Validity and reliability of the 7Cs positive youth development model instrument for physical education
La validez y fiabilidad del instrumento del modelo de desarrollo positivo juvenil 7Cs para la educación física

Authors

Aang Rohyana [1,2]
Amung Ma'mun [1]
Tite Juliantine [1]
Dian Budiana [1]
Cucu Hidayat [2]
Agus Arief Rahmat [2]
Lalu Hulfian [3]

[1] Universitas Pendidikan Indonesia
(Indonesia)
[2] Universitas Siliwangi (Indonesia)
[3] Universitas Pendidikan Mandalika
(Indonesia)

Corresponding author:
Amung Ma'mun
amung@upi.edu

Abstract

Introduction: The 7Cs scale remains very limited in Indonesia and in physical education learning among senior high school students.
Objective: This study aims to validate the measurement instrument for competence, confidence, character, caring, connection, contribution, and creativity (7Cs) in physical education.
Methodology: This study employs a research and development approach, following the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. Five raters designed and validated seven indicators and 78 statements, and the instrument was tested on 222 students from various regions in Indonesia. Data analysis included Aiken's V for content and construct validity through Exploratory Factor Analysis.
Results: Content validity scores were ≥0.74, indicating strong content and construct consistency. The KMO-MSA value of 0.888 confirmed that the data were adequate for factor analysis. Anti-image correlation tests also demonstrated that all indicators made significant contributions to the measured construct (>0.50). The extraction values for each indicator were >0.50, showing strong associations with the underlying factors. In the component matrix test, all indicators had loading values above 0.50, confirming the consistency and appropriateness of the indicators within the instrument. Reliability testing yielded a coefficient of 0.97.
Discussion: The results of the development of the 7Cs instrument show that physical education does not only focus on physical aspects, but also on the development of students' cognitive, character, and social competence.
Conclusions: The findings of this study can be used by teachers to evaluate positive youth development through physical education.

Keywords

Instrument positive youth development; 7Cs instrument; evaluation of the 7Cs in physical education; 7Cs-based physical education; physical education for positive youth development.

Resumen

Introducción: Sin embargo, la escala de las 7Cs sigue siendo muy limitada en Indonesia y en el aprendizaje de la educación física entre los estudiantes de secundaria.
Objetivo: Este estudio tiene como objetivo validar el instrumento de medición de la competencia, la confianza, el carácter, la empatía, la conexión, la contribución y la creatividad (7Cs) en la educación física. Metodología: Este estudio emplea un enfoque de investigación y desarrollo, siguiendo el modelo de Análisis, Diseño, Desarrollo, Implementación y Evaluación (ADDIE). Cinco evaluadores diseñaron y validaron siete indicadores y 78 enunciados, y el instrumento fue aplicado a 222 estudiantes de diversas regiones de Indonesia. El análisis de datos incluyó el coeficiente V de Aiken para la validez de contenido y la validez de constructo mediante Análisis Factorial Exploratorio. Resultados: Los puntajes de validez de contenido fueron ≥0.74, lo que indica una fuerte consistencia tanto en el contenido como en el constructo. El valor KMO-MSA de 0.888 confirmó que los datos eran adecuados para el análisis factorial. Las pruebas de correlación anti-imagen también demostraron que todos los indicadores realizaron contribuciones significativas al constructo medido (>0.50). Los valores de extracción para cada indicador fueron >0.50, lo que muestra asociaciones sólidas con los factores subyacentes. En la prueba de la matriz de componentes, todos los indicadores presentaron valores de carga superiores a 0.50, lo que confirma la consistencia y pertinencia de los indicadores dentro del instrumento. La prueba de fiabilidad arrojó un coeficiente de 0.97.
Discusión: Los resultados del desarrollo del instrumento de las 7Cs muestran que la educación física no se enfoca únicamente en los aspectos físicos, sino también en el desarrollo de las competencias cognitivas, del carácter y sociales de los estudiantes.
Conclusiones: Los hallazgos de este estudio pueden ser utilizados por los docentes para evaluar el desarrollo positivo de los jóvenes a través de la educación física.

Palabras clave

Instrumento de desarrollo positivo juvenil; instrumento de las 7Cs; evaluación de las 7Cs en la educación física; educación física basada en las 7Cs; educación física para el desarrollo positivo juvenil.

Introduction

Physical education in senior high schools plays a crucial role in the holistic development of students, not merely in terms of movement skills. Instead, teachers mediate students through various movement activities to achieve educational goals (Blegur, Yustiana, et al., 2023). It includes enhancing analytical thinking skills (Blegur, Rajagukguk, et al., 2023), critical thinking skills (Dupri et al., 2019; Pill & SueSee, 2017; Usra et al., 2023), creative thinking skills (Ahmad et al., 2020; Dupri et al., 2021), and also fostering positive social-emotional attitudes that are useful in daily life (life skills) (Papacharisis et al., 2007; Razali et al., 2024). It means that effective physical education must contribute to the development of various student competencies, including motor competence, self-confidence, positive character, social caring, the ability to collaborate, positive contribution, and creativity (Dimitrova et al., 2021; Kuspratiwi et al., 2024; Muratbayevich, 2024; Wiium & Dimitrova, 2019). To facilitate the integration of comprehensive physical education learning outcomes, Dimitrova et al. (2021) have proposed the 7Cs model (competence, confidence, character, caring, connection, contribution, creativity) as a framework to assess these important aspects in the context of holistic education. Implementing the 7Cs model in physical education for senior high school students is realized by identifying specific indicators for each 7Cs dimension relevant to physical education activities and learning.

For example, competence can be measured through mastery of basic sports techniques and social and emotional skills to achieve success in learning. Confidence is measured through self-belief developed via challenging learning experiences, support from the surrounding environment, and courage to participate and compete. Character is measured through developing moral values, ethics, positive attitudes, sportsmanship, and honesty during the learning process. Caring is measured through empathy and concern for others, creating a harmonious, inclusive learning environment and teamwork. Connection is measured through building and maintaining positive relationships with peers, teachers, and the school community. Contribution is seen through active participation in various social and academic activities to achieve common goals. Finally, creativity is measured through the ability to generate new ideas, innovate in problem-solving, and experiment during the learning process. This study is highly relevant to education because it provides a comprehensive framework for assessing students' holistic development beyond mere performance-based assessment (Dimitrova et al., 2021; Geldhof et al., 2014, 2019). The 7Cs model has also been successfully used by Manrique-Millones et al. (2021) to reduce experiences of alcohol and drug use, violence, and suicide attempts in Colombia and Peru. Abdul Kadir et al. (2021) successfully used the 7Cs model to enhance mindfulness among youth in Malaysia.

In addition to being used for extracurricular activities, the 7Cs model holds values that can be transformed into the context of physical education. It is necessary to develop and test the validity and reliability of the 7Cs instrument to determine whether the instrument can represent the content being measured and predict the level of measurement error (Blegur et al., 2024; Lohr, 2002) to optimize the process of diagnosis, evaluation, and development of students' 7Cs in physical education. The 7Cs instrument will enhance the quality of physical education by providing more accurate and comprehensive information about student development. The data obtained can be used to design more effective and targeted learning interventions, prepare students to face future challenges, and encourage innovation in physical education. The theoretical relevance lies in the testing and application of the 7Cs model in the context of physical education. Meanwhile, the practical relevance lies in providing a valid and reliable instrument to measure students' holistic development. The development of holistic competence in adolescents emphasizes the importance of an approach that integrates cognitive, affective, and psychomotor aspects (Bowers et al., 2015; Lerner et al., 2015, 2021). Thus, this idea explains how individual development is influenced by the complex interaction between internal factors (cognitive abilities, emotions, and motivation) and external factors (social environment, culture, and opportunities).

During the learning process, teachers must create a learning environment that supports and facilitates the development of all aspects of students' personalities, not just their cognitive abilities (Kim et al., 2019). Students' personal development occurs optimally when they can develop skills, confidence, and positive moral values in a supportive social context (Raharjo et al., 2023). The 7Cs model aligns with this idea because it includes various aspects of development, including competence (cognitive and psychomotor aspects), confidence (affective aspect), character (moral and ethical aspects), caring (social-emotional aspect), connection (social aspect), contribution (pro-social aspect), and creativity (cognitive

and psychomotor aspects). The significance of developing the 7Cs measurement instrument is that the 7Cs emphasize the social and environmental context in individual development. This study aims to empirically examine how the 7Cs model can be applied and measured in the context of senior high school physical education. The 7Cs model in PYD provides an integrated approach to physical education that not only focuses on the physical aspect but also shapes personality, social attitudes, and life skills that benefit students' development in their daily lives. By implementing this model, physical education can help students grow into better individuals holistically.

Behind the significance of the 7Cs theory and model, unfortunately, the lack of a standardized instrument (validity and reliability) to measure the 7Cs in the context of physical education in senior high schools has become an obstacle in evaluating the effectiveness of learning and monitoring students' overall development. A high-quality instrument is helpful for clinical and research purposes (Scholtes et al., 2011). Validity and reliability are essential components in assessing the quality of research findings. Validity refers to the degree of accuracy in measuring what the research intends to measure. Meanwhile, reliability relates to the consistency of measurement across time, instruments, and different observers. Ensuring that the research results can be replicated and trusted (Hair et al., 2021; Hair Jr et al., 2019, 2020). The results of the construction of valid and reliable instruments can provide more comprehensive and accurate information regarding the holistic development of high school students in physical education, compared to relying solely on performance-based assessments. Data obtained by teachers through valid and reliable instruments are then used to design more effective and targeted learning interventions, as well as to evaluate the impact of physical education learning on the development of students' character and competence holistically.

Finally, this study aims to develop and test the validity and reliability of the 7Cs positive youth development model instrument for physical education. It begins with item analysis and development and tests the content validity of the 7Cs measurement instrument based on expert judgment through Aiken's V test, followed by testing the construct validity of the 7Cs measurement instrument using factor analysis. It then concludes by testing the reliability of the 7Cs measurement instrument using Cronbach's alpha coefficient.

Method

This research employed a research and development (R&D) method using the ADDIE model (analysis, design, development, implementation, evaluation) (Branch, 2010).

Analysis stage

A literature review was conducted to understand the concept of the 7Cs, physical education in senior high schools, and the development of measurement instruments. The focus of the study included the operational definitions of each dimension of the 7Cs in the context of senior high school physical education, the characteristics of senior high school students relevant to the 7Cs, as well as measurement methods that are relevant and have been used in previous studies. Literature sources included reputable academic journals (Scopus, Web of Science, Google Scholar), textbooks, and official documents related to the senior high school physical education curriculum. Subsequently, a needs analysis was conducted through a preliminary study and semi-structured interviews with 10 physical education teachers from different senior high schools in Tasikmalaya City, West Java, Indonesia.

The interviews aimed to explore the key indicators of each 7C dimension relevant to physical education learning in senior high schools. The interview statements focused on the behaviors and characteristics of senior high school students that reflect each 7C dimension and the challenges and opportunities in measuring the 7Cs in the senior high school environment. The interview data were recorded, transcribed, and analyzed qualitatively using thematic analysis to identify emerging themes and patterns. Example interview questions included: "How do you identify students with high self-confidence in physical education learning?" "What indicators do you use to assess students' social care in the context of team sports?". After data reduction, content analysis was performed on the lesson plans and physical education learning materials for senior high schools to identify the implied 7C indicators in the curriculum. The content analysis results were then integrated with the findings from the literature review and needs analysis to create a comprehensive framework of indicators.

Design stage

Based on the needs analysis and literature review results, statement items were designed for each dimension of the 7Cs. The design of the instrument took into account several aspects. First is relevance, meaning each statement item must be relevant to the key indicators identified in the analysis stage. Second, clarity, meaning the formulation of the statement should be straightforward, easy to understand, and not cause ambiguity for senior high school students. The language used is adjusted to the comprehension level of senior high school students. Third is validity, meaning the statements are formulated based on relevant theories and concepts, referring to the operational definitions of the 7Cs that have been established. Fourth is a representation of dimensions, meaning the statement items comprehensively represent all aspects of each dimension of the 7Cs.

Fifth is the balance, meaning the number of statement items for each dimension of the 7Cs is aimed to be balanced, reflecting the weight of each dimension. Sixth is the type of statement, meaning closed statements with a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree), which measures students' perceptions of themselves in the context of physical education learning. Seventh, format, meaning the instrument is designed as a questionnaire that is easy for senior high school students to complete. The questionnaire will be tested in a pilot and a primary test.

Based on the design, a draft instrument consisting of statement items for each dimension of the 7Cs was developed. The component indicators were developed according to Dimitrova et al. (2021). Then, the researcher developed sub-indicators to align with the research objectives based on the context or scope within physical education, as shown in Table 1.

Table 1. Components, descriptions, sub-indicators, and instrument design references

No	Components (7Cs)	Description	Sub Indicators	References
1	Competence (mastery of skills)	The ability of individuals to develop academic, social, and emotional skills to achieve success in learning	Close friendship Self-efficacy Academic competence (knowledge and skills)	Chiu and Lin (2019), Dolin et al. (2018), and Kauertz et al. (2012)
2	Confidence (the development of self-confidence in the learning process)	The confidence that develops through challenging learning experiences and support from the surrounding environment	Belief in self-ability Initiative Ability to take risks Ability to handle pressure Resilience Public speaking Independence in task completion	Westover (2024)
3	Character (building character in learning)	The development of moral values, ethics, and positive attitudes in the learning process	Integrity Responsibility Discipline Empathy Cooperation Independence in decision-making Courage Justice Perseverance Openness	Biddle (2022)
4	Connection (building social relationships within groups)	The ability to establish and maintain positive relationships with peers, teachers, and the school community	Social support Positive relationships with peers Relationship with teachers Involvement in group activities	Bradley et al. (2021)
5	Caring (developing love and care)	A sense of empathy and care for others that creates a harmonious and inclusive learning environment	Empathy Concern for the well-being of others Actions that prioritize compassion Building caring relationships	Harlynking (2009)
6	Contribution (participating in the group for a common goal)	Active participation in various social and academic activities to achieve common goals	Social involvement Involvement in decision-making Service and responsibility Cooperation and collaboration Awareness of positive impact	Viktor (2023)
7	Creativity (thinking and acting creatively)	The ability to generate new ideas, innovate in problem-solving, and experiment in the learning process	Creative thinking Creativity in Action Innovation in problem-solving Exploration and experimentation Creative collaboration Creativity in enhancing motivation	Reisman et al. (2016) and Runco (2023)

Development stage

The draft instrument was then submitted to five experts (raters) for content validation. The validators comprised one physical education lecturer, one physical education teacher, two psychometrics experts, and one language expert. The experts were asked to assess each statement item's content validity and clarity using a structured validation sheet. Feedback from the experts was used to revise the draft instrument. The content validity criterion refers to the Content Validity Ratio (CVR) (Lawshe, 1975; Romero Jeldres et al., 2023). The CVR formula is CVR = (Ne - N/2) / N/2, where Ne is the number of experts who rate the statement item as relevant, and N is the total number of experts. Statement items with a CVR value of less than 0.74 were revised or removed.

Overall, the validators evaluated 78 items from seven indicators, with the following details. The competence indicator consists of six items (1-6), including "I have difficulty forming deep friendships with my classmates." The confidence indicator consists of 13 items (7-20), including "I often feel nervous and confused when I have to speak or perform in front of my peers during lessons." The character indicator consists of 19 items (21-40), including "I sometimes favor close friends in group situations." The connection indicator consists of seven items (items 41-48), including "I actively participate in group activities at school." The caring indicator consists of seven items (items 49-56), including "I rarely interact with friends outside of academic activities." The contribution indicator consists of nine items (57-66), including "I dare to voice my opinion during class meetings." The creativity indicator consists of 11 items (67-78), including "I look for alternative solutions if the first method fails."

Table 2. Item design for expert validation

No	Statements	Responses				
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I have a close friend who always supports me in learning					
2	I often feel that I don't fully understand the skills taught by the Physical Education teacher					
3	I often feel unable to achieve the learning targets set					
4	I master the subject matter well					
5	I am confident I can overcome learning difficulties					
6	I have difficulty forming deep friendships with my classmates					
7	I always look for ways to start projects or discussions in class					
8	I often get nervous and confused when I have to speak and perform in front of my friends during the learning process					
9	Failure does not make me give up, but instead, I learn to do better					
10	I can complete tasks without relying on others					
11	I feel comfortable when presenting or speaking in front of many people					
12	I avoid situations that require me to make risky decisions					
13	I find it hard to bounce back after experiencing failure					
14	I panic easily when tasks pile up					
15	I remain calm when facing exams or presentations					
16	I am brave enough to try new learning methods even if they carry the risk of failure					
17	I tend to wait for instructions before acting					
18	I believe I can complete difficult tasks if I try hard enough					
19	I often doubt my abilities when facing new challenges					
20	I need constant help from teachers or friends to complete tasks					
21	I treat all friends equally, without favoritism					
22	I keep trying until the task is done, even if it takes a long time					
23	I find it hard to balance play and study time					
24	I am capable of making important decisions without others' intervention					
25	I find it hard to accept opinions that differ from my thoughts					
26	I am afraid of being criticized if I share ideas or opinions					
27	I sometimes cheat when I cannot answer questions					
28	I am always honest when doing assignments or exams					
29	I am open to receiving feedback from teachers or friends					
30	I often ask others to make important decisions for me					
31	I sometimes favor close friends in group situations					
32	I tend to ignore the problems others are experiencing					
33	I care when I see a friend in difficulty					
34	I am brave enough to express my opinion even if it differs from others					
35	I easily give up if the task feels too difficult					
36	I enjoy working together with friends in a group					
37	I have a regular study schedule every day					
38	I prefer working alone rather than discussing with the team					
39	I often procrastinate tasks					
40	I complete tasks on time even though they are difficult					

41	I actively participate in group activities at school
42	I often feel isolated from my group of classmates
43	I feel like no one cares when I am struggling
44	I feel like the teacher does not understand my needs as a student
45	I am comfortable discussing academic or personal problems with the teacher
46	I feel supported by my friends when facing problems
47	I easily make friends with anyone in the class
48	I avoid activities that require working with many people
49	I try to understand the feelings of friends who are sad
50	I rarely interact with friends outside of academic activities
51	I sometimes act harshly unintentionally due to emotions
52	I often offer help to friends in need
53	I maintain good communication with my friends to support each other
54	I always behave kindly and politely to everyone at school
55	I feel I don't need to interfere in other people's affairs
56	I don't think much about others' feelings when making decisions
57	I am active in social activities such as social service or school community service
58	I am brave enough to voice my opinion during class meetings
59	I feel my efforts do not have a significant impact on the group
60	I often behave individualistically in group work
61	I am willing to sacrifice my personal time to help the group task
62	I always try to find a solution together when the team faces a problem
63	I am reluctant to take on extra responsibilities outside of individual tasks
64	I tend to remain silent and follow others' decisions
65	I prefer not to participate in social activities at school
66	I believe my contributions benefit the group
67	I often come up with unique ideas to solve problems
68	I enjoy trying unconventional learning methods
69	I tend to give up if the initial solution doesn't work
70	I use creativity to make learning more enjoyable
71	I feel group discussions are just a waste of time
72	I prefer following proven methods rather than experimenting
73	I have difficulty finding new ways to face challenges
74	I enjoy discussing with friends to explore innovative ideas
75	I look for alternative solutions if the first method fails
76	I avoid things I have never tried before
77	I am not interested in finding creative ways to boost my learning spirit
78	I am interested in trying new tools or technologies to support learning

Implementation stage

Data Collection Technique

The primary data collection technique is the questionnaire. The validated questionnaire will be distributed to the respondents. In addition to the questionnaire, supporting data will be collected through participant observation during physical education lessons to validate the questionnaire data and provide a more comprehensive view of student behavior. Learning documentation, such as teacher notes and student performance assessment results, will also be used as supporting data. Observations will be conducted using a structured observation sheet validated by experts, focusing on student behaviors representing each dimension of the 7Cs. Documentation data will be collected with the approval of the teachers and schools, ensuring confidentiality and research ethics.

Population

The study's population consists of senior high school students across Indonesia. The sampling technique used is stratified random sampling, which aims to ensure the representation of various student characteristics, specifically class X students aged 16-18. The sample size is more than 200 individuals, considering that sample size calculations will account for the desired error rate and test power. After the questionnaires were distributed, 222 respondents were obtained.

Questionnaire

The questionnaire was distributed directly to the selected schools via Google Forms. Before filling out the questionnaire, the researcher briefly explained the research objectives and the questionnaire completion process, ensuring the confidentiality of respondents' answers. Respondents were given ample time to complete the questionnaire.

Pilot Test

Before the main test, a pilot test was conducted with 20 senior high school students outside the main sample to test the instrument's clarity and feasibility, including the clarity of instructions, the time needed for completion, and the student's understanding of the statements. The pilot test results were used to revise the instrument before it was used in the main test.

Evaluation stage

The data obtained from the stage 2 (primary test) trial were analyzed using several techniques:

Validity Test

The content validity of the expert assessments was measured using the Content Validity Ratio (CVR) formula (Lawshe, 1975; Romero Jeldres et al., 2023). A high CVR value indicates good content validity. Statement items with a CVR value of less than 0.74 were revised or removed. The CVR value will be calculated for each statement item and each dimension of the 7Cs. Furthermore, construct validity was measured using Exploratory Factor Analysis (EFA) (Brown, 2015; Thompson, 2004). This analysis is a multivariate statistical method that has become a fundamental tool in theory and measurement development and validation in psychology (Watkins, 2018) to identify common factors that explain the observed covariance between a set of measured variables (Blegur, Mahendra, et al., 2023). This analysis was conducted using Microsoft Excel and SPSS 29 software.

Reliability Test

Internal consistency reliability was measured using Cronbach's alpha coefficient, with a parameter >0.60 indicating acceptable reliability in exploratory research (Hair Jr et al., 2020; Mahardika et al., 2024; Nunnally & Bernstein, 1994; ten Berge, 1995; Thorndike, 1995). This coefficient measures how consistently the statement items measure the same construct. The Cronbach's alpha value will be calculated for each dimension of the 7Cs and the overall instrument.

Results

Content validity ratio

The results of the content validity test were measured by expert assessments (Content Validity Ratio - CVR), which include material consistency and construct consistency by five raters, with a total of 78 statements from seven indicators. All content validity items, including material consistency and create consistency, were calculated using the Aiken-V formula with a significance level of 0.05 on a 1-5 scale, and the values were ≥0.74, indicating that all components are valid (see Figure 1). The data show significant variation among items, with some points reaching a maximum value of 0.95. It proves that certain items perform better than others, even though accepting critical values still falls within the valid criteria.

Figure 1. Material consistency instrument (left), construct consistency (right)
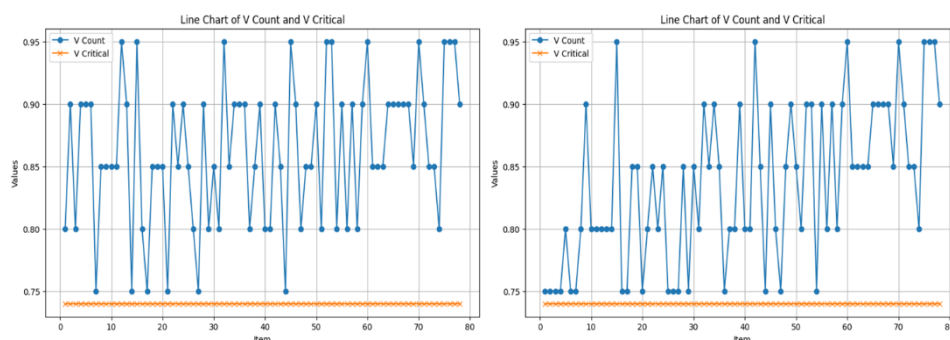
Exploratory factor analysis

In the Exploratory Factor Analysis (EFA), the sample adequacy is first assessed in the context of factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO-MSA) is an important tool in

factor analysis that helps researchers assess sample adequacy and the feasibility of the analysis. By using the KMO value, researchers can ensure that the data used in the factor analysis is adequate, enhancing the validity and reliability of the analysis results. The KMO-MSA value obtained is 0.888, which has an excellent interpretation value. The prerequisite criterion for continuing the analysis is that the KMO MSA value (>0.50) allows the factor analysis to proceed (see Table 3).

Table 3. KMO and Bartlett's test

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.888
Bartlett's Test of Sphericity	Approx. Chi–Square	835.455
	df	21
	Sig.	0.000

Next, an anti-image correlation matrices test was conducted, a measure used in factor analysis, particularly in the context of EFA. The purpose of this value is to evaluate the suitability of each indicator (item) in the proposed factor model. The anti-image correlation value is crucial in factor analysis as it helps researchers assess the appropriateness and contribution of each indicator in the model. By using this value, researchers can enhance the validity and reliability of the measurement instrument and ensure that all indicators used are relevant and aligned with the measured construct. It was found that the anti-image correlation values for each indicator were: competence = 0.886, confidence = 0.879, character = 0.857, caring = 0.907, connection = 0.888, contribution = 0.888, and creativity = 0.914. These results have met the criteria or reference value of >0.50 and can be further analyzed while maintaining the seven indicators established (see Table 4).

Table 4. Anti-image correlation matrices

Indicator	Anti-image correlation value	Critical value	Conclusion
Competence	0.886	0.50	Completed
Confidence	0.879	0.50	Completed
Character	0.857	0.50	Completed
Caring	0.907	0.50	Completed
Connection	0.888	0.50	Completed
Contribution	0.888	0.50	Completed
Creativity	0.914	0.50	Completed

The next step is to analyze the output of communalities, which is a measure that indicates the proportion of variance in each variable that can be explained by the factors identified in the model. Analyzing the communalities output is an important step in factor analysis that helps researchers assess the suitability of variables, improve the model's validity, and support revision decisions. Using this information, researchers can ensure that the model produced is representative and reliable. The extraction value testing criterion is known to be >0.50, including competence = 0.516, confidence = 0.573, character = 0.798, caring = 0.622, connection = 0.586, contribution = 0.737, and creativity = 0.732. Finally, it is concluded that all seven indicators used have values >0.50, which means that all the indicators have strong relationships (see Table 5, extraction column).

Table 5. Communalities and component matrix

Indicator	Initial	Extraction	Component matrix[a]
Competence	1.000	0.516	0.593
Confidence	1.000	0.573	0.611
Character	1.000	0.798	0.893
Caring	1.000	0.622	0.789
Connection	1.000	0.586	0.765
Contribution	1.000	0.737	0.858
Creativity	1.000	0.732	0.855

Extraction method: Principal component analysis

Then, the analysis continued by examining the output of the component matrix, which shows the relationship between the original variables and the resulting factors. Analyzing the output of the component matrix is an important step in factor analysis that helps researchers assess the relationships between variables and factors, identify the factor structure, and support the interpretation of the results. Using this information, researchers can ensure that the generated model is representative and reliable. The

factor loading test criteria are known to be >0.50 (N=222), according to the table by Hair Jr et al. (2020), which include competence = 0.593, confidence = 0.611, character = 0.893, caring = 0.789, connection = 0.765, contribution = 0.858, and creativity = 0.855. Reflecting on the data above, it can be concluded that all seven indicators are consistent and suitable for use (see Table 5, component matrix column).

Next, the researcher calculates the reliability test, which aims to assess the consistency and reliability of the measurement instrument. Calculating the reliability test is a crucial step in the research that helps assess the consistency and reliability of the measurement instrument. To ensure the instrument is reliable, the researcher can improve the research results' validity, interpretation, and quality. The reliability test values using Cronbach's alpha are as follows: competence = 0.622, confidence = 0.658, character = 0.824, caring = 0.680, connection = 0.610, contribution = 0.739, and creativity = 0.766. Therefore, the conclusion is that all indicators are reliable, as Cronbach's alpha values are greater than 0.60 (see Table 6).

Table 6. Reliability test result of Cronbach alpha

Indicators	Cronbach's Alpha	Criteria reference	Conclusion
Competence	0.622	0.60	Reliable
Confidence	0.658	0.60	Reliable
Character	0.824	0.60	Reliable
Caring	0.680	0.60	Reliable
Connection	0.610	0.60	Reliable
Contribution	0.739	0.60	Reliable
Creativity	0.766	0.60	Reliable

Discussion

The main objective of this study is to construct a 7C instrument based on PYD for physical education in senior high school students. The results of this study successfully constructed 78 statement items developed from the seven Cs indicators (Competence, confidence, character, caring, connection, contribution, and creativity). Starting with the Aiken test results, it was found that all items had a value ≥0.74. Continuing with the KMO-MSA test = 0.888, this result proves that the data used is highly adequate for factor analysis. The anti-image correlation values for each indicator were also >0.50, reinforcing that all indicators significantly contribute to the measured construct. The extraction values for each indicator ranged from 0.516 to 0.798 (>0.50), showing that all indicators have a strong relationship with the measured factors. The component matrix test showed that all indicators had loading values >0.50, ranging from 0.593 to 0.893, confirming the consistency and appropriateness of these indicators in the instrument. The reliability test results showed a value of 0.97, well above the established threshold (>0.60), concluding that the developed instrument is highly reliable. Each indicator also showed good reliability values. Specifically, the character indicator had the highest value (0.824), and the connection indicator had the lowest value = 0.609.

This study complements previous research by Geldhof et al. (2014, 2019), which had previously validated the 5Cs (excluding contribution and creativity). They measured PYD components with a 34-item Cs model, detailed as follows: First, six items on the competence indicator related to social, academic, and physical competencies, with a reliability value of 0.697. Second, six items on the confidence indicator related to appearance, positive identity, and self-esteem, with a reliability value of 0.901. Third, the character indicator refers to behavior, social awareness, personal values, and value diversity, with a reliability value of 0.596. Fourth, six items on the caring indicator related to an individual's willingness to help someone when seeing that person in need, with a reliability value of 0.889. Fifth, eight items on the connection indicator focus on adolescents' relationships with family, school, community, and peers, with a reliability value of 0.786. This 5Cs scale also uses a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. This scale has also been adapted into Spanish by Gomez-Baya et al. (2019) and was used by Novak et al. (2023) to develop positive youth development (PYD) among 3559 high school students in Croatia.

According to Karakulak and Cüre-Acer (2021), the 5Cs and 6Cs models of PYD by Geldhof et al. (2014, 2019) and the newly developed 7Cs model by Dimitrova et al. (2021) have similarities in emphasizing the strengths and potential of youth as well as internal and external developmental assets that, together

and longitudinally, have been shown to predict life satisfaction (Zhou et al., 2020). The development of the 7Cs instrument in the context of physical education is significant because education is the medium for preparing students to become citizens who can survive by responding to and meeting the various challenges of life in the present and future. For example, competence emphasizes the importance of an optimistic outlook in student development. Confidence refers to students' positive feelings toward their self-esteem and belief in their competence. Connection reflects bonds with individuals and institutions. Character plays a role in shaping a generation of youth obedient to social norms and rules. Caring refers to the ability to sense and understand the feelings of others, whether through sympathy or empathy. Contribution is related to active roles in the broader community (Bowers et al., 2010; Olurin, 2024). Creativity includes fluency, flexibility, elaboration, originality, and the ability to solve problems in new and adaptive ways, which is meaningful in social and cultural contexts (Dimitrova et al., 2021).

The development of the 7Cs scale is indeed still minimal. Recently, only Buenconsejo et al. (2025) succeeded in developing the 7Cs scale using factorial analysis, involving 1888 emerging adults (M±SD age = 24.10±6.89) from five countries in Southeast Asia, such as Indonesia (n = 253), Malaysia (n = 289), the Philippines (n = 496), Singapore (n = 306), and Thailand (n = 544). The study's results proved significant differences in the 7Cs across the five countries. Therefore, with the results of this current study, not only have we succeeded in developing the 7Cs scale in the Indonesian context to fit better the social and cultural context of students in Indonesia, but this scale also fills the gap in Buenconsejo et al. (2025) by using a population of senior high school students aged 16-18 years. Developing the 7Cs instrument (competence, confidence, character, caring, connection, contribution, and creativity) is significant in physical education. Each of these aspects plays an important role in holistically shaping students through comprehensive and meaningful learning designs so that they are physically active and develop higher-order thinking skills and social and emotional attitudes. Considering that physical education aims not only to improve physical abilities but also through physical activities, teachers need to develop students' life skills so they can overcome various life challenges they encounter (life skills) (Cronin et al., 2020; Papacharisis et al., 2007; Razali et al., 2024; Suardika et al., 2021).

Conclusions

The research findings conclude that after undergoing validity and reliability tests, the instrument developed is valid and reliable or deemed suitable for measuring the 7Cs in senior high schools. The design of the research instrument through validity and reliability testing is important, as it ensures that the data collected are accurate, consistent, and trustworthy. Validity testing ensures that the instrument measures what it is supposed to measure. In contrast, reliability testing guarantees the consistency of the measurement results and ensures the quality of the data, which guarantees the validity of conclusions and enhances scientific credibility. Without these two tests, the risk of misinterpretation is high, harming the overall scientific process (Karnia, 2024; Mohajan, 2017). Overall, this study successfully designed and validated a 7Cs measurement instrument that can be used to assess students' competencies in senior high school within the context of physical education. The results provide significant contributions to the development of physical education and student character development. The implications of this study can be used to improve physical education practices in schools and for further research in this field. This study is still limited because the instrument testing only uses EFA. Therefore, we recommend that future research can conduct further testing using more complex ones such as outer and inner model tests and goodness-of-fit tests using Structural Equation Modeling (CB-SEM) analysis. This analysis can provide more optimal results in the development of the 7Cs instrument in physical education, especially for high school students.

Acknowledgements

References

Abdul Kadir, N. B., Mohd, R. H., & Dimitrova, R. (2021). Promoting mindfulness through the 7Cs of positive youth development in Malaysia. In R. Dimitrova & N. Wiium (Eds.), *Handbook of Positive Youth Development: Advancing Research, Policy, and Practice in Global Contexts* (pp. 49–62). Springer. https://doi.org/10.1007/978-3-030-70262-5_4

Ahmad, K., Nurkhin, A., Muhsin, & Pramusinto, H. (2020). Problem-based learning strategy: Its impact on students' critical and creative thinking skills. *European Journal of Educational Research*, *9*(3), 1141–1150. https://doi.org/10.12973/eu-jer.9.3.1141

Biddle, T. D. (2022). Character traits strategic leaders need. *The US Army War College Quarterly: Parameters*, *52*(2), 103–116. https://doi.org/10.55540/0031-1723.3155

Blegur, J., Mahendra, A., Mahardika, I. M. S., Lumba, A. J. F., & Rajagukguk, C. P. M. (2023). Construction of analytical thinking skills instruments for micro teaching courses. *Journal of Education Research and Evaluation*, *7*(2), 184–196. https://doi.org/10.23887/jere.v7i2.57025

Blegur, J., Rajagukguk, C. P. M., Sjioen, A. E., & Souisa, M. (2023). Innovation of analytical thinking skills instrument for throwing and catching game activity for elementary school students. *International Journal of Instruction*, *16*(1), 723–740. https://doi.org/10.29333/iji.2023.16140a

Blegur, J., Subarjah, H., Hidayat, Y., Ma'mun, A., Mahendra, A., Mahardika, I. M. S., & Hardiansyah, S. (2024). Peer-assessment academic integrity scale (PAAIS-24). *Emerging Science Journal*, *8*(2), 513–526. https://doi.org/10.28991/ESJ-2024-08-02-09

Blegur, J., Yustiana, Y. R., Taufiq, A., Ilham, M., & Hardiansyah, S. (2023). Integrating analytical thinking skills into physical education to improve student learning outcomes. *Jurnal Keolahragaan*, *11*(2), 180–190. https://doi.org/10.21831/jk.v11i2.61176

Bowers, E. P., Geldhof, G. J., Johnson, S. K., Hilliard, L. J., Hershberg, R. M., Lerner, J. V., & Lerner, R. M. (2015). *Promoting positive youth development: Lessons from the 4-H study*. Springer International Publishing. https://doi.org/10.1007/978-3-319-17166-1

Bowers, E. P., Li, Y., Kiely, M. K., Brittian, A., Lerner, J. V., & Lerner, R. M. (2010). The Five Cs model of positive youth development: A longitudinal analysis of confirmatory factor structure and measurement invariance. *Journal of Youth and Adolescence*, *39*(7), 720–735. https://doi.org/10.1007/S10964-010-9530-9/METRICS

Bradley, G. L., Ferguson, S., & Zimmer-Gembeck, M. J. (2021). Parental support, peer support and school connectedness as foundations for student engagement and academic achievement in Australian youth. In R. Dimitrova & N. Wiium (Eds.), *Handbook of Positive Youth Development* (pp. 219–236). Springer. https://doi.org/10.1007/978-3-030-70262-5_15

Branch, R. M. (2010). *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.

Buenconsejo, J. U., Ferrer-Wreder, L., Kadir, N. B. A., Krauss, S., Yu, Y., Aruta, J. J. B., Suryani, A. O., Kittiteerasack, P., & Dimitrova, R. (2025). The factorial validity and measurement invariance of the 7Cs of positive youth development among emerging adults in southeast Asia. *Developmental Psychology*. https://doi.org/10.1037/DEV0001956

Chiu, M.-H., & Lin, J.-W. (2019). Modeling competence in science education. *Disciplinary and Interdisciplinary Science Education Research*, *1*(1), 12. https://doi.org/10.1186/s43031-019-0012-y

Cronin, L. D., Marchant, D., Johnson, L., Huntley, E., Kosteli, M. C., Varga, J., & Ellison, P. (2020). Life skills development in physical education: A self-determination theory-based investigation across the school term. *Psychology of Sport and Exercise*, *49*, 101711. https://doi.org/10.1016/j.psychsport.2020.101711

Dimitrova, R., Fernandes, D., Malik, S., Suryani, A., Musso, P., & Wiium, N. (2021). The 7Cs and developmental assets models of positive youth development in India, Indonesia and Pakistan. In R. Dimitrova & W. Wiium (Eds.), *Handbook of Positive Youth Development: Advancing Research, Policy, and Practice in Global Contexts* (pp. 17–33). Springer Nature. https://doi.org/10.1007/978-3-030-70262-5_2

Dolin, J., Black, P., Harlen, W., & Tiberghien, A. (2018). Exploring relations between formative and summative assessment. In J. Dolin & R. Evans (Eds.), *Transforming Assessment. Contributions from Science Education Research* (pp. 53–80). Springer. https://doi.org/10.1007/978-3-319-63248-3_3

Dupri, Nazirun, N., & Candra, O. (2021). Creative thinking learning of physical education: Can be enhanced using discovery learning model? *Journal Sport Area*, *6*(1), 37–47. https://doi.org/10.25299/sportarea.2021.vol6(1).5690

Dupri, Nazirun, N., & Risma, N. S. (2019). Penerapan model problem based learning untuk meningkatkan keterampilan berpikir kritis pada pendidikan jasmani. *Journal Sport Area*, *4*(2), 318–326. https://doi.org/10.25299/sportarea.2019.vol4(2).3760

Geldhof, G. J., Bowers, E. P., Boyd, M. J., Mueller, M. K., Napolitano, C. M., Schmid, K. L., Lerner, J. V., & Lerner, R. M. (2014). Creation of short and very short measures of the five cs of positive youth development. *Journal of Research on Adolescence*, *24*(1), 163–176. https://doi.org/10.1111/jora.12039

Geldhof, G. J., Larsen, T., Urke, H., Holsen, I., Lewis, H., & Tyler, C. P. (2019). Indicators of positive youth development can be maladaptive: The example case of caring. *Journal of Adolescence*, *71*(1), 1–9. https://doi.org/10.1016/j.adolescence.2018.11.008

Gomez-Baya, D., Reis, M., & Gaspar de Matos, M. (2019). Positive youth development, thriving and social engagement: An analysis of gender differences in Spanish youth. *Scandinavian Journal of Psychology*, *60*(6), 559–568. https://doi.org/10.1111/sjop.12577

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). An introduction to structural equation modeling. In *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook* (pp. 1–29). Springer. https://doi.org/10.1007/978-3-030-80519-7_1

Hair Jr, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis*. Cengage.

Hair Jr, J. F., Page, M., & Brunsveld, N. (2020). *Essentials of business research methods* (4th ed.). Routledge. https://doi.org/10.4324/9780429203374

Harlynking, J. (2009). The art of caring: Increasing empathy through conversation. *Honors Program Theses*, *87*, 1–31. https://scholarship.rollins.edu/honors/87

Karakulak, A., & Cüre-Acer, S. (2021). Book review: Handbook of positive youth development: Advancing the next generation of research, policy, and practice in global contexts. *Frontiers in Psychology*, *12*, 716388. https://doi.org/10.3389/fpsyg.2021.716388

Karnia, R. (2024). Importance of reliability and validity in research. *Psychology and Behavioral Sciences*, *13*(6), 137–141. https://doi.org/10.11648/j.pbs.20241306.11

Kauertz, A., Neumann, K., & Haertig, H. (2012). Competence in science education. In B. J. Fraser, K. Tobin, & C. J. McRobbie (Eds.), *Second International Handbook of Science Education* (1st ed., pp. 711–721). Springer Netherlands. https://doi.org/10.1007/978-1-4020-9041-7_47

Kim, S., Raza, M., & Seidman, E. (2019). Improving 21st-century teaching skills: The key to effective 21st-century learners. *Research in Comparative and International Education*, *14*(1), 99–117. https://doi.org/10.1177/1745499919829214

Kuspratiwi, F. W., Subagyo, & Nevitaningrum, N. (2024). Does physical education activity affect character development in primary school students? *Journal of Advances in Sports and Physical Education*, *7*(06), 171–174. https://doi.org/10.36348/jaspe.2024.v07i06.009

Lawshe, C. H. (1975). A quantitative approach to content validity. *Personnel Psychology*, *28*(4), 563–575. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x

Lerner, R. M., Lerner, J. V., Murry, V. M., Smith, E. P., Bowers, E. P., Geldhof, G. J., & Buckingham, M. H. (2021). Positive youth development in 2020: Theory, research, programs, and the promotion of social justice. *Journal of Research on Adolescence*, *31*(4), 1114–1134. https://doi.org/10.1111/jora.12609

Lerner, R. M., Lerner, J. V., P. Bowers, E., & John Geldhof, G. (2015). Positive youth development and relational-developmental-systems. In W. F. Overton, P. C. M. Molenaar, & R. M. Lerner (Eds.), *Handbook of Child Psychology and Developmental Science* (7th ed., pp. 507–651). Wiley. https://doi.org/10.1002/9781118963418.childpsy116

Lohr, K. N. (2002). Assessing health status and quality-of-life instruments: Attributes and review criteria. *Quality of Life Research*, *11*, 193–205. https://doi.org/10.1023/A:1015291021312

Mahardika, I. M. S., Blegur, J., Berliana, Anaktotoy, J., Boleng, L. M., & Arhesa, S. (2024). Global transformational leadership scale: Cross-cultural adaptation of Indonesian sports science student context. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(5), 3068–3080. https://doi.org/10.11591/ijere.v13i5.29122

Manrique-Millones, D. L., Pineda-Marin, C. P., Millones-Rivalles, R. B., & Dimitrova, R. (2021). The 7Cs of positive youth development in Colombia and Peru: A promising model for reduction of risky behaviors among youth and emerging adults. In R. Dimitrova & N. Wiium (Eds.), *Handbook of Positive Youth Development: Advancing Research, Policy, and Practice in Global Contexts* (1st ed., pp. 35–48). Springer. https://doi.org/10.1007/978-3-030-70262-5_3

Mohajan, H. K. (2017). Two criteria for good measurements in research: Validity and reliability. *Annals of Spiru Haret University. Economic Series*, *17*(4), 59–82. https://doi.org/10.26458/1746

Muratbayevich, J. P. (2024). Physical education and its impact on mental health. *International Journal of Pedagogics*, *4*(11), 220–224. https://doi.org/10.37547/ijp/Volume04Issue11-42

Novak, M., Šutić, L., Gačal, H., Roviš, D., Mihić, J., & Maglica, T. (2023). Structural model of 5Cs of positive youth development in Croatia: relations with mental distress and mental well-being. *International Journal of Adolescence and Youth*, *28*(1), 2227253. https://doi.org/10.1080/02673843.2023.2227253

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Olurin, T. (2024). Demographics and five Cs of PYD as predictors of the domains of contribution among youth in Nigeria. *Youth*, *4*(2), 661–678. https://doi.org/10.3390/youth4020045

Papacharisis, V., Theofanidis, G., & Danish, S. (2007). Education through the physical: The effectiveness of teaching life skills program in physical education. In L. A. Chiang (Ed.), *Motivation of Exercise and Physical Activity* (pp. 66–77). Nova Science Publishers.

Pill, S., & SueSee, B. (2017). Including critical thinking and problem solving in physical education. *Journal of Physical Education, Recreation & Dance*, *88*(9), 43–49. https://doi.org/10.1080/07303084.2017.1367741

Raharjo, H. P., Kusuma, D. W. Y., Putra, R. B. A., & Irsyada, R. (2023). Physical education with the TPSR model: Building characters and basic manipulative movements in elementary school students. *Journal Sport Area*, *8*(2), 239–250. https://doi.org/10.25299/sportarea.2023.vol8(2).11072

Razali, Blegur, J., Ma'mun, A., Berliana, Mahendra, A., Juliantine, T., Lubis, A. E., Prasetiyo, R., & Tlonaen, Z. A. (2024). Physical education teachers' experiences in promoting life skills using differentiated instruction. *Retos*, *57*, 641–654. https://doi.org/10.47197/retos.v57.106167

Reisman, F., Keiser, L., & Otti, O. (2016). Development, use and implications of diagnostic creativity assessment app, RDCA – Reisman diagnostic creativity assessment. *Creativity Research Journal*, *28*(2), 177–187. https://doi.org/10.1080/10400419.2016.1162643

Romero Jeldres, M., Díaz Costa, E., & Faouzi Nadim, T. (2023). A review of Lawshe's method for calculating content validity in the social sciences. *Frontiers in Education*, *8*, 1271335. https://doi.org/10.3389/feduc.2023.1271335

Runco, M. A. (2023). Creativity and learning. In *International Encyclopedia of Education* (4th ed., pp. 135–140). Elsevier. https://doi.org/10.1016/B978-0-12-818630-5.14031-X

Scholtes, V. A., Terwee, C. B., & Poolman, R. W. (2011). What makes a measurement instrument valid and reliable? *Injury*, *42*(3), 236–240. https://doi.org/10.1016/j.injury.2010.11.042

Suardika, I. K., Ma'mun, A., Kusmaedi, N., & Budiana, D. (2021). Development of life skills through physical education and sports. *Advances in Social Science, Education and Humanities Research*, *618*, 367–371. https://doi.org/10.2991/assehr.k.211223.063

ten Berge, J. M. F. (1995). J. C. Nunnally and I. H. Bernstein. Psychometric theory. New York: McGraw-Hill, 1994, xxiv+752 pages, £51.95. *Psychometrika*, *60*(2), 313–315. https://doi.org/10.1007/BF02301419

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications.* (1st ed.). American Psychological Association. https://doi.org/10.1037/10694-000

Thorndike, R. M. (1995). Book review: Psychometric theory (3rd ed.) by Jum Nunnally and Ira Bernstein New York: McGraw-Hill, 1994, xxiv + 752 pp. *Applied Psychological Measurement*, *19*(3), 303–305. https://doi.org/10.1177/014662169501900308

Usra, M., Bayu, W. I., Solahuddin, S., & Octara, K. (2023). Improving critical thinking ability using teaching game for understanding. *Journal of Physical Education and Sport*, *23*(2), 419–423. https://doi.org/10.7752/jpes.2023.02051

Viktor, P. (2023). The role of human choices in the learning process. *The Eurasia Proceedings of Educational and Social Sciences*, *33*, 158–165. https://doi.org/10.55549/epess.1413361

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

Westover, J. H. (2024). Building confidence in the workplace. *Human Capital Leadership Review*, *13*, 1. https://doi.org/10.70175/hclreview.2020.13.1.9

Wiium, N., & Dimitrova, R. (2019). Positive youth development across cultures: Introduction to the special issue. *Child & Youth Care Forum*, *48*(2), 147–153. https://doi.org/10.1007/s10566-019-09488-7

Zhou, Z., Shek, D. T. L., & Zhu, X. (2020). The importance of positive youth development attributes to life satisfaction and hopelessness in mainland Chinese adolescents. *Frontiers in Psychology*, *11*, 553313. https://doi.org/10.3389/fpsyg.2020.553313

Authors and translators' details:

Aang Rohyana	aangrohyana@upi.edu	Author
Amung Ma'mun	amung@upi.edu	Author
Tite Juliantine	titejuliantine@upi.edu	Author
Dian Budiana	dianbudiana@upi.edu	Author
Cucu Hidayat	cucuhidayat@unsil.ac.id	Author
Agus Arief Rahmat	agusarifrahman@unsil.ac.id	Author
Lalu Hulfian	laluhulfian@undikma.ac.id	Author
Zuvyati Aryani Tlonaen	zuvyatitlonaen@ukaw.ac.id	Translator