Research Article

Development, Validity, and Reliability of Adolescent Motivation Inventory-cerebral Palsy

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ABSTRACT

Objectives: Motivation is the most influential factor in the drive and performance of adolescents with cerebral palsy (CP). As identification and analysis of volition in Iranian adolescents with CP seem to be essential, designing appropriate tools for assessing their motivation is crucial. To achieve this goal, we developed an adolescent motivation inventory-CP (AMI-CP) and evaluated its psychometric properties.

Methods: In the first phase, item generation was conducted. Next, in the second phase, face and content validities of the items were assessed. Moreover, construct validity was assessed by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). A total of 304 adolescents with CP participated in the EFA, while 210 adolescents with CP participated in the CFA. Afterward, convergent and discriminant validities of the inventory were measured. Moreover, reliability was evaluated by calculating Cronbach α, McDonald's omega, average inter-item correlation, composite, and test re-test reliability. Lastly, the standard error of measurement (SEM) and the minimum detectable change (MDC) were applied.

Results: Five factors with 22 items were extracted by EFA, accounting for 50.42% of the variance. The results of model fit indexes confirmed the goodness-of-fit of the final model with 20 items. In addition, the AMI-CP had a Cronbach α value of 0.75 and an intra-class correlation coefficient of 0.94. Moreover, the SEM and MDC of the inventory were 2.63 and 7.31, respectively.

Discussion: The AMI-CP is a helpful measure of motivation in adolescents with CP. This inventory can enhance the assessment of the CP adolescents' motivation by evaluating values, interests, personal causation, and physical and social environments.

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Highlights

● The adolescent motivation inventory-cerebral palsy (AMI-CP) is a tool with good psychometric properties for intrinsic and extrinsic motivation measurement of adolescents with cerebral palsy (CP).

● The AMI-CP contains different aspects, such as values, interests, personal causation, and physical and social environments that affect CP adolescents' motivation.

● The AMI-CP provides a feasible and easy-to-administer inventory for rehabilitation therapists to determine aspects that affect the CP adolescents' motivation related to their occupational performance.

Plain Language Summary

Adolescents with CP need motivation to succeed in school, participate in and engage in social and recreational activities. To assess motivation in adolescents with CP, we need an appropriate tool. It is essential to have a valid and reliable assessment that matches our culture and contains several aspects of CP adolescents' perceptions of their motivation related to their necessities of life. The AMI-CP includes 20 items in five domains: Values, personal causation, interests, physical environment, and social environment. AMI-CP appears to be a helpful measure of motivation in adolescents with CP.

Introduction

Cerebral palsy (CP) is recognized as brain damage during the development of the central nervous system (CNS). It causes everlasting movement and posture impairment in children. CP is often associated with childhood communication and behavior impairments [1]. Furthermore, these CNS damages cause developmental deficiency in cognition, emotion, social, and motivation skills, symbolizing developmental changes throughout adolescence [2]. These impairments potentially lead to functional limitations and social participation restrictions throughout life [2]. To overcome these limitations, patients with CP must continuously receive rehabilitation services, cooperate with their intervention plans, participate in community actions, and adapt to their environment [3]. As a result, to achieve these goals, such as more school achievement and success in social participation, they should have a higher level of motivation [4], volition [5], and interests [6]. Motivation has been described as a state or an emotion and mainly unconscious with two dimensions: Intrinsic (refers to doing something because it is exciting or enjoyable inherently) and extrinsic (doing something because it leads to an external reason) [7].

On the other hand, volition refers to an unconscious act of free will, which is more like a trait [8]. One of the supreme dominant individual characteristics (personal) that regulate functional and motor consequences is mo-

tivation/volition [9, 10], which has an essential role in practice and new learning in CP survival [11]. However, the evidence indicates that school-age children and adolescents with CP exhibit considerably inferior ranks of mastery motivation compared to their typically developing age group [12, 13]. Therefore, it is essential to investigate the motivational level of adolescents with CP.

To assess motivation in adolescents with CP, we need an appropriate tool. Three rating scales have been used to measure motivation in school-aged children with motor delay or physical disability [14-16]: The dimensions of mastery questionnaire, version 18 (DMQ18) [14], the volitional questionnaire (VQ) [15], and the pediatric motivation scale (PMOT) [16] (Table 1). The DMQ18 (the school-age self-rating version), as the global discriminative measure of mastery motivation, provides an overall assessment of the mastery motivation of school-age children [14]. Mastery motivation is an unconscious talent that helps humans explore their environment [14]. While volition is a conscious act of free will, its assessment for adolescents with CP is vital. In addition, this tool does not assess the physical environment that affects the motivation of people with CP [17].

The VQ is an observational assessment tool that measures adolescents' motivation by examining their engagement in different occupational behaviors with subjective information about how the environment influences their volition [15]. Although the VQ was developed based on the model of human occupation (MOHO), it has not

Table 1. The review of motivation tools for the children of school-aged with a physical disability or motor delay

Author/ Year	Assessment	Purpose	Subscales	Population Assessed	Assessment Type	Reliability	Validity	Theoretical Approach
Morgan et al. 2015, [14]	Dimensions of mastery questionnaire, version 18 (DMQ18)	The DMQ18 (the school-age self-rating version), as the global discriminative measure of mastery motivation, provides an overall assessment of mastery motivation of school-age children	Cognitive/object persistence scale, gross motor persistence scale, social persistence/mastery motivation with adults scale, social persistence/mastery motivation with children/peers scale, mastery pleasure scale, negative reactions to challenge in mastery situations scales, general competence compared to peers scale	The infant version (6-23 months) The preschool version (2-6 years) school-age by adult version (students from first grade through high school)	Infant, preschool, school-age rated by adults, and school-age self-report	Test re-test reliability (ICCs 0.74 to 0.82 on instrumental subscales)	Good content validity construct validity: Five-factor Significant correlations between the DMQ18 cognitive/object persistence scale and behavioral persistence at puzzle tasks (r=0.42) and for persistence at all tasks (r=0.28).	Mastery motivation
De las Heras et al. 2007 [15]	Volitional questionnaire (VQ)	The VQ measures an adolescent's motivation by examining how the adolescent is engaged in different occupational behaviors with subjective information about how the environment influences the adolescent's volition	Exploration, competency, and achievement environment	≥8 years individuals with psychiatric disabilities and developmental disabilities	Observational assessment	Higher Inter-rater reliability for the instrument	Face and content validity Rasch analysis for construct validity	MOHO
Tatla et al. 2015 [16]	PMOT	The PMOT assesses the children and adolescents with head injuries during the therapy sessions	Interest/enjoyment, competence, relatedness, and autonomy (intrinsic motivation). Value/usefulness and effort/importance (extrinsic motivation and internal regulation).	8-18 years children and youth with ABI or complex developmental disabilities	Self-report	Test re-test reliability (r=0.97). Internal consistency for PMOT total (α=0.96) and subscales (α=0.79-0.91	Good content and face validity The PMOT and PVQ moderately correlated in the rehabilitation subsample (r=0.71, P<0.01); no correlation was found in the healthy subsample (P>0.05).	Self-determination theory

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been designed for people with CP, and the environment assessment is subjective. Also, inter-rater reliability and observer expectancy bias are two data collection problems of observational tools [18], so it is necessary to develop a self-report tool.

The PMOT assesses the motivation of children and adolescents with head injuries during therapy sessions [16]. PMOT is not a global tool, but it can determine a child's or adolescent's motivation during their therapy plan. Nevertheless, the PMOT does not assess the environment affecting motivation. The severe limitation of this field is the lack of comprehensive motivation evaluation for adolescents with CP based on occupational performance that measures intrinsic and extrinsic motivational factors. Motivational evaluation helps rehabilitation therapists make accurate clinical decisions, clarify the effect of motivation on the client's willingness to perform life roles and occupations, and cooperate more effectively during their rehabilitation intervention [19]. For this reason, the MOHO is used as a theoretical framework for developing the tool.

The present study has been designed to develop a reliable and valid inventory to measure motivation in adolescents with CP based on four reasons. First, based on literature [20, 21] and the MOHO website [22], a reliable and valid rating tool to measure motivation in adolescents with CP has not been developed to date. Second, intervention outcomes are influenced by the client's motivation [23]. Methodologically, motivation has a confounding effect on the result of the intervention in a clinical and research setting [23]. Consequently, assessing and controlling the motivation in both settings using valid tools are crucial. Third, since cost-effective interventions for CP is essential [24], an appropriate motivational tool for adolescents with CP can help reduce treatment sessions. Fourth, the construct of motivation is implicit and dynamic, which could be why it is difficult to measure [25]. Accordingly, a valid and reliable contextually specific assessment is needed to assess the several aspects of CP adolescents' perceptions of motivation related to their occupational performance. Based on these four reasons, this study was planned to develop and evaluate the psychometric properties of adolescent motivation inventory-CP (AMI-CP).

Materials and Methods

Study design

This is the second part of PhD occupational therapy thesis of the first author, which was designed using a

mixed method [26]. The first part is qualitative research published [17] and used for developing the AMI-CP. For creating and validating the inventory, several aspects of CP adolescents' motivation related to occupational performance were assessed based on some method [26, 27]. The present study had three phases: Phase 1, the item generation phase (from March 1 to June 6, 2019); phase 2, assessing face and content validities (from June 10 to July 3, 2019); phase 3, a cross-sectional survey of CP adolescents' responses to the inventory and investigation of the inventory's psychometrics (from July 4 to November 1, 2019) (Figure 1).

Phase 1: Item generation

The authors conducted the item generation. The items of AMI-CP were extracted through three steps. An extensive literature review was performed on the concept and available motivation and volition scales between 2000 and 2019 (step one). In addition, a qualitative study, using directed content analysis, was conducted concerning volition from the MOHO (step two) [17]. Lastly, the nominal group technique (NGT) was also applied (step three) [28].

The literature review aimed to compare, critically appraise, and precisely measure the quality of the measurement properties of all motivation and volition tools for people with a physical disability, such as adolescents with CP. A systematic search of computerized databases from March 2000 to March 2019 recognized papers in Medline, CINAHL, Embase, PsycInfo, Web of Science, and ERIC. The search used the subject heading (MeSH) terms and text words for "movement disorders," "physical disability," and "motor delay." MeSH terms and text words for "volition" and "motivation" unified with "outcome assessments" and "psychometrics" were used to emphasize search results on measures of motivation. Additional articles were identified through manual checking of citation tracking and reference lists.

Regarding the first part of the qualitative study [17], factors affecting motivation in adolescents with CP were volition (personal causation, values, and interests), intrinsic motivation, and environmental features (physical and social environments), as extrinsic motivation [17]. Based on previous findings, intrinsic motivation factors that affected the volition of adolescents with CP were considered in six categories: Individual values, enjoying interpersonal relationships, enjoying performing activities, individual perceptions of ability level, family and community-related values, and sense of control over conditions. Furthermore, the volition of adolescents with
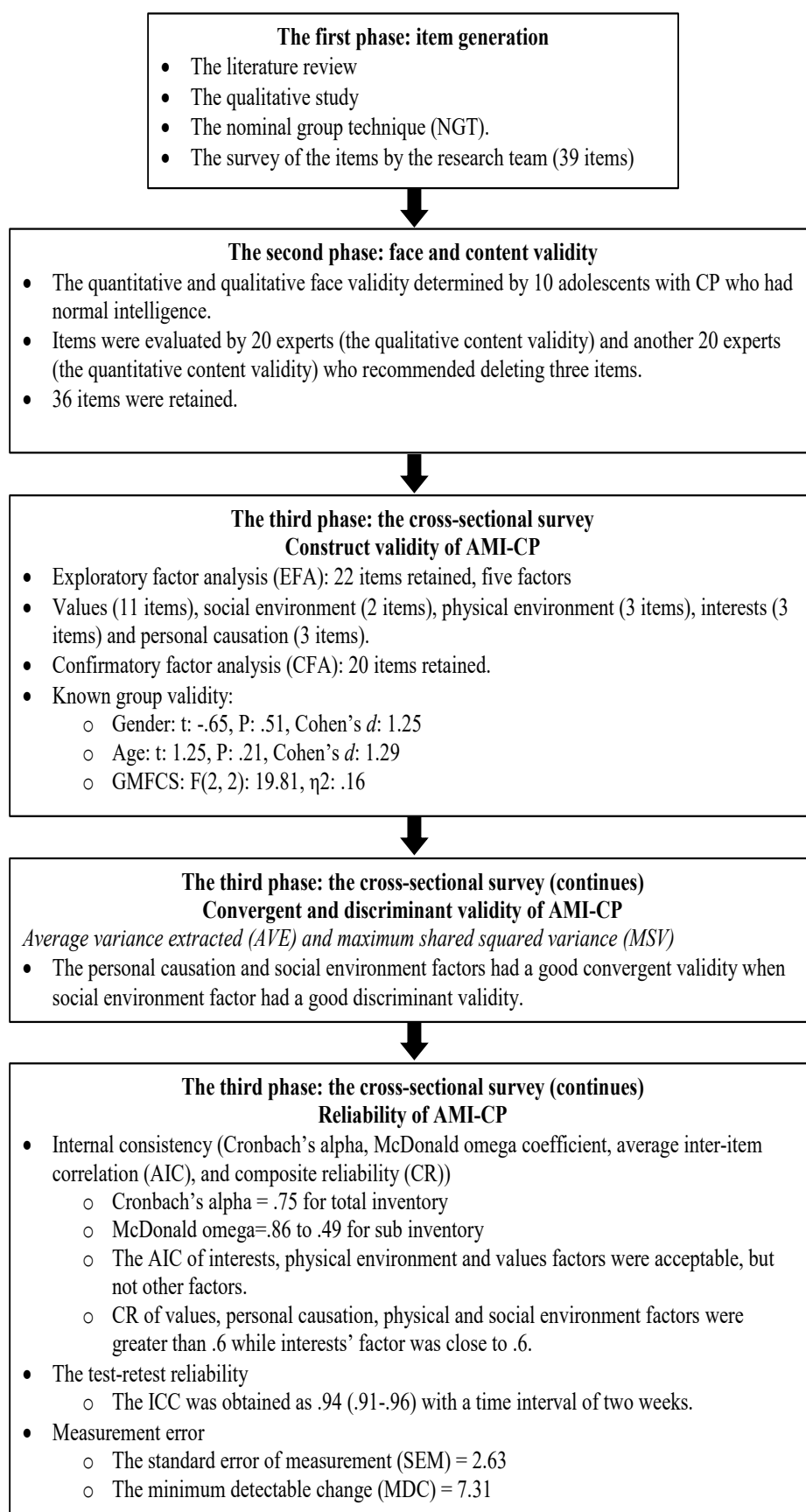
The first phase: item generation
- The literature review
- The qualitative study
- The nominal group technique (NGT).
- The survey of the items by the research team (39 items)

The second phase: face and content validity
- The quantitative and qualitative face validity determined by 10 adolescents with CP who had normal intelligence.
- Items were evaluated by 20 experts (the qualitative content validity) and another 20 experts (the quantitative content validity) who recommended deleting three items.
- 36 items were retained.

The third phase: the cross-sectional survey
Construct validity of AMI-CP
- Exploratory factor analysis (EFA): 22 items retained, five factors
- Values (11 items), social environment (2 items), physical environment (3 items), interests (3 items) and personal causation (3 items).
- Confirmatory factor analysis (CFA): 20 items retained.
- Known group validity:
    - Gender: t: -.65, P: .51, Cohen's d: 1.25
    - Age: t: 1.25, P: .21, Cohen's d: 1.29
    - GMFCS: F(2, 2): 19.81, $\eta2$: .16

The third phase: the cross-sectional survey (continues)
Convergent and discriminant validity of AMI-CP
Average variance extracted (AVE) and maximum shared squared variance (MSV)
- The personal causation and social environment factors had a good convergent validity when social environment factor had a good discriminant validity.

The third phase: the cross-sectional survey (continues)
Reliability of AMI-CP
- Internal consistency (Cronbach's alpha, McDonald omega coefficient, average inter-item correlation (AIC), and composite reliability (CR))
    - Cronbach's alpha = .75 for total inventory
    - McDonald omega=.86 to .49 for sub inventory
    - The AIC of interests, physical environment and values factors were acceptable, but not other factors.
    - CR of values, personal causation, physical and social environment factors were greater than .6 while interests' factor was close to .6.
- The test-retest reliability
    - The ICC was obtained as .94 (.91-.96) with a time interval of two weeks.
- Measurement error
    - The standard error of measurement (SEM) = 2.63
    - The minimum detectable change (MDC) = 7.31

Figure 1. Development of the AMI-CP

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CP-affected extrinsic motivation factors was categorized into two groups: Physical context features and social context features [17]. Therefore, based on 403 primary codes in the six categories, the research team prepared 57 items for the first draft of this inventory.

The NGT [28] was performed with 10 experts (six PhD and two MSc holders in occupational therapy and two PhD holders in clinical psychology). All participants had at least 10 years of clinical experience with adolescents with CP. After forming the pool of items, the authors refined the inventory to prepare it for phase 2.

AMI-CP is a global self-report volition-based inventory to measure intrinsic and extrinsic motivation in adolescents with CP. All items are measured on a 5-point Likert scale (5=strongly agree, 4=agree, 3=neither agree nor disagree, 2=disagree, and 1=strongly disagree), and a total score is calculated. Higher scores indicate that adolescents with CP are more motivated in occupational performance. Adolescents with CP completed the AMI-CP in 20 minutes.

Phase 2: Face and content validity

The AMI-CP was assessed both qualitatively and quantitatively for face validity. For measuring the quantitative face validity, using the item impact technique (IIT), 10 adolescents with CP and no intellectual disability took part. Each participant rated the suitability of each item based on a Likert scale (1; extremely unsuitable to 5; extremely suitable). The item impact score of individual items was calculated using the Equation 1:

1. *Frequency (%)×Suitability*

Frequency refers to dividing the number of people who score 4 and 5 on an item by the total number of people, and suitability is the average score of each item. A score of more than 1.5 for each item means a suitable item is maintained in the inventory [29]. Next, for assessing the qualitative face validity of the AMI-CP, for the items with below 1.5 scores, the same 10 adolescents evaluated the relevance, difficulty, and uncertainty of the items [29].

For the qualitative content validity of the inventory, the AMI-CP was provided to 20 experts to comment on the item allocation, wording, and scaling [30, 31]. All experts in this study phase had 10 or more years of clinical experience with adolescents with CP (15 PhD holders in occupational therapy, one psychiatrist, and four PhD holders in clinical psychology). The research

team adjusted the AMI-CP according to their respective proficiency. For the quantitative content validity of the inventory, the content validity ratio (CVR) [32], item-level content validity index (I-CVI), and the overall scale (scale-level or S-CVI) [33] were calculated for the items. According to Lawshe [32], when the number of specialists is 20, the minimum acceptable CVR equals 0.42. In the present study, CVR was conducted with the same 20 experts. To assess the I-CVI, another 20 experts with 10 or more years of clinical experience working with adolescents with CP (10 PhD holders in occupational therapy, seven MSc holders in occupational therapy, one psychiatrist, and two PhD holders in clinical psychology) were requested to rate the relevance of the AMI-CP items. Then, the number of professionals selecting the last two answers was separated by the total number of experts [34]. Next, the modified kappa value was calculated. Its minimum item maintenance value was considered >0.74 [33]. As an average of the I-CVAs for all items on the scale, the S-CVI/Ave was evaluated for the AMI-CP. Finally, the AMI-CP items that showed I-CVIs of 0.78 or more and an S-CVI/Ave of 0.90 or more were appraised as having excellent content validity [33].

Phase 3: The cross-sectional survey

Sample and setting

Using a multistage sampling, the study participants were enrolled in exceptional physical-motor schools and private clinics. First, 31 provinces in Iran were divided into 7 areas based on their populations: North, North-West, Central foothills and lowlands, Zagros, South-coast, North-East, East, and South-East (stage 1) [35]. Then, one province was randomly selected from each area (stage 2) (Guillan, East-Azerbaijan, Tehran, Hamedan, Hormozgan, North-Khorasan, and South-Khorasan). Next, participants were recruited using the convenience sampling method in the capital of each selected province. Based on evidence, the sample size was calculated [36]. A total of 304 adolescents completed the inventory in the exploratory factor analysis (EFA) phase, and 210 adolescents completed it in the confirmatory factor analysis (CFA) phase. There was no missing data. The inclusion criteria were as follows: 1) Diagnosis of CP (diagnosed by a pediatric neurologist), 2) Age 10–19 years [37], 3) The level of gross motor function classification system (GMFCS) between I to III [38, 39], 4) The intelligence quotient (IQ) within the normal range approved by the SPARCLE study [40], 5) Have communications skills or hand movement ability for responding the inventory, and 6) to be willing and ready to participate. The exclusion criteria were as follows: 1) Epilepsy impacting mo-

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tor skills, 2) Visual impairment limiting activity, and 3) Orthopedic or neurosurgery in the past six months. The Iran University of Medical Sciences Ethics Committee approved the study on June 24, 2018. Voluntary participation was guaranteed. Participants were ensured that their medical care was not affected. The confidentiality of participants' information was guaranteed.

Data collection

For the survey study, the Department of Research and Technology from Iran University of Medical Sciences issued an introduction letter to provide permission to collect data from the physical-motor disabilities schools in Iran. Consequently, the sampling process started after getting agreement from the ministers of exceptional sensory-motor schools. Next, informed consent was obtained from all participants, and preliminary data were collected from their parents. Subsequently, the research objectives and inventory completion were explained to the participants in detail. Then, the level of gross motor function was assessed using GMFCS by an expert and trained occupational therapist who was blinded to the study objectives and had 5 years of clinical experience. The participants had an average range of IQ based on the SPARCLE study [40]. An occupational therapist performed intelligence testing with 5 years of clinical experience. Next, the adolescents with CP completed the AMI-CP in a quiet school environment from 9:00 AM to 12:00 PM at break times. When completing the inventory, none of the participants felt stressed or tired.

Data analysis

Construct validity

The EFA studied the factor analysis of the AMI-CP with SPSS software, version 16 (SPSS Inc., Chicago, IL, USA). The maximum likelihood method was used for the extraction method, and Promax with Kaiser normalization was used for the rotation method. The suitability of the study sample was checked by the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. The number of factors was determined based on eigenvalues (one or less were ignored) and scree plot. Furthermore, based on the Equation 2:

2. $V = 5.152\sqrt{(n-2)}$

, items with absolute loading values of 0.3 or bigger were considered suitable [41].

The suitable factor structure for EFA was examined by CFA conducted with AMOS software, version 16 (SPSS Inc., Chicago, IL, USA). The item was removed where the factor loading was lower than the threshold (0.3) based on the first order [42]. Model fit indexes were the chi-square (χ^2) test, adjusted goodness-of-fit index (AGFI), the minimum discrepancy divided by its degrees of freedom (CMIN/df), root mean square error of approximation (RMSEA), incremental fit index (IFI), and parsimonious comparative fit index (PCFI) [43].

Based on the literature, since the AMI-CP items were 36 for EFA and 22 for CFA, the sample size was calculated to be at least 300 and 200 adolescents with CP, respectively [36].

As the United Nations International Children's Emergency Fund (UNICEF) reports, adolescents are in two parts: Early adolescence (between 10 and 14 years) and late adolescence (between 15 and 19 years) [44]. For the known-group validity, differences in the adolescent age (early adolescence/late adolescence) (n=210) and gender (boys/girls) (n=210) were determined using the independent t-test and effect sizes using Cohen's d with pooled standard deviations. Effect sizes were calculated to examine the magnitude of the differences. According to Cohen [45], a d value >0.80 is considered large, 0.50-0.79 medium, 0.20-0.49 small, and 0.0-0.19 as insignificant. Moreover, differences in the scores for groups (GMFCS I-III) (n=210) were determined using analysis of variance (ANOVA) [46]. The level of significance was established at P≤0.05.

Convergent and discriminant validity

Convergent validity was evaluated by estimating average variance extracted (AVE) and composite reliability (CR). To establish convergent validity, the AVE of constructs should exceed 0.5 but not more than their CR. Moreover, the AVE evaluated discriminant validity and maximum shared squared variance (MSV), which was less than their AVE [47, 48].

Reliability

Using the Cronbach α, McDonald omega coefficient, and average inter-item correlation (AIC), the internal consistency (for absolute agreement for the domains and individual items of the AMI-CP) was measured [49]. A reliability of 0.7 or bigger determined satisfactory internal consistency [50]. When the CR of the factor was measured, values between 0.6 and 0.7 were accepted, provided other indicators were also conventional [46].

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Table 2. The demographic profiles of the participants in EFA (n=304) and CFA (n=210)

Demographic Characteristics		Mean±SD/No. (%)	
		EFA	CFA
Age (y)		14.72±2.55	14.09±2.65
Gender	Male	184(60.5)	108(51.4)
	Female	120(39.5)	102(48.6)
GMFCS	Level I	81(26.6)	43(20.5)
	Level II	105(34.5)	74(35.2)
	Level III	118(38.8)	93(44.3)

Abbreviations: GMFCS: Gross motor function classification system; EFA: Exploratory factor analysis; CFA: Confirmatory factor analysis.

AIC of 0.2 to 0.4 was also considered a good internal consistency. To establish the test re-test reliability of the AMI-CP (n=80), the intra-class correlation coefficient (ICC) was applied in a 2-week interval by using a 2-way mixed ICC for absolute agreement with 95% confidence interval at the level of individual items [47]. In addition, the Cronbach α and ICC for the first and second administrations were applied. Moreover, absolute reliability was applied using the standard error of measurement (SEM) and the minimum detectable change (MDC) [48].

Results

Phase 1: Item generation

In phase one, 57 items were created as the primary pool based on the literature review, participants' views, and NGT. The repetitive items were deleted after the authors surveyed the items. The items with overlapping concepts were merged. Finally, for psychometric properties, a pool containing 39 items was prepared.

Phase 2: Face and content validity

Regarding the face validity of AMI-CP, since the results showed six items of the inventory were inappropriate and unclear, they were revised. The results of CVR demonstrated that two items gained an index lower than the minimum value of 0.37 in the Lawshe table, according to the evaluation of the 20 specialists. Items 11, 'Healing by God is important to me' with CVR=-0.1, and 14, 'I do not accept my inability to do my activities' with CVR=0.3, were considered unacceptable. Furthermore, regarding the I-CVI results of the inventory, one item was less than the minimum value of 0.78. Item

26, 'I am interested in loneliness' with I-CVI=0.6, was considered unacceptable. The AMI-CP gained S-CVI/Ave=0.97, suggesting appropriate content validity.

Phase 3: The cross-sectional survey

Construct validity

The demographic characteristics of our participants in EFA and CFA are shown in Table 2. According to the EFA findings, the KMO was 0.8 and Bartlett's test of sphericity was significant (P<0.001, χ^2=1469.06, df=231). As a result, the sampling was adequate. According to the findings, 14 items were deleted from the AMI-CP due to not meeting the minimal factor loading. The scree plot and theory support presented that the five factors had the required adequacy to explain the factorial construct validity of this inventory. The five factors were extracted from the EFA. These factors are based on 22 items named values (11 items), social (2 items), physical environment (3 items), interests (3 items), and personal causation (3 items). This condition explained 50.42% of the common variance (Table 3). The social environment factor with two items was extracted from the EFA due to having a high factor loading [42].

The maximum likelihood CFA with the second dataset using a sample of 210 participants was recruited to assess and validate the factor structure gained with EFA. Figure 2 shows the final CFA for the sample. According to the final construct model, the measurement errors between the items 9 and 8 (e1, e2), 9 and 7 (e1, e4), 8 and 6 (e2, e6), as well as 26 and 24 (e10, e11) correlated with each other (Figure 2). The CFA (indices) results confirmed the final model's goodness-of-fit (Table 4).

Table 3. The results of performing EFA on the AMI-CP

Factor	Item	Loading	h²	λ	Variance %	Ω	α	AIC
1. Values	AMI.9: Success in the future	0.83	0.61					
	AMI.8: Having a good job in the future	0.58	0.33					
	AMI.10: Healing my physical disability in the future	0.52	0.28					
	AMI.7: Having a purpose in life	0.52	0.29					
	AMI.4: Having face-to-face communication with my family and friends	0.46	0.25					
	AMI.6: Doing my self-care tasks independently (like dressing, toileting, eating, and activities like that)	0.46	0.26	3.71	16.88	0.53	0.77	0.26
	AMI.5: Proving my abilities to others	0.44	0.22					
	AMI.11: Having the ability to do my tasks to get a good result	0.44	0.29					
	AMI.1: Not being ridiculed by others	0.42	0.21					
	AMI.26: Being interested in helping others	0.41	0.22					
	AMI.24: having a friendly relationship with others.	0.36	0.28					
2. Social Environment	AMI.32: Others' good treatment toward me	0.98	0.85	2.25	10.23	0.86	0.72	0.57
	AMI.33: Others believe in my ability	0.57	0.45					
3. Physical Environment	AMI.30: The suitability of school desks and chair	0.75	0.54					
	AMI.31: Adaptability of the toilet	0.63	0.44	1.44	6.58	0.63	0.64	0.38
	AMI.29: The suitability of places with stairs	0.38	0.26					
4. Interests	AMI.21: The enjoyment of doing entertaining things (like watching TV, exercising, playing, and activities like that).	0.66	0.43					
	AMI.34: My family's encouragement	0.51	0.44	2.28	10.4	0.60	0.59	0.33
	AMI.22: Enjoying the activities I know	0.47	0.29					
5. Personal Causation	AMI.13: The trouble with doing my tasks because of my physical disability	0.67	0.50					
	AMI.14: Not being skillful at doing my tasks	0.52	0.30	1.39	6.33	0.49	0.21	0.05
	AMI.17: Eagerness to do the tasks I want to do despite being slow	-0.34	0.23					

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AIC: Average inter-item correlation.

h²: Communality; λ: Eigenvalue; Ω: McDonald's omega coefficient; α: Cronbach alpha coefficients.

As known group validity, a comparison of the mean score of the AMI-CP in different levels of GMFCS showed that level I has more motivation (medium effect size). No significant difference was found between the age and gender of the adolescents with CP for the AMI-CP (large effect size) (Table 5).

Convergent and discriminant validities

The AVE for personal causation and social environment factors were greater than 0.5, while they were lower than 0.5 for values, interests, and physical environment. The AVE for the social environment factor was greater than the MSV for other factors. According to these results, the

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Table 4. Fit indices of the first order CFA of the AMI-CP

CFA	χ²	df	P	CMIN/df	RMSEA	PCFI	AGFI	IFI
1st order after structure modification	254.13	156	< 0.001	1.62	0.05	0.73	0.85	0.9
Fit indexes			<0.05	<3 good	<0.08	>0.5	>0.5	>0.9

Abbreviations: CFA: Confirmatory factor analysis; df: Degree of freedom; χ²: Chi-square; CMIN/df: The minimum discrepancy divided by its degrees of freedom; RMSEA: Root mean square error of approximation; AGFI: Adjusted goodness-of-fit index; PCFI: Parsimonious comparative fit index; IFI: Incremental fit index.

Table 5. Convergent, discriminant validity and reliability of AMI-CP

Subgroups of AMP-CP	CR	AVE	MSV
Values	0.75	0.24	0.52
Interests	0.58	0.32	0.52
Personal causation	0.70	0.53	0.60
Physical environment	0.68	0.42	0.60
Social environment	0.77	0.64	0.23

Abbreviations: CR: Composite reliability; AVE: Average variance extracted; MSV: Maximum shared squared variance.

personal causation and the social environment factors had a good convergent validity, while the social environment factor had a good discriminant validity (Table 6).

Reliability

The results showed that the Cronbach α coefficient value for the total AMI-CP was equal to 0.75, representing acceptable reliability. The Cronbach α coefficient of values and social environment factors were greater than 0.7,

while other factors were lower. McDonald's omega coefficient of the social environment factor was also greater than 0.7, which is unacceptable for other factors. Moreover, the CR of values, personal causation, and physical and social environment factors were greater than 0.6, while the interests' factor was close to 0.6. In addition, AIC of interests, the physical environment, and values factors were acceptable, but not for other factors (Table 3). The ICC between the test and re-test scores was ob-

Table 6. Associations between the adolescent motivation inventory-CP score, demographics and GMFCS levels (n=210)

Variables		Mean±SD	t	P	Cohen's d
Gender	Male	89.25±8.62	-0.65	0.51	1.25
	Female	90.07±9.37			
Age	Early adolescent	90.28±8.41	1.25	0.21	1.29
	Late adolescent	88.69±9.77			
Variables		Mean±SD	$F_{(2, 207)}$	P	η²
GMFCS	Level I	94.41±8.28	19.81	<0.0001	0.16
	Level II	88.82±7.63			
	Level III	85.72±8.85			

GMFC: Gross motor function classification system; η²: Eta squared.

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Table 7. Internal consistency and test re-test reliability of the AMI-CP (n=80)

Factor	α		r*	95% CI
	Test	Re-test		
Values	0.66	0.74	0.94	0.91-0.96
Social environment	0.64	0.68	0.82	0.72-0.88
Physical environment	0.51	0.46	0.86	0.78-0.91
Interests	0.59	0.60	0.86	0.78-0.91
Personal causation	0.56	0.57	0.88	0.81-0.92
Total	0.63	0.70	0.94	0.91-0.96

α: Cronbach α coefficients.

*P<0.001.

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tained as 0.94 (0.91-0.96) with a time interval of two weeks. The Cronbach α for the first administration was 0.63 and for the second administration was 0.7 (Table 7). Moreover, the SEM (2.63) and MDC (7.31) further support the absolute reliability of the AMI-CP total score.

Discussion

The present study was conducted to develop and evaluate the psychometric properties of an AMI-CP. The theoretical framework of AMI-CP is designed based on the MOHO as the well-recognized and occupation-focused practice model in the world that explains how occupations are motivated, patterned, and performed within everyday environments. Based on MOHO, volition is important in participating in everyday activities [49].

In the psychometric phase, investigating and then confirming the underlying structure of the inventory were conducted with EFA and CFA. EFA showed that the AMI-CP is the 5-factor construct in this sample of adolescents with CP. The final version of this inventory includes 20 items based on 5 factors (values, personal causation, interests, physical environment, and social environment). Compared with the VQ and PMOT [15, 16], the AMI-CP, as the self-report, volition-based, and global inventory of motivation in adolescents with CP, utilizes a specific measurement approach. Moreover, compared with DMQ 18 (the school-age self-rating version) [14], the AMI-CP was developed based on volition that evaluated awareness of the act. Within MOHO [49], two aspects of motivation are discovered: Intrinsic motivation (volition) and extrinsic motivation (the environment). The AMI-CP is divided into intrinsic motivation (values, interests, and personal causation) and extrinsic

motivation (physical and social environments). As a result, this feature makes this inventory unique among other 'people with physical disability motivational tools.' Some tools [50, 51] have some items of AMI-CP, but these tools are not motivational. Moreover, these tools have not been designed for adolescents with CP. However, this would need to be studied further.

The first factor entailed 10 items related to 'values' that the participants stated. However, this factor was not extracted from the other motivational tools. In the Schwartz portrait values questionnaire [50], some items consider values, but this questionnaire is not motivational. Based on this study's results, there seem to be values that are the same for adolescents regardless of whether they have CP. However, this issue would need to be studied further.

The second factor of AMI-CP entailed two items related to the 'social environment.' This factor determined the extrinsic motivation of the level of support a person with CP receives from the social environment. The evidence also emphasized the effects of social context factors prompting social participation among people with CP [52].

The third factor, the 'physical environment,' was related to the lack of adaptation in the house for self-care activities and outside of the house, which positioned limitations on the adolescents' abilities to participate in different social activities. These findings seemed consistent with two other studies in which the physical environment factor, as a supportive or a limiting factor, influences adolescents' participation in their daily lives [52, 53]. However, this factor was not extracted from the DMQ18 (the school-age self-rating version), VQ, and
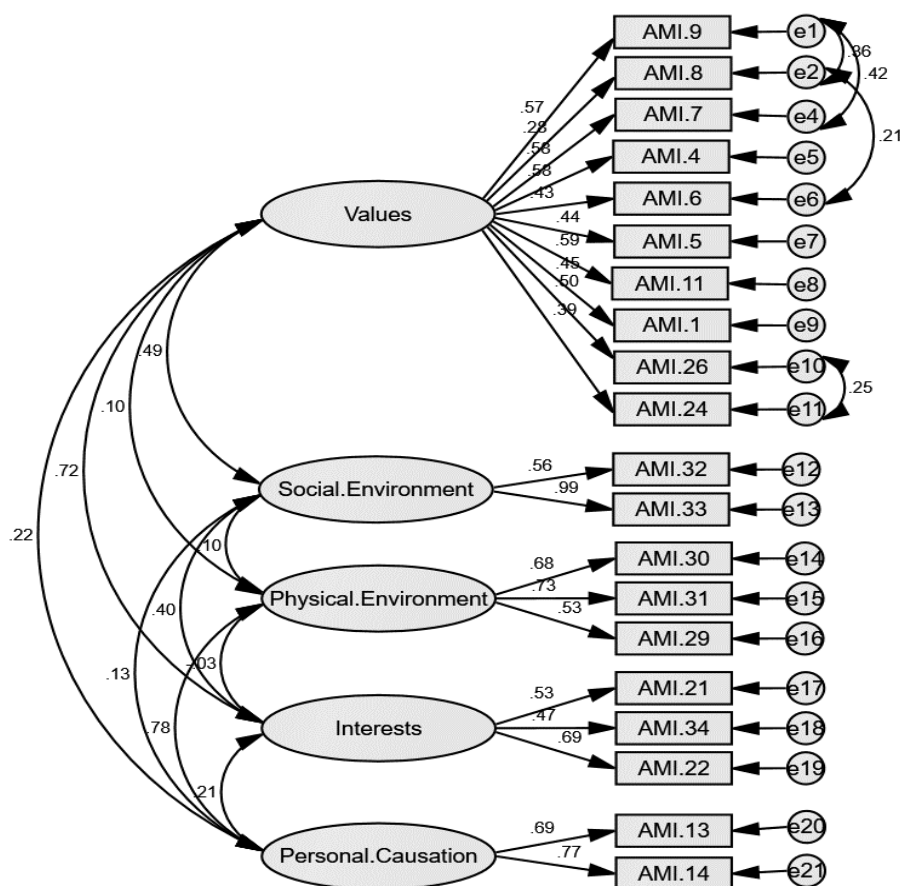
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Figure 2. The final structural model of the AMI-CP

PMOT [14-16]. In assessing motivation in adolescents with CP, 'physical environment features' are one of the main factors affecting motivation [52].

Another factor of the AMI-CP was 'interests' by which adolescents with CP enjoyed entertaining and performing joyful activities. These results were consistent with other studies [14-16]. They showed that motivation was beneficial and productive when developing interests accompanied it. This finding indicates that evaluating someone's interests is one of the most significant factors in adolescents with CP and typically developing peers.

Finally, the fifth extracted factor was 'personal causation'. Items in this factor showed different perceptions of participants' ability levels. This factor has not been extracted in any of the DMQ18 (the school-age self-rating version), VQ, and PMOT [14-16]. Since adolescents with CP have different perceptions of their ability levels, evaluating personal causation in their motivation is one of the most critical factors.

With the study of data distribution along with the elimination of insignificant data, the CFA model, which was used to determine the validity of the AMI-CP, established the final factor construct of the existing inventory. After evaluation, the results of the present study indicate the good fit of model for all indices.

This study also revealed that adolescents with CP (GMFCS level I) had more motivation in their occupations. Furthermore, no significant difference was found between the age and the sex of an adolescent with CP for the AMI-CP. The occupational therapist deal with improving the level of interdependency in adolescence and children [54] and for this aim a large body of evidence indicated the strong relationship among categorization, sorting and reasoning with functional activity [55] the relationship of these component with motivation should more assess in adolescence.

The present study used AVE and MSV to assess the convergent and discriminant validities of the identified five factors. However, the validity of the AMI-CP was not relatively acceptable. If there is a problem with

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convergent validity, it means that the items do not correlate well enough with the factor, or in other words, the observed variables do not explain the latent factor well. If there is a problem in discriminant validity, it means that the items of one factor are highly correlated with those of other factors. In other words, the factor is better explained by the observable variables of different factors. For various reasons, convergent and discriminant validity of some factors was not accepted. As a result, it is challenging for the researchers and the participants to differentiate their meanings. To date, there seems to be no other research in which the results could be compared with the findings of the present one.

The Cronbach α coefficient and Omega-McDonald's evaluated the AMI-CP's stability. The Cronbach α was low in some aspects because of the number of items in some factors and the sample size. Moreover, item 17, 'eagerness to do the tasks I want to do despite being slow' with a low factor load, has reduced the stability in this factor, which was removed based on the CFA results. It seems that participants did not understand the meaning of this item. They also understood the meaning of this item in reverse. As a result, the item became negative with a low factor load. This finding may be attributed to the fact that these results must be rechecked with other samples. However, the perfect test re-test reliability of AMI-CP in this study supports the applicability of this inventory in motivational research.

Conclusion

According to these findings, the developed 20-item five-factor AMI-CP is a simple, valid, and reliable tool for measuring CP adolescents' intrinsic and extrinsic motivations. However, the discriminant and convergent validities of the AMI-CP were not relatively acceptable. In addition, the internal consistency was low in some factors that need further investigation.

Limitations and strengths

The present study's limitation was the lack of a valid and reliable motivation assessment tool for adolescents with CP in Iran that could be used for convergent validity. Another limitation of the present study was the unavailability of samples. Owing to the participants' physical limitations, they were more likely to stay home, and consequently, their availability was limited.

Ethical Considerations

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