monitor the changes and outcomes of competitiveness (11). To accurately measure competitiveness in online classes, we require reliable assessment tools that can capture its various dimensions and aspects (1).

Various scales have been designed to measure this concept based on different dimensions and aspects of competitiveness (12). Some of these scales are multidimensional, and some are unidimensional. For instance, the Competitive Attitude Scale (CAS), which was presented by Ryckman and colleagues (1993), consists of five factors, each of which represents an aspect of competitiveness (13). At the same time, the Hyper-Competitive Attitude (HCA) scale, which was presented by Ryder and colleagues (2006), has only one factor that measures the hypercompetitive attitude (14). However, both scales may have less efficiency in online environments since these environments have specific conditions and variables that can affect individual competitiveness (15). Suppose that in online environments, an individual may compete with people who are geographically, culturally, and socially distant from him or her, which may affect his or her attitude and motivation. Also, an individual may pursue different goals and values in competition, which may not be compatible with the existing scales (16, 17).

One of the new tools for measuring competitiveness is the Psychological Competitiveness Scale (CPS-CS), introduced by Liu and colleagues in 2022. This scale is a new and valid tool for measuring competitiveness, but it has only been tested on students in China (18). Therefore, there is a need to examine the validity and reliability of this scale in different communities and educational environments. In particular, this scale can help measure students' competitiveness in online classes, which have become popular during the COVID-19 pandemic. However, no investigation has been carried out in this area.

Therefore, validating the CPS-CS scale is necessary as it will provide a valid and reliable

tool for measuring the competitiveness of students in online classes, which is a critical factor for their academic success and well-being. It will also contribute to the literature on cross-cultural adaptation and validation of psychological scales and the application of normalization process theory in online education. This research will provide valuable insights for researchers, educators, counselors, and policymakers focused on understanding and improving student competitiveness in online learning environments.

Validation of a measurement scale involves assessing its accuracy and precision in measuring the intended concept. There are different types of validation, each chosen according to the purpose and nature of the scale. For instance, psychometric validation examines the alignment of the scale with the theoretical concept and the factor model. Adaptive validation examines the alignment of the scale with the target society and culture. Normalization validation examines the normal distribution and reference values of the scale.

Considering the significance of competitiveness in online classes and the need to measure it, this research aimed to validate the Competition Psychology Scale for College Students (CPS-CS) in online classes. This research can provide a valid and reliable tool for measuring students' competitiveness in online classes, thereby contributing to the advancement of knowledge and research in this area.

Methods
Study Design and Setting
This cross-sectional survey employed a psychometric methodology to validate the CPS-CS scale specifically for Iranian university students involved in online learning. The research was carried out during the first semester of the 2022-2023 academic year, involving students from Tehran University.

The CPS-CS scale was initially developed by Liu and colleagues (18) for a Chinese academic context. For the current study, this scale underwent a Persian translation through a bidirectional translation method, ensuring linguistic precision and cultural adaptability without resorting to an intermediary language like English. This method has received confirmation of its validity in prior research, making it an appropriate choice for the Iranian student population. For validation, the construct validity was assessed using both exploratory and confirmatory factor analyses.

The executive framework of the research depicted in Figure 1 encompasses the processes of translation, conducting a pilot study, assessing content validity, reliability, and concurrent validity, along with determining structural validity of the data.
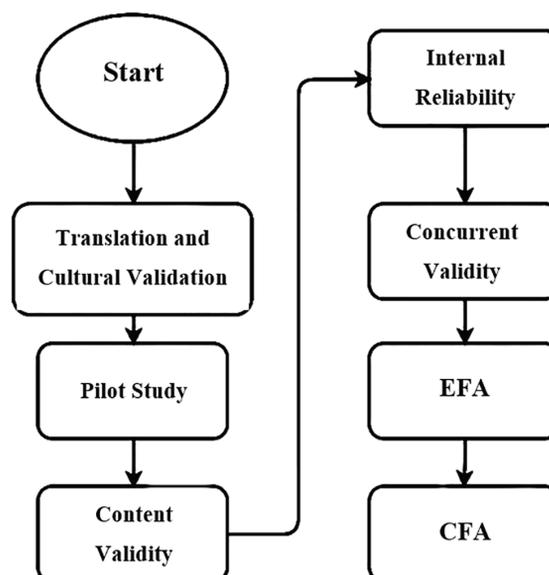

Figure 1: Executive framework of the research

Participants and Sampling
The research sample was drawn from Tehran University, Iran, for the 2022-2023 academic year, with a total population of approximately 56,000 individuals. The sample size required for assessing concurrent validity was determined using Krejcie and Morgan's table and Cochran's formula (19, 20):

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left[\frac{z^2 pq}{d^2} - 1\right]}$$

In this formula, n represents the sample size,

Z=1.96 corresponds to the z-score for a 90% confidence level, P=0.5 and q=0.5 denote the estimated proportions of the characteristic being examined in the population, d=0.05 signifies the acceptable margin of error, and N=56,000 is the total population size. Based on the calculations using Cochran's formula (20), an estimated sample size of approximately 380 was determined. Considering that the data collection method involved electronic questionnaires and previous research has reported that the typical response rate for online surveys is approximately 25%, we distributed the questionnaire link to 1,300 students selected through a stratified sampling approach across multiple faculties.

Considering that the main aim of this study was to examine construct validity and evaluate the instrument's psychometric properties, previous research has consistently shown that larger sample sizes generally produce more reliable and robust findings (21-23).

The literature indicates that the ideal sample size for Exploratory Factor Analysis (EFA) typically ranges from 10 to 20 participants for each questionnaire item (22). In this research, a ratio of 28 participants per item was established, resulting in a necessary sample size of 448. Similarly, for Confirmatory Factor Analysis (CFA), the literature recommends a sample size of 10 to 20 participants per item (22). In this case, the ratio was 22 participants per item, resulting in a necessary sample size of 352.

The Bont formula was utilized to determine the sample size needed for reliability testing. This formula is based on the subject-to-item ratio and is expressed as:

$$n = \left(z\left(1 - \frac{\alpha}{2}\right) + z\left(1 - \frac{e}{2}\right) \right)^2 (k - 1)$$

$$(e^2(k\rho + 1 - \rho))n = (k - 1)(e^2(k\rho + 1 - \rho))$$

$$(z(1 - \tfrac{\alpha}{2}) + z(1 - \tfrac{e}{2}))^2$$

Where *n* represents the sample size, *k* denotes the number of survey items, ρ is the expected Intraclass Correlation Coefficient (ICC), *e* signifies the margin of error, α is the level of significance, and $z\left(1 - \frac{\alpha}{2}\right)$ and $z(1 - \frac{e}{2})$

are the z-scores corresponding to the specified α and *e*. In this study, the target ICC was set at 0.8, with a margin of error of 0.05 and a significance level of 0.05. Substituting these values into the formula yielded a required sample size of 244 for reliability testing, subsequently adjusted to 250 for this research.

Participants eligible for this study were individuals enrolled at Tehran University who had engaged in electronic learning for at least one semester and consented to participate in the research. Exclusions were made for participants who did not fully complete the survey, skipped any questions, provided inconsistent or contradictory answers, or expressed negative sentiments or discomfort during the process.

Tools/Instruments

The data collection tools included the CPS-CS and the HCA scales.

CPS-CS Scale: This scale is a comprehensive 16-item measure designed to evaluate competitive tendencies across three distinct facets: Competitive Learning with seven items, Competitive Educational Activities with five items, and Social Relationships with four items. Participants rated each statement on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Scores for Competitive Learning varied between 7 to 35, for Competitive Educational Activities from 5 to 25, and for Social Relationships between 4 to 20. Cumulative scores on the scale range from 16 to 80, with higher scores indicating an increased level of competitiveness. The original questionnaire developed by Liu and colleagues encompassed these identical categories, and the translation preserved the conceptual integrity of the original framework. The translation was performed using the forward-backward method, a widely accepted standard for ensuring the accurate translation of psychological assessments. The scale has demonstrated well-established validity and reliability. A panel of ten experts in educational psychology evaluated the content validity, with the Content Validity Ratio

(CVR) and Content Validity Index (CVI) for all components surpassing the 0.7 threshold (24, 25). The structural validity was endorsed by CFA, affirming the appropriateness of the tripartite model. Reliability was ascertained using Cronbach's alpha coefficient and the item discrimination index. The Cronbach's alpha for the entire instrument was 0.91, with individual dimensions ranging from 0.82 to 0.88. Each item's discrimination index exceeded 0.4, attesting to the scale's reliability (18).

HCA Scale: The HCA scale refers to the Hyper-Competitive Attitude instrument, which consists of 12 items based on Rife and Berger's (1999) theory of hypercompetition. It encompasses two domains: hypercompetitive attitudes within the workplace (W) with six items, and within social settings (S) with six items. Participants indicate their level of agreement on a five-point Likert scale from one (Strongly Disagree) to five (Strongly Agree). Individual item scores vary from one to five, with the aggregate score ranging from 12 to 60, and higher totals reflecting a more pronounced hypercompetitive mindset. The instrument's validity and reliability are robust. Four organizational psychology and competition specialists assessed its content validity, with the CVI and CVR indices for all items exceeding the 0.8 mark. Its structural validity was appraised through CFA. The bifactorial structure was found to be a good representation of the data, and both dimensions demonstrated substantial factor loadings. The scale's reliability was evaluated through Cronbach's alpha coefficient and the item discrimination index. The overall Cronbach's alpha coefficient was 0.87, with each dimension scoring between 0.81 and 0.84. All items had a discrimination index above 0.4 (13, 26). The scale's content validity has been ratified within Iran, and its reliability is further corroborated by a Cronbach's alpha coefficient of 0.91 (27).

Translation and Cultural Validation

The research team undertook the translation and cultural adaptation of the questionnaire with permission from the original creators. The back-translation technique was employed alongside a cultural validation and translation assessment toolkit. Two linguists proficient in English and Persian translated the questionnaire into Persian and back into English. Additionally, a native English speaker with a strong command of Persian contributed to the process. Following a consensus among the translators, the finalized questionnaire version was obtained. Community members who were bilingual and bicultural examined the questionnaire's content for cultural relevance and suitability for the target audience. They also verified the translation's clarity and accuracy. The researchers made revisions to the questionnaire incorporating this feedback (28).

Pilot Study

A preliminary study was conducted with 30 students, comprising 15 males and 15 females, with an average of 22.4 years (SD=2.1). This pilot study aimed to evaluate the practicality and receptiveness of the CPS-CS scales within the Iranian setting and determine the necessary sample size for the primary research. The pilot study's findings indicated favorable psychometric qualities for the CPS-CS scales, and participants found the questions clear and straightforward. The study's subject matter also garnered positive interest and participant feedback.

Data Collection

We used Google Forms software and an electronic sampling method to obtain the participants' responses to the CPS-CS and the HCA scales. Each questionnaire had a QR code students scanned with their smartphone to resolve the relevant page in Google Forms. They completed and submitted the questionnaire. The information was securely stored in an online database using electronic methods. The researchers obtained informed consent from the students before answering the questionnaire. The data collection process lasted two months, from May to June 2023. The researchers monitored the data quality

and completeness weekly and followed up with the participants who had not completed the questionnaire or had missing data. The researchers also performed data cleaning and screening procedures to identify and remove outliers, duplicates, and inconsistent responses. The data collection resulted in 948 valid responses from the participants, which were used for further analysis.

Validity and Reliability - The research performed a comprehensive evaluation of the questionnaire's validity and reliability using several recognized methods as follows:

Content validity: evaluating the relevance and comprehensiveness of the questionnaire items by calculating two standard indices of CVI and CVR based on the opinions of 15 experts, which included two psychologists, three psychometricians, one expert in educational technology, two educational managers, and two counselors, all holding PhD degrees, as well as one educational psychologist, one industrial psychologist, one social psychologist, one clinical psychologist, and one school psychologist. In this study, questions with a CVR higher than 0.49 are accepted unconditionally, and questions that did not achieve the minimum validity ratio are removed from the questionnaire. Also, CVI higher than 0.79 leads to the confirmation of the content validity of the questionnaire (24, 25)

Concurrent validity: The concurrent validity was assessed using Pearson and Spearman correlation between the CPS-CS and HCA scores.

Construct validity: Construct validity was explored using EFA and CFA within the Structural Equation Modeling (SEM) framework. The study utilized EFA to assess the applicability of the factor structure proposed in the original article for the Iranian sample. EFA also explored potential improvements to the factor structure by modifying the questionnaire items. The EFA process involved the Principal Axis Factoring approach with Varimax rotation (29). The number of factors in EFA was determined using both the scree plot method and

Kaiser's criterion. The scree plot, a graphical representation of the factors' eigenvalues against their number, helped identify the point at which the plot begins to level off, indicating the optimal number of factors. Kaiser's criterion recommends retaining only those factors with eigenvalues exceeding one. These two approaches were applied concurrently to finalize the factor count. The dataset's suitability for factor analysis was confirmed before EFA through the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity, with a KMO value above 0.60 affirming the data's appropriateness for this analysis (30).

CFA assessed the fit of a hypothetical factor model with the observed data. Several fit indices were used to evaluate the model fit, such as Root Mean Square Error of Approximation (RMSEA; acceptable if less than 0.05), confidence interval (CI; acceptable if includes 0.05 or less), the comparative fit index (CFI; acceptable if greater than 0.95), Normed Fit Index (NFI; acceptable if greater than 0.95), Non-Normed Fit Index (NNFI; acceptable if greater than 0.95), Incremental Fit Index (IFI; acceptable if greater than 0.95), the Standardized Root Mean Square Residual (SRMR; acceptable if less than 0.08), Goodness of Fit Index (GFI; acceptable if greater than 0.90), and Adjusted Goodness of Fit Index (AGFI; acceptable if greater than 0.90) (31).

Internal reliability: The internal reliability was evaluated using split-half methodology, test-retest reliability, and Cronbach's alpha coefficient.

Data Analysis

The analysis of the data was executed using SPSS 25 and Lisrel 8.8. Descriptive statistical measures such as mean, standard deviation, frequency, and percentage were utilized to characterize the demographic profile of the participants. Inferential statistical tools were applied to ascertain the questionnaire's validity and reliability, including Pearson and Spearman correlation coefficients, EFA, CFA, Cronbach's alpha coefficient, test-retest

reliability, and the independent samples t-test. A significance threshold of 0.05 was upheld for all analyses.

Ethics - Ethical approval was obtained from the Ethics Committee of the Islamic Azad University, Arak Branch, following the guidelines outlined in the Helsinki Declaration. The research team consistently upheld ethical principles during the study and engaged with the ethics committee as required. All participants were provided informed consent after receiving comprehensive information regarding the study's objectives and methodologies, their right to withdraw at any point, and the confidentiality of their data. Additionally, proactive strategies were established to address any potential ethical concerns.

Results

Demographic Characteristics

Out of the 1,300 questionnaires distributed electronically, 1,231 participants responded. Nearly half of the respondents possessed an undergraduate degree (48.3%). Females constituted a slight majority at 52.5%. Most students were younger than 25 years (61.5%). The most common academic field was arts and humanities (25.5%). A significant portion of the respondents were unmarried (74.4%),

and a slight majority (52.1%) identified as local residents (Table 1).

Findings of Content Validity

Assessments conducted by 15 subject matter experts regarding content validity resulted in CVR scores ranging from 0.70 to 0.80 and CVI scores between 0.80 and 0.95 for the survey items. These values surpass the minimum thresholds of 0.49 for CVR and 0.79 for CVI according to Lawshe's criteria, thereby confirming the strong content validity of the survey in evaluating student competitiveness (Table 2).

In the EFA, the extraction index varied between 0.54 and 0.72, reflecting the degree to which each item contributes to the variance accounted for by the identified factors. Also factor analysis was conducted to validate the factor structure of the CPS-CS questionnaire within the Iranian sample. The KMO index for sampling adequacy was 0.941, indicating that a significant portion of the variance among variables could be attributed to common variance, thereby meeting the requirements for factor analysis. Bartlett's test of sphericity yielded a score of 4622.140 with 120 degrees of freedom and a significance level of $P<0.001$ (Table 2).

Table 1: Demographic Characteristics of Participants and Responses to the Questionnaire

Characteristics		Total (n=1231) n (%)	Concurrent (n=240) n (%)	Exploratory (n=427) n (%)	Confirmatory (n=331) n (%)	Reliability (n=233) n (%)
Educational level	Bachelor's Degree	595 (48.3)	103 (42.9)	214 (50.1)	162 (48.9)	116 (49.8)
	Master's Degree	432 (35.1)	94 (39.2)	155 (36.3)	109 (32.9)	74 (31.8)
	Doctoral Degree	204 (16.6)	43 (17.9)	58 (13.6)	60 (18.1)	43 (18.5)
Gender	Female	646 (52.5)	146 (60.8)	209 (48.9)	169 (51.1)	122 (52.4)
	Male	585 (47.5)	94 (39.2)	218 (51.1)	162 (48.9)	111 (47.6)
Age	Less than 25 years old	757 (61.5)	148 (61.7)	251 (58.8)	202 (61.0)	156 (67.0)
	More than 25 years old	474 (38.5)	92 (38.3)	176 (41.2)	129 (39.0)	77 (33.0)
Field of study	Humanities	314 (25.5)	61 (25.4)	104 (24.4)	91 (27.5)	58 (24.9)
	Basic Sciences	243(19.7)	46 (19.2)	83 (19.4)	66 (19.9)	48 (20.6)
	Medical Sciences	216 (17.5)	39 (16.3)	76 (17.8)	52 (15.7)	49 (21.0)
	Engineering/Technology	281 (22.8)	65 (27.1)	92 (21.5)	69 (20.8)	55 (23.6)
	Agriculture/Veterinary Sciences	97 (7.9)	15 (6.3)	40 (9.4)	25 (8.5)	14 (6.0)
	Arts	80 (6.5)	14 (5.8)	32 (7.5)	25 (7.6)	9 (3.9)
Marital status	Single	916 (74.4)	173 (72.1)	322 (75.4)	249 (75.2)	172 (73.8)
	Married	315 (25.6)	67 (27.9)	105 (24.6)	82 (24.8)	61 (26.2)
Residence status	Resident	641 (52.1)	114 (47.5)	230 (53.9)	169 (51.1)	128 (54.9)
	Non-resident	590 (47.9)	126 (52.5)	197 (46.1)	162 (48.9)	105 (45.1)

Table 2: Content and construct validity characteristics (Rotated Component Matrix)

Item	CVR	CVI	Extraction	Factors		
				Competitive learning	Competitive performance	Competitive relationship
i1	0.80	0.90	0.70	0.79		
i2	0.70	0.80	0.68	0.77		
i3	0.80	0.90	0.65	0.77		
i4	0.70	0.80	0.66	0.77		
i5	0.70	0.80	0.70	0.81		
i6	0.70	0.80	0.65	0.76		
i7	0.70	0.80	0.64	0.77		
i8	0.70	0.80	0.62		0.70	
i9	0.70	0.85	0.61		0.68	
i10	0.70	0.90	0.61		0.69	
i11	0.70	0.85	0.63		0.70	
i12	0.70	0.85	0.58		0.64	
i13	0.80	0.95	0.60			0.69
i14	0.80	0.90	0.61			0.66
i15	0.80	0.90	0.72			0.76
i16	0.70	0.80	0.54			0.62
Eigenvalues				7.91	2.38	1.01
Percent of Variance				49.46	14.86	6.33
Cumulative Variance				70.65		

KMO=0.941, Bartlett's test of sphericity: P<0.001

As demonstrated in Table 2, the EFA revealed three factors from 16 variables. This determination was supported by the convergence observed in the scree plot and compliance with Kaiser's criterion, indicating the necessity of extracting three factors, each possessing an eigenvalue exceeding one (Figure 2).

The CFA demonstrated a satisfactory alignment between the theoretical model and the empirical data. The fit indices are summarized in Table 3, where the values align with established standards indicative of a good fit. Moreover, all factor loadings surpassed 0.40, denoting that the factors sufficiently elucidate the variables. These findings support the model's validity (Table 3 and Figure 3).
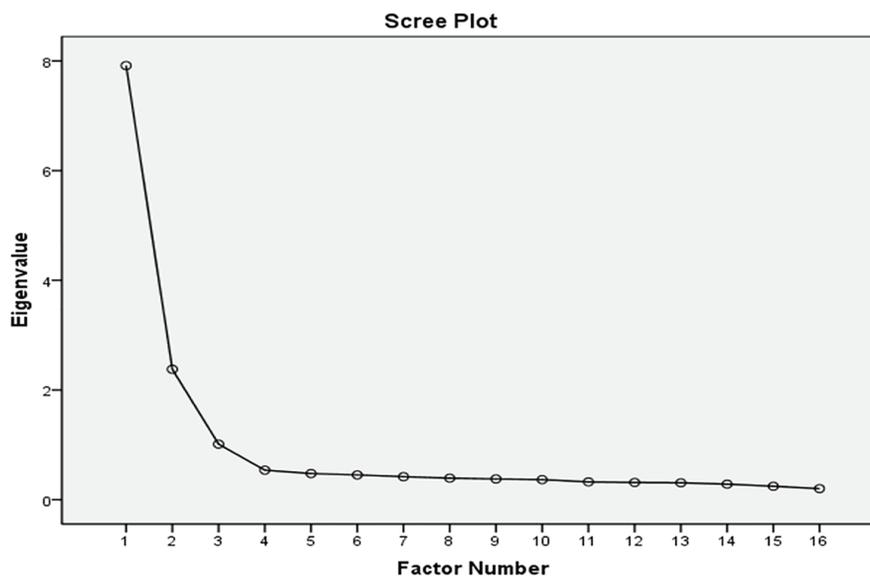

Figure 2: Scree plot of the eigenvalues of the factors

Table 3: Summary of the Confirmatory Factor Analysis Fit Indices

Fit Index	Obtained Value	Standard Benchmark
χ2 (Chi-square)	152.10	-
P value	0.00077	>0.05
RMSEA	0.039	<0.05
90% CI for RMSEA	[0.026, 0.051]	-
CFI	0.99	>0.90
NFI	0.99	>0.90
NNFI	0.99	>0.90
IFI	0.99	>0.90
SRMR	0.028	<0.08
GFI	0.95	>0.90
AGFI	0.93	>0.85

* RMSEA: Root Mean Square Error of Approximation; CI for RMSEA: Confidence Interval; CFI: Comparative Fit Index; NFI: Normed Fit Index; NNFI: Non-Normed Fit Index; IFI: Incremental Fit Index; SRMR: Standardized Root Mean Square Residual; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index
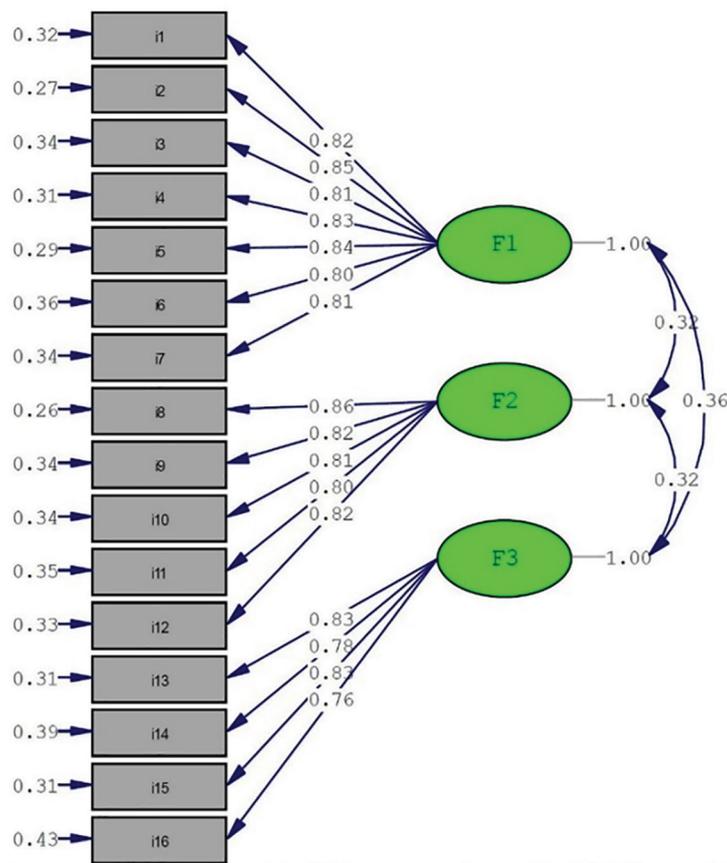
Chi-Square=152.10, df=101, P-value=0.00077, RMSEA=0.039

Figure 3: Factor loadings and model fit indices of the Confirmatory Factor Analysis

Findings of Concurrent Validity

Analysis of concurrent validity revealed a robust and direct correlation between CPS-CS and HCA scores (r=0.763, P=0.001), signifying a direct relationship where an increase in CPS-CS scores corresponds with an elevation in HCA scores. This underscores the concurrent validity of both scales, confirming that CPS-CS is an effective measure of competitiveness alongside HCA (Table 4).

Table 4: Concurrent Validity Analysis between CPS-CS and HCA Scores (N=240)

Correlation Coefficient (r)	P value	Sample Size (N)	Interpretation
0.763	0.001	240	Strong, positive correlation between CPS-CS and HCA scores, indicating concurrent validity.

* CPS-CS: Competition Psychology Scale for College Students; HCA: Hyper-Competitive Attitude

Table 5: Summary of Independent t-Test Results for Competitiveness Scale Scores

Scale	Group	Mean±SD	t	P value	MD	CI
Competitive Learning	Iranian	21.68±8.33	2.17	0.03	1.26	-0.24, 2.76
	Chinese	20.42±5.20				
Competitive Educational Activities	Iranian	15.66±5.95	3.51	<0.01	1.44	0.64, 2.24
	Chinese	14.22±4.67				
Competitive Educational Activities	Iranian	12.46±4.76	-0.76	0.45	-0.25	-0.92, 0.42
	Chinese	12.71±3.27				
Overall Competitiveness	Iranian	49.81±15.95	1.66	0.10	2.47	-0.55, 5.49
	Chinese	47.34±11.03				

* SD: Standard Deviation; MD: Mean Difference; CI: Confidence Interval (at 95% level)

Reliability

The total Cronbach's alpha for the questionnaire was 0.865. The reliability coefficients for the first and second halves of the test were 0.879 and 0.804, respectively. The reliability values for the first, second, and third factors were also 0.915, 0.880, and 0.881, respectively. These metrics suggest that the questionnaire and its factors possess commendable internal consistency. Furthermore, the correlation between the test's two iterations, spaced two weeks apart, was statistically significant at the 0.05 level with a coefficient of 0.714 (P=0.001). Cronbach's alpha values can range from 0 to 1, with higher values indicating greater internal consistency among the items or dimensions measured by the questionnaire (32). Cronbach's alpha values in scientific research are commonly categorized as follows: a value of less than 0.6 indicates weak reliability, while values between 0.6 and 0.7 suggest moderate reliability. Values ranging from 0.7 to 0.8 reflect good reliability, and those above 0.8 signify excellent reliability. These categories reflect a consensus among researchers regarding the interpretation of Cronbach's alpha, with a threshold of 0.7 commonly accepted as the minimum standard for reliability across various disciplines (33, 34). The Cronbach's alpha obtained in this research indicates that the reliability of the questionnaire has been confirmed as good to excellent.

Comparison of Competitiveness Scale Scores in Iranian and Chinese Students

The comparative analysis via independent t-test of competitiveness scale scores among Iranian and Chinese students showed uniformity across all metrics. The collated data is depicted in Table 5. These insights corroborate the dependability and authenticity of the competitiveness scale for student groups in Iran and China, consistent with the initial investigation findings.

Discussion

This study was one of the initial efforts to validate the CPS-CS in Iranian students. It examined the content, concurrent, and construct validity along with internal and test-retest reliability of the scale, employing appropriate statistical indices.

The results demonstrated that the student competitiveness questionnaire has significant content validity, with CVR values ranging from 0.70 to 0.80 and CVI values from 0.80 to 0.95 for the questionnaire items. These results surpass the Lawshe table's minimum requirements of 0.49 for CVR and 0.79 for CVI (25). This aligns with the standards

set by Waltz and Bausell (24), confirming the questionnaire's high content validity in measuring student competitiveness. These findings are consistent with those of Liu and colleagues (2024), Liu and colleagues (2023), Zhang and colleagues (2023), and Zhang and colleagues (2023) (18, 35-37). In explaining this congruence, it can be pointed out that the questionnaire was constructed using valid methods and acceptable standards, and the content scale aligns with the intended concept, capable of measuring various dimensions of competitiveness.

The results indicated that the student competitiveness questionnaire has a high concurrent validity compared to the HCA scale, as evidenced by a robust and positive correlation (r=0.763, P=0.001). This suggests that as the CPS-CS score increases, so does the HCA score, indicating that the CPS-CS is as effective in measuring competitiveness as the HCA scale. This finding is consistent with the results of other authors (18, 38). The scientific rationale for this observation is that the questionnaire, employing a correlational approach, demonstrates a robust positive relationship with an established criterion scale in the domain of competitiveness. This indicates that the questionnaire effectively reflects the levels of competitiveness in alignment with the criterion scale.

The results of the EFA showed that the student competitiveness questionnaire has a three-dimensional factor structure, which includes competitive learning, competitive performance, and competitive relationship. This finding is consistent with the results of other studies (18, 38, 39). The scientific rationale behind this finding is that the questionnaire, employing the EFA method, can effectively differentiate various dimensions of competitiveness and enhance the total variance explained.

The results of the CFA showed that the proposed model for the student competitiveness questionnaire has a good fit with the data and the model fit indices are within the acceptable range. This finding is consistent with the results of previous research (38, 39). The underlying scientific rationale indicates that the three-dimensional model of the questionnaire, analyzed through the CFA method, demonstrates no significant difference with the data and can explain the observed variables well by the factors.

To enhance the comprehension of the research outcomes, the factor structure under scrutiny was juxtaposed with other competitiveness instruments, revealing a disparity in dimensionality. For instance, Gill and Deeter's (1988) sport competitiveness questionnaire enumerates five dimensions—competitiveness, effort, commitment, self-confidence, anxiety, and fear of failure (40). Similarly, Griffin's work (1990) competitiveness questionnaire articulates four dimensions—competitiveness, commitment, self-confidence, anxiety, and fear of failure (41). This dimension variation may reflect the distinct thematic competitiveness concerns in sports, work, and education. Nonetheless, this divergence does not imply a disconnection among the dimensions. Elements such as self-confidence and fear of failure are recurrent across all questionnaires, signifying their pivotal role in the construct of competitiveness. Conversely, dimensions like competitive learning and competitive performance are exclusive to the student competitiveness questionnaire, underscoring their pertinence in the academic context. Hence, the student competitiveness questionnaire is validated for its structural integrity and is deemed a reliable metric for assessing competitiveness among students in virtual learning environments.

Similarly, the analysis of the CPS-CS scale highlights a specific emphasis on competitive learning and educational activities. This is in contrast to the Competitiveness Orientation Measure (COM), which encompasses a broader range of dimensions, including general competitiveness, dominance, competitive emotions, and personal improvement (42). The COM is engineered as a versatile and encompassing measure for the nuanced and succinct appraisal of competitive drives across varied sectors such

as employment and athletics. As a result, while both instruments dissect distinct aspects of competition, the CPS-CS scale hones in on the ramifications of competitive dynamics within educational settings and their impact on social interrelations. In contrast, the COM casts a broader net, addressing competitive propensities across many arenas. This dichotomy in thematic concentration can be pivotal in selecting an apt evaluative tool tailored to specific research inquiries.

The findings demonstrated that the student competitiveness questionnaire possesses an acceptable level of internal consistency and test-retest reliability, both of which are essential for reliably assessing competitiveness levels over time. Specifically, the Cronbach's alpha value for the entire questionnaire was 0.865, indicating good internal reliability. For the first half of the test, Cronbach's alpha was 0.879; for the second half, it was 0.804, suggesting acceptable reliability. The individual factors of the questionnaire also demonstrated high reliability, with the first factor at 0.915, the second at 0.880, and the third at 0.881. Additionally, the test-retest reliability over a two-week interval showed a significant correlation of 0.714 ($P=0.001$), further confirming the stability of the questionnaire over time. This finding is consistent with the findings of the original author (18). The scientific rationale behind this finding indicates that the questionnaire demonstrates high internal consistency and homogeneity, as evidenced by Cronbach's alpha and the correlation between the two test administrations. Additionally, it exhibits temporal stability, ensuring the results' reliability.

This research demonstrated that the competitiveness scale is reliable and valid in both countries and is consistent with the findings of the original research conducted in China.

Limitations and Suggestions

This research presents several strengths, notably introducing a novel scale for assessing student competitiveness in Iran. However, it also has limitations. First, the sample was only from Tehran University and was not representative of other students. This may limit the generalizability of the results to other populations or contexts. Second, the cross-sectional method did not allow causal inferences between variables. Third, the quantitative methods did not consider qualitative factors of competitiveness. For instance, the students' motivations, attitudes, beliefs, or emotions that may influence their competitiveness were not explored. Moreover, the online learning environment may have specific features or challenges that affect the students' competitiveness, such as the quality of interaction, feedback, or support. These factors were not measured or controlled in this study.

We propose several directions for future investigations: First, conducting additional studies with larger and more diverse samples from various universities or countries would enhance the external validity and applicability of the CPS-CS scale, as well as the findings of this research. Second, employing longitudinal methods to investigate causal relationships would facilitate the examination of changes and effects related to competitiveness over time and across different contexts. Third, incorporating qualitative methods such as interview, observation or case study could provide insights into the qualitative aspects of competitiveness, leading to a more nuanced understanding of the phenomenon and its underlying mechanisms. Fourth, performing cross-cultural validation studies would assess the applicability and generalizability of the CPS-CS scale in various educational environments and societies, highlighting both the similarities and differences in competitiveness across diverse cultures and contexts.

Conclusion

This study aimed to validate the CPS-CS in Iranian students, providing a valuable tool for measuring competitiveness in online classes—a pressing need in today's educational landscape. The results of

this study demonstrated that the CPS-CS possesses robust psychometric properties, effectively capturing various dimensions of competitiveness. Comprising three factors—competitive learning, competitive performance, and competitive relationship— each aspect delineates crucial elements of competitiveness within an academic setting. Moreover, the findings align with other research in the field, suggesting that the CPS-CS is a suitable instrument for the Iranian context, reflecting the competitive dynamics prevalent in the society. This scale holds significant potential for researchers, instructors, and students who aim to assess competitiveness in online learning environments, fostering a deeper understanding of this construct. Applying the CPS-CS in Iran enriches the global discourse on student competitiveness, offering insights that may resonate across different cultural landscapes.

Abbreviations

CPS-CS: Competition Psychology Scale for College Students
HCA: Hyper-Competitive Attitude

Authors' Contribution

RH and DT were responsible for the initial drafting of the manuscript, while also carrying out the statistical analysis and its subsequent validation. AA, DT, and MJ conducted a thorough review and provided their endorsement of the final draft. All the authors approved the final manuscript.

Conflict of Interest

The authors declare that they have no financial or personal relationships that may be perceived as a potential conflict of interest.

Ethical Considerations

The study was executed strictly with ethical standards and received approval from the Research Ethics Committee of the Islamic Azad University of Arak Branch (Code: IR.IAU.ARAK.REC.1400.015), following the guidelines outlined in the Helsinki Declaration. All participants were given informed consent following a thorough explanation of the study's aims and methods, their right to withdraw at any time, and the confidentiality of their data.

Availability of Data and Materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The CPS-CS questionnaire utilized in this research is included in the supplementary file.

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