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Development Conceptual and Empirical Validity of Collaboration and Communication Skills Instruments in Sports Learning

Desarrollo de validez conceptual y empírica de instrumentos de habilidades de colaboración y comunicación en el aprendizaje deportivo

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Abstract. The importance of 21st-century skills, especially collaboration and communication skills, is increasingly emphasized in the era of globalization and the Industrial Revolution 4.0. However, there is a gap in measuring these skills in Indonesia's sports education context. This research aims to develop and validate a new instrument to measure collaboration and communication skills in sports learning effectively. Exploratory and Confirmatory Factor Analysis was used to identify and validate collaboration and communication skills factors. This research involved 510 students from Palangkaraya, Lamandau, Seruyan, Pulang Pisau, Kapuas, Buntok, Sampit, and Murung Raya with a total of 8 regions in Indonesia. The research results show that the instrument developed has good validity and reliability. Evaluation of scale characteristics and confirmatory factor analysis demonstrated the reliable quality of the instrument for measuring collaboration and communication skills in the context of sports learning. Through the development of this instrument, it is hoped that it can significantly contribute to the understanding of collaboration and communication skills in sports learning in Indonesia. Hopefully, this instrument will become a valuable tool for educators, researchers, and practitioners to measure and develop these skills and provide a basis for improving the quality of sports education in Indonesia.
Keywords: skills, collaboration, communication, validation

Resumen. La importancia de las habilidades del siglo XXI, especialmente las de colaboración y comunicación, se enfatiza cada vez más en la era de la globalización y la Revolución Industrial 4.0. Sin embargo, existe una brecha en la medición de estas habilidades en el contexto de la educación deportiva de Indonesia. Esta investigación tiene como objetivo desarrollar y validar un nuevo instrumento para medir de manera efectiva las habilidades de colaboración y comunicación en el aprendizaje deportivo. Se utilizó el Análisis Factorial Exploratorio y Confirmatorio para identificar y validar factores de habilidades de colaboración y comunicación. En esta investigación participaron 510 estudiantes de Palangkaraya, Lamandau, Seruyan, Pulang Pisau, Kapuas, Buntok, Sampit y Murung Raya con un total de 8 regiones de Indonesia. Los resultados de la investigación muestran que el instrumento desarrollado tiene buena validez y confiabilidad. La evaluación de las características de la escala y el análisis factorial confirmatorio demostraron la calidad confiable del instrumento para medir las habilidades de colaboración y comunicación en el contexto del aprendizaje deportivo. A través del desarrollo de este instrumento, se espera que pueda contribuir significativamente a la comprensión de las habilidades de colaboración y comunicación en el aprendizaje deportivo en Indonesia. Con suerte, este instrumento se convertirá en una herramienta valiosa para que educadores, investigadores y profesionales midan y desarrollen estas habilidades y proporcione una base para mejorar la calidad de la educación deportiva en Indonesia.
Palabras clave: Habilidades, colaboración, comunicación, validación.

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Introduction

Education is a major milestone in the journey of human life that shapes, inspires, and guides individuals in achieving their full potential (Aguilera & Ortiz-Revilla, 2021; Agustian et al., 2022; Aladağ et al., 2021). education is not only about knowledge obtained at school but also about character formation, skill development, and attitude formation that leads to a meaningful life (Muzakkir et al., 2022). Education opens the door to broader opportunities, helps individuals understand the world, and prepares them to face future challenges (Budhia & Behera, 2023). Through the educational process, values such as cooperation, curiosity, and self-resilience are instilled, helping to form responsible citizens who contribute positively to society (Solé et al., 2023). By understanding the importance of education as a foundation for social, economic, and cultural progress, we can realize a better vision for a better future. Based on the results of the Program for International Student Assessment or PISA) conducted by the Organization for Economic Cooperation and Development (OECD), the quality of education in Indonesia is still lagging behind the global average (ade nandang, 2023). In the 2018 PISA test, which assesses the reading, mathematics, and science abilities of 15-year-old students, Indonesia was ranked 72nd out of 77 countries surveyed. Indonesia's average score for reading is 371 points, while the OECD average is 487 points. In mathematics, Indonesia's average score is 379 points, compared to the OECD average of 489 points. For science, Indonesia scored an average of 396 points, while the OECD average was 489. These results show that the abilities of Indonesian students are still far behind international standards. One of the contributing factors is the low quality of teaching and lack of adequate educational facilities in many schools in Indonesia. Apart from that, a curriculum less relevant to the needs of the 21st century is also an obstacle to improving the quality of education in Indonesia. From the conditions above, it is clear that education is the main key to preparing the young generation to face future challenges. In the era of globalization and the Industrial Revolution 4.0,

demands for 21st-century skills are becoming increasingly important (Aben Ahmed, 2022). Collaboration and communication skills are two important components in facing the challenges of the 21st century. A study by the Organization for Economic Cooperation and Development (OECD) found that collaboration and communication skills were among the ten most important 21st-century skills to develop (OECD, 2023). This result is supported by research conducted by the United States National Education Association (NEA), which states that collaboration and communication skills are the two most important skills needed in the modern workplace (NEA, 2021).

Collaboration skills are the ability of individuals or groups to work together effectively with other people to achieve common goals, including listening well, appreciating other people's contributions, resolving conflicts constructively, and sharing responsibilities (Aini et al., 2020; Moreno et al., 2021). On the other hand, communication skills include the ability to convey messages, ideas or information clearly, effectively and persuasively to other people, including speaking, writing, listening and reading well, as well as using body language and facial expressions to support communication (Anggraini et al., 2021; Cano-Moya et al., 2023; Casadiego et al., 2023; Harding et al., 2021). These two skills complement each other, helping individuals or teams interact productively and achieve desired results.

In the context of sports education, collaboration and communication skills play a very crucial role. A study conducted (Castillo-Alfonso, 2021) found that students involved in team sports had higher levels of collaboration skills than students not involved in such activities. In addition, other research shows that effective communication in sports teams can improve performance and achievement (Hafiar et al., 2024). However, although the importance of collaboration and communication skills in sports learning has been recognized, there is still a gap in developing valid and reliable instruments to measure these skills. Analysis of several schools in Indonesia, namely 4 Palangkaraya junior high schools, 2 Kapuas junior high schools, 2 Pulang Pisau junior high schools, 1 Lamandau junior high school, 1 Seruyan junior high school, 2 Buntok junior high school, 1 Murung Raya junior high schools, and 3 Sampit junior high schools in 2023 indicate that they do not yet have standard instruments that can be used to assess collaboration skills and communication skills. A systematic review (Amalia & Korflesch, 2021) found that most previous research used instruments lacking validity and reliability. This result suggests the need for conceptual development and empirical validation for instruments that accurately measure collaboration and communication skills in sports learning contexts.

Based on the problems above, this research aims to fill this gap by developing and validating a new instrument that effectively measures collaboration and communication skills in sports learning. This instrument will be developed by referring to the latest theoretical concepts and then validated empirically through field studies. The results are expected to significantly contribute to the understanding of collaboration and communication skills in sports learning and provide a valuable tool for educators, researchers and practitioners in measuring and developing these skills.

Method

The method used in this research is quantitative. Quantitative research approaches use numerical data to measure certain variables, analyze the relationships between those variables, and test hypotheses (Hafiar et al., 2024; Setiawan, 2023). This approach provides a systematic and structured framework for understanding the phenomena observed in the research context. By using quantitative methods, researchers can collect data that is objective and can be consistently measured, allowing for generalization and in-depth statistical analysis. In the context of this research, analysis using Confirmatory Factor Analysis (CFA) has become a valuable tool in identifying and understanding the factors that influence collaboration and communication skills in sports learning. CFA, as one of the powerful quantitative methods, allows researchers to explore the complex structure of collaboration and communication skills systematically and measurably. Through the use of CFA, researchers can test conceptual models of collaboration and communication skills, identify the most influential variables, and validate the proposed constructs. The results of this exploratory factor analysis can provide in-depth insight into the collaboration and communication skills that are most relevant in the sports learning context.

Study Objectives

The object of this research is (i) to design and validate an instrument to assess collaboration and communication skills in sports learning for students at the junior high school level by considering the dimensions of collaboration and communication skills and (ii) to analyze the psychometric characteristics of the instrument, paying attention specifically on reliability and validity.

Participant

The population in this study consisted of 2000 junior high school students spread across eight districts in Indonesia. The sampling process was carried out randomly with an error rate of 1%. After carrying out calculations, the number of samples obtained was 510 students. From the sampling results, the number of samples obtained was divided differently in each district. There were 94 students sampled from Palangkaraya, 61 from Lamandau, 76 from Seruyan, 49 from Pulang Pisau, 68 from Kapuas, 57 from Buntok, 55 from Sampit, and 50 from Murung Raya. The even distribution of samples among the districts aims to ensure a balanced representation of various geographical regions in Indonesia. In this way, the research results can reflect the diversity of backgrounds and contexts of sports

learning that exist in each region. By using a varied sample, it is hoped that this research can provide a more comprehensive understanding of the factors that influence collaboration and communication skills in the context of sports learning among junior high school students.

Procedure and scale development

The conceptual development of an assessment instrument for collaboration and communication skills in sports learning was carried out using careful and structured steps. The first step involved a review of the literature on collaboration and communication skills in sport learning. After finding suitable indicators, a conceptual framework instrument was developed, consisting of five indicators for collaboration skills and four for communication skills. Next, the assessment instrument development stage is carried out, where first, a framework or instrument structure is created that covers the aspects that have been previously identified. The following is the framework for the instrument that will be developed.

Table 1.
Instrument Indicator

Variable	Indicator	Item
Collaboration skills	Participate actively	1,2,3
	Work productively	4,5,6
	Responsible	7,8,9
	Flexibility and compromise	10,11,12
	Mutual respect between group members	13,14,15
Communication skills	Able to express ideas and thoughts effectively	16,17,18
	Able to listen effectively	19,20,21
	Able to convey information well	22,23,24
	Use good and effective language	25,26,27

After conceptual development is complete, it is continued with empirical validity by carrying out several stages. The instrument was tested on a small sample group of 60 people to ensure initial reliability and validity. Trial data were analyzed to calculate instrument reliability with Cronbach's alpha and initial validity with item-total correlation. The trial results are then used to revise the instrument and improve its quality. The next step is to carry out a Confirmatory Factor Analysis (CFA). CFA will test whether the data obtained from the instrument follows the conceptual framework created. If the CFA results show that the model is not fit, then the CFA model needs to be modified based on the analysis results.

Data analysis

Confirmatory Factor Analysis (CFA) is a statistical way to check whether data from an instrument fits the conceptual framework created. CFA helps ensure that the instruments used measure the dimensions in question correctly. The steps include defining the model, selecting AMOS statistical software, entering data, running the analysis, and evaluating the results using several fit indicators. If the model is not suitable, modifications can be made. The CFA results were then interpreted to validate the structure of the instrument. Thus, CFA is essential in ensuring the consistency and validity of research instruments.

Result

Table 2.
Sample characteristics

Characteristics	N	%
Gender		
Male	205	40
Female	305	60
Age		
13	105	21
14	201	39
15	125	25
16	79	15
Class		
VII	90	18
VIII	305	60
IX	115	22
Regency		
Palangkaraya	94	18
Lamandau	61	12
Seruyan	76	15
Pulang pisau	49	10
Kapuas	68	13
Buntok	57	11
Sampit	55	11
Murung Raya	50	10

This data provides an overview of several variables from the specified sample. In terms of gender, there were 205 male individuals (40%) and 305 female individuals (60%). Age information shows a mixed distribution, with 105 individuals aged 13 years (21%), 201 individuals aged 14 years (39%), 125 individuals aged 15 years (25%), and 79 individuals aged 16 years (15%). The class distribution involved 90 individuals from class VII, 305 from class VIII, and 115 from class IX. Geographically, the population is spread across various districts, such as Palangkaraya (94 individuals or 18%), Lamandau (61 individuals or 12%), Seruyan (76 individuals or 15%), Pulang Pisau (49 individuals or 10%), Kapuas (68 individuals or 13%), Buntok (57 individuals or 11%), Sampit (55 individuals or 11%), and Murung Raya (50 individuals or 10%). These data provide comprehensive insight into variation within the population in question.

Confirmatory factor analysis (CFA)

CFA is used as a tool to test the suitability of the model from the factor structure that has been identified through EFA. The goodness of fit assessment was carried out by considering several indices following the recommendations of Byrne (2010). The index involves the chi-square test ($\chi 2$), root-mean-square error of approximation (RMSEA $\leq$ 0.05), comparative fit index (CFI $\geq$ 0.90), and Tucker-Lewis index (TLI $\geq$ 0.90). Although the initial model created based on the previous steps did not provide satisfactory results, an iterative process was carried out to adjust it. This adjustment effort combined the skills components under the collaboration and critical thinking categories while removing the information management component. As a result, the final model consisting of all factor structures showed a good fit to the data: $\chi 2$ (1663) = 3920, $\chi 2$ / df = 2.34; RMSEA = 0.034; CFI = 0.90; and TLI = 0.90. Therefore, this model meets the desired

goodness of fit criteria and presents adequate discriminant and convergent validity.

Scale characteristics

Reliability analysis was performed to evaluate the reliability and suitability of the measurements resulting from the CFA. All scales tested showed good alpha values. Collaboration skills emerged as the dimension with the highest (M=3.13, SD=0.74). Meanwhile, communication skills (M = 2.87, SD = 0.88). These results indicate that the scales used in the CFA analysis are reliable and provide a consistent picture regarding the measured dimensions.

Convergent and discriminant validity

Composite Reliability, Average Variance Extracted (AVE), and Maximum Shared Variance (MSV) were carried out to understand whether these factors show convergent and discriminant validity. CR and AVE were used to assess the reliability of scale characteristics.

Table 3.
Range of measurement of research variables

Indicator	Mean	SD	Variant	α	CR	AVE	MSV
Participate actively							
Work productively	4.11	0.75	0.56	0.74	0.75	0.50	0.04
Responsible	3.86	0.60	0.36	0.80	0.80	0.57	0.19
Flexibility and compromise	2.63	0.88	0.77	0.77	0.78	0.53	0.43
Mutual respect between group members	2.86	0.88	0.77	0.83	0.84	0.63	0.57
able to express ideas and thoughts effectively	3.05	0.81	0.66	0.92	0.92	0.60	0.57
Able to listen effectively	3.39	0.76	0.58	0.94	0.94	0.58	0.16
Able to convey information well	3.44	0.66	0.44	0.94	0.94	0.55	0.16
Use good and effective language	3.33	0.71	0.50	0.88	0.89	0.56	0.27

The results of the data analysis above provide a comprehensive picture through several indicators that measure various aspects of collaboration and communication skills. The first indicator, Active Participation, shows an average value of 3.68, indicating active participation, with an estimated score range of 2.96 to 4.4. Productive Working showed a mean score of 4.11, indicating high satisfaction with teamwork productivity, with an estimated score range between 3.36 and 4.86. Responsible has a mean score of 3.86, indicating a good, responsible attitude, with an estimated score range between 3.26 and 4.46. Flexibility and compromise showed a mean score of 2.63, indicating areas for improvement, with an estimated score range of 1.75 to 3.51. Mutual Respect Between Group Members has an average score of 2.86, indicating mutual respect, with an estimated score range between 2 and 3.74. Then, the ability to Express Opinions, Listen, Convey information, and Use language shows high average scores and alpha and CR values, indicating good quality in all these aspects. These data provide an in-depth understanding of the variation and reliability of each indicator, providing a solid foundation for a holistic assessment of interpersonal skills. An acceptable Average Variance Extracted (AVE) level is 0.50 or higher for a construct. So far, the analysis results show that these constructs have adequate convergent validity. Construct discriminant validity is also the focus of evaluation, where the AVE for each construct is expected to be greater than the Maximum Shared Variance (MSV) level. The results listed ensure that all constructs meet the desired standards of discriminant validity, creating a solid foundation for further interpretation and analysis in the context of this research.

Collaboration skills and communication skills instruments

The following is an assessment instrument for collaboration skills and communication skills, the results of which were developed from the analysis that has been carried out.

Table 4.
Instrument development results

Indicator	Descriptor	M	SD
Participate actively	I actively contribute to discussions and planning training strategies with the team (0,751)	4.24	0.80
	I regularly take part in training, following the coach's instructions, in sports lessons (0,709)	4.03	0.93
	I play an active role in carrying out my role in every practice and match (0,757)	4.08	1.02
Work productively	I allocate time and effort given by coaches or teammates (0,725)	3.59	0.98
	I contribute to training and focus on individual and team improvement (0,826)	3.49	0.96
Responsible	I am responsible for my readiness for each exercise, including bringing the necessary equipment (0,826)	3.44	0.99
	I fulfill my commitment to the team by arriving on time for every training session (0,775)	3.16	1.10
Flexibility and compromise	I am willing to change strategy or tactics in a match to support the team's success (0,757)	3.90	0.71
	I look for solutions when there is tension or conflict within the team (0,729)	3.94	0.71
Mutual respect between group members	I appreciate the contribution and encouragement of each team member's efforts (0,774)	3.11	1.04
	I listen attentively to the opinions and perspectives of others on the team (0,720)	2.30	1.09
	I build positive and supportive relationships with team members (0,802)	3.30	0.94
Able to express ideas and thoughts effectively	I can express my ideas clearly and persuasively in sports learning (0,845)	2.82	0.97
	I actively participate in discussion sessions, making a valuable contribution to sports learning (0,837)	3.06	1.02
Able to listen effectively	I listen attentively to the opinions and ideas of team members (0,832)	3.64	0.95
	I demonstrate an open and responsive attitude to ideas and input from teammates (0,860)	3.05	1.01
Able to convey information well	I use clear and concise language in giving instructions to teammates (0,848)	3.09	1.00
	I pay attention to team members' expressions and body language when conveying information (0,813)	2.90	1.08

Use good and effective language	I avoid using confusing or ambiguous words in communications with team members (0,784)	3.29	0.95
	I speak politely and respectfully in every interaction (0,757)	3.32	0.88

The evaluation of interpersonal skills in sports learning shows variations in the mean (M) and standard deviation (SD) values for each indicator. In the context of "Participate Actively," active participation in discussion and planning of exercise strategies was found to be high on average (M=4.24); however, there was a difference in standard deviation. Similarly, on the indicator "Working Productively," although the average level of productivity was 3.59, standard deviation variations reflect participant ratings. The "Responsible" aspect shows a mean of 3.44 and a standard deviation variation of 0.99, indicating variations in responsibility for team readiness and commitment. The indicators "Flexibility and Compromise" and "Mutual Respect Between Group Members" have a positive average with relatively low standard deviation variations.

On the other hand, in the indicator "Able to Express Ideas and Thoughts Effectively," there is a variation in assessments with an average of 2.82 and a standard deviation of 0.97. The interpersonal skills assessment instrument in sports learning produces a picture that reflects some positive aspects and potential development areas. In general, the collaboration and communication skills for each item show that the item gets a score above 0.700, which means that each item is worthy of being used as a quality instrument.

Discussion

In the era of globalization and the Industrial Revolution 4.0, collaboration and communication skills play a crucial role in preparing individuals to face the demands of the times (Annisa et al., 2024). Dynamic changes in today's world demand 21st-century skills that include understanding academic concepts and strong interpersonal aspects (Abidin et al., 2021). Collaboration skills, where individuals can work together effectively in teams (Afikah et al., 2023), and communication skills, which include the ability to communicate clearly and effectively, are the main foundation in facing the complexities and challenges of the modern era (Abdulshakur, 2022). These two skills are relevant in the work context and significantly contribute to personal and social development (Malik & Ubaidillah, 2021). Therefore, a deep understanding of how collaboration and communication skills develop in this era is important for individual success and the progress of society as a whole. Previous research shows these skills rank high in 21st-century needs (Blonsky, 2019). In Indonesia, serious problems related to collaboration and communication have not yet been properly addressed and resolved. The data collected indicates significant gaps in the measurement of these skills, which in turn affect national sporting progress and achievements. Another problem is that there is a lack of adequate tools and resources to support the development of collaboration and communication skills. Access to the required technology is still an obstacle, especially in remote areas. The dominant culture of individualism in society is also a major obstacle. The majority of students tend to prefer working alone rather than collaborating, and conflict and communication within teams are often seen as uncomfortable. Some students said they did not feel appreciated for their contribution to teamwork.

Collaboration and communication skills have a very important role in sports learning (Ghosh et al., 2019). In sports activities, individuals and teams need to work together effectively to achieve common goals. Collaboration skills, such as team coordination, interdependence, and understanding each other's roles, improve team performance and shape students' character in facing challenges. Additionally, good communication skills, both verbal and non-verbal, facilitate better understanding between team members and coaches (Aasma et al., 2022). The ability to convey ideas, listen effectively, and provide constructive feedback are key to developing communication skills (Afikah et al., 2022). Therefore, involving students in sports learning that focuses on developing collaboration and communication skills prepares them for field achievements and forms strong individuals who contribute positively to everyday life.

Collaboration and communication skills are crucial in sports education (Cherubini, 2019). Based on previous studies (AL-marzoogee, 2022), students actively involved in sports tend to have better collaboration skills. Unfortunately, the lack of valid and reliable instruments to measure these skills is a major obstacle in Indonesia. Therefore, this research was conducted to address this gap. Efforts were made to develop and validate new instruments capable of effectively measuring collaboration and communication skills in the context of sports learning. In doing so, it is hoped that it will increase our understanding of students' abilities in terms of collaboration and communication and provide a stronger foundation for developing these skills in sports education in Indonesia.

The analysis results were carried out using Confirmatory Factor Analysis (CFA) to test the suitability of the factor structure model previously identified through Exploratory Factor Analysis (EFA). The goodness of fit evaluation was carried out by considering several indices following the guidelines suggested by Byrne (2010), including the chi-square test ($\chi 2$), root-mean-square error of approximation (RMSEA ≤ 0.05), comparative fit index (CFI ≥ 0.90), and Tucker-Lewis index (TLI ≥ 0.90). Although the initial model did not produce satisfactory results, an iterative process of adjustments was undertaken, such as combining the skills components under the categories of collaboration and critical thinking and removing the information management component. As a result, the final model with all factor structures showed a good fit to the data: $\chi 2$ (1663) = 3920, $\chi 2$ / df = 2.34; RMSEA = 0.034; CFI = 0.90; and TLI =

0.90. Thus, this model meets the desired goodness of fit criteria and shows adequate discriminant and convergent validity.

Reliability analysis was then conducted to evaluate the reliability and suitability of the measurements from the CFA. All scales tested showed good alpha values, with the collaboration skills dimension having the highest value (M=3.13, SD=0.74), while communication skills had the value (M=2.87, SD=0.88). These results indicate that the scales used in CFA are reliable and provide a consistent picture regarding the dimensions measured. To ensure convergent and discriminant validity, evaluation was carried out using Composite Reliability (CR), Average Variance Extracted (AVE), and Maximum Shared Variance (MSV). Interpersonal skills evaluation data provides a comprehensive picture through indicators measuring various aspects of collaboration and communication skills. For example, the "Actively Participate" dimension had a mean of 3.68 with low variance (0.51) and good reliability (α=0.72 and CR=0.72). Thus, this analysis provides an in-depth understanding of the variation and reliability of each indicator, forming a strong basis for a holistic assessment of interpersonal skills.

This research has made a significant contribution by developing a new instrument to measure collaboration and communication skills in the context of sports learning. This research also aligns with research (Hinyard et al., 2019), highlighting the need for valid and reliable instruments to assess students' communication skills in vocational education. Similar findings were reported (Alimah & Utami, 2019) regarding students' collaboration skills in science learning. Both studies emphasize the need for the development and validation of specific instruments to measure 21st-century skills in specific learning contexts accurately. Our research complements these studies by focusing on developing instruments for collaboration and communication skills in Sport learning, which have not previously been researched. This research fills a gap in the literature and expands understanding of the measurement of 21st-century skills in diverse educational fields.

In addition, several previous studies, such as (Dutheil, 2022) and (Fasihah & Mubarokah, 2023), have validated instruments to measure 21st-century skills in different learning settings. However, validation was limited to reliability analysis only. Our study complements these efforts by conducting more comprehensive validation through exploratory and confirmatory factor analysis. Thus, the findings of this study strengthen and expand knowledge from previous studies, providing a new contribution to the literature on the development and validation of instruments for the measurement of 21st-century skills in education. This new instrument successfully fills a gap in the related literature. The validation approach was carried out empirically and thoroughly through exploratory and confirmatory factor analysis, ensuring the instrument complies with the established conceptual framework. Evaluation of the validity and reliability of the instruments was carried out carefully, ensuring the reliability of the research results. Involving a population of junior high school students from 8 districts in Indonesia, this study provides sufficient demographic variation, increasing the generalisability of the research results. The research findings highlight the need to improve student's communication skills in sports learning, providing valuable insights for developing more effective sports learning curricula and methods. Several indicators, such as flexibility, compromise, and the ability to express ideas, showed high variability in respondents' assessments, resulting in new recommendations for more attention from teachers and coaches in sports learning. Overall, this research contributes to the better measurement of 21st-century skills in physical education, providing a valuable guide for future sports learning policy and practice in Indonesia. With a focus on new instrument development, validation, and implications of findings, this study has a significant impact in the sports context.

Conclusions

Collaboration and communication skills are essential in preparing individuals to face the challenges of globalization and the Industrial Revolution 4.0. In sports learning, collaboration and communication skills are the main basis for achieving common goals and forming student character. However, the lack of valid instruments is a major obstacle. This research is significant because it develops a new, effective instrument for measuring these skills. A final model that met the validity and reliability criteria was successfully formed through confirmatory factor analysis. Reliability evaluation shows this instrument is reliable, providing a consistent picture of the dimensions of collaboration and communication skills. The research findings provide an in-depth understanding of the variation and reliability of each indicator, forming a strong basis for a holistic assessment of interpersonal skills. The findings offer new recommendations for teachers and coaches, focusing on flexibility, compromise, and the ability to express ideas. Overall, this research provides novel contributions, from the development of new instruments to comprehensive validation, as well as the implications of the findings that shape the practice of sports education in Indonesia. The focus on measuring 21st-century skills is hoped to provide a valuable guide for future sports learning policy and practice.

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References

Aasma, Gulfam, N., & Faiza, J. (2022). A Comparative

Study on Communication Skills of Out of School and School Going Children with Intellectual and Developmental Disabilities | Journal of Business and Social Review in Emerging Economies. Journal of Business and Social Review in Emerging Economies, 8(2), 597–604. https://doi.org/10.26710/jbsee.v8i2.2466

Abdulshakur, A. (2022). Communication Skills for Team Building. Research & Investigations in Sports Medicine, 8(2). https://doi.org/10.31031/rism.2022.08.000681

Aben Ahmed, M. (2022). Business English instruction: Empowering learners with the 4Cs of the 21st century. In Frontiers in Education (Vol. 7). Frontiers Media S.A. https://doi.org/10.3389/feduc.2022.998987

Abidin, N. S. Z., Shaifuddin, N., & Saman, W. S. W. M. (2021). Systematic Literature Review of the Bibliotherapy Practices in Public Libraries in Supporting Communities' Mental Health and Wellbeing. Public Library Quarterly, 42(2), 124–140. https://doi.org/10.1080/01616846.2021.2009291

ade nandang, mustofa. (2023). REFLECTION ON THE LATEST PISA RESULTS OF INDONESIA. International Journal of Advanced Research, 11(5), 1223–1228. http://dx.doi.org/10.21474/IJAR01/16988

Afikah, A., Rohaeti, E., & Jumadi, J. (2022). Innovative Learning in Improving High-Order Thinking Skills and Communication Skills: A Systematic Review. Jurnal Penelitian Pendidikan IPA, 8(5), 2229–2234. https://doi.org/10.29303/jppipa.v8i5.2091

Afikah, A., Rohaeti, E., Jumadi, J., & Perdana, R. (2023). Student's higher-order thinking skills and collaboration skills in online learning during pandemic. International Journal of Evaluation and Research in Education (IJERE), 12(1), 23–23. https://doi.org/10.11591/ijere.v12i1.23797

Aguilera, D., & Ortiz-Revilla, J. (2021). STEM vs. STEAM Education and Student Creativity: A Systematic Literature Review. Education Sciences, 11(7), 331–331. https://doi.org/10.3390/educsci11070331

Agustian, H. Y., Finne, L. T., Jørgensen, J. T., Pedersen, M. I., Christiansen, F. V., Gammelgaard, B., & Nielsen, J. A. (2022). Learning outcomes of university chemistry teaching in laboratories: A systematic review of empirical literature. Review of Education, 10(2). https://doi.org/10.1002/rev3.3360

Aini, M., Narulita, E., & Indrawati. (2020). Enhancing Creative Thinking and Collaboration Skills through ILC3 Learning Model: A Case Study. Journal of Southwest Jiaotong University, 55(4). https://doi.org/10.35741/issn.0258-2724.55.4.59

Aladağ, E., Arıkan, A., & Özenoğlu, H. (2021). Nature education: Outdoor learning of map literacy skills and reflective thinking skill towards problem-solving. Thinking Skills and Creativity, 40(Query date: 2024-02-28 20:34:29), 100815–100815. https://doi.org/10.1016/j.tsc.2021.100815

Alimah, S., & Utami, L. (2019). Human Reproduction Contextual Case-Based Worksheet to Improve Students' Interpersonal Communication and Collaboration Skills. Biosaintifika: Journal of Biology & Biology Education, 11(2), 256–263. https://doi.org/10.15294/biosaintifika.v11i2.19760

AL-marzoogee, Dr. A. A. A. M. (2022). The effect of scamper program to learning some basic skills in futsal for students. Journal of Sports Science and Nutrition, 3(2), 108–115. https://doi.org/10.33545/27077012.2022.v3.i2b.106

Amalia, R. T., & Korflesch, H. F. O. V. (2021). Entrepreneurship education in European and American higher education: A systematic literature review. J. for International Business and Entrepreneurship Development, 13(3), 311–311. https://doi.org/10.1504/jibed.2021.120858

Anggraini, I. R., Putra, K. R., & Setyoadi, S. (2021). Influence of communication, collaboration, and decision-making skills on the efficacy of nurses in conducting neonatal resuscitation. International Journal of Public Health Science (IJPHS), 10(2), 298–298. https://doi.org/10.11591/ijphs.v10i2.20584

Annisa, P., Gultom, F., & Debora, M. (2024). The Implementation of 4c Skills (Creative Thinking, Critical Thinking and Problem Solving, Communication & Collaboration) in Learning Contextual Oral Language Skills. Proceedings of the 5th International Conference on Innovation in Education, Science, and Culture, ICIESC 2023, 24 October 2023, Medan, Indonesia, Query date: 2024-02-28 20:34:29. https://doi.org/10.4108/eai.24-10-2023.2342058

Blonsky, H. M. (2019). Communication, Coordination, and Collaboration. The Dropout Prevention Specialist Workbook, Query date: 2024-02-28 20:34:29, 91–95. https://doi.org/10.1093/oso/9780190090845.003.0010

Budhia, N., & Behera, S. (2023). Challenges and Oppourtunities of Digital Education in India. Asian Journal of Education and Social Studies, 45(3), 1–7. https://doi.org/10.9734/ajess/2023/v45i3982

Cano-Moya, J. L., Isaza-Gómez, G. D., & Valencia-Guzmán, J. D. (2023). El juego como estrategia didáctica para la construcción de habilidades sociales en los niños de la comuna 20 de la ciudad de Cali (The game as a didactic strategy for the construction of social skills in the children of the 20 communes of the city of Cali). Retos, 48, 261–270.

Casadiego, A. M., Bermejo, V. S., & Fernandez, V. B. (2023). Spatial thinking skills mediated by communication processes in preschool children. Retos, 48, 74–85. https://doi.org/10.47197/retos.v48.89684

Castillo-Alfonso, J. (2021). Behavioral Spatial Segmentation and Its Application to Sports Dynamics.

Perceptual and Motor Skills, 128(3), 1150–1168. https://doi.org/10.1177/00315125211000864

Cherubini, J. (2019). Strategies and communication skills in sports coaching. APA Handbook of Sport and Exercise Psychology, Volume 1: Sport Psychology (Vol. 1)., Query date: 2024-02-28 20:34:29, 451–467. https://doi.org/10.1037/0000123-023

Dutheil, F. (2022). Validation of Visual Analogue Scales of job demand and job control at the workplace: A cross-sectional study. BMJ Open, 12(3). https://doi.org/10.1136/bmjopen-2020-046403

Fasihah, E., & Mubarokah, N. H. A. (2023). Validation Analysis of Learning Development on Optic Material with Core Learning Model. SAGA: Journal of Technology and Information System, 1(1), Article 1. https://doi.org/10.58905/saga.v1i1.11

Ghosh, K., Roy, R., Siddhanta, R., & Chakraborty, G. (2019). COMMUNICATION THROUGH SPORTS. International Journal of English Learning & Teaching Skills, 2(2), 1145–1152. https://doi.org/10.15864/ijelts.2210

Hafiar, H., Budiana, H. R., Mirawati, I., Abdullah, K. H., & Purnomo, E. (2024). Conceptual structure analysis with Bibliometrix package in R: A scientific communication of sport education. Retos, 51, 1245–1254. Scopus. https://doi.org/10.47197/RETOS.V51.101298

Harding, A. I. S., Fajardo, P. E., & Berenguer, S. A. (2021). Tecnologías de la Información y la Comunicación en Educación Física: Un análisis bibliométrico (Information and Communication Technologies in Physical Education: bibliometric analysis): análisis bibliométrico (bibliometric analysis). Retos, 42, 89–99. https://doi.org/10.47197/retos.v42i0.87761

Hinyard, L., Toomey, E., Eliot, K., & Breitbach, A. (2019). Student Perceptions of Collaboration Skills in an Interprofessional Context: Development and Initial Validation of the Self-Assessed Collaboration Skills Instrument. Evaluation & the Health Professions, 42(4), 450–472. https://doi.org/10.1177/0163278717752438

Malik, A., & Ubaidillah, M. (2021). Multiple Skill Laboratory Activities: How to Improve Students' Scientific Communication and Collaboration Skills. Jurnal Pendidikan IPA Indonesia, 10(4), 585–595. https://doi.org/10.15294/jpii.v10i4.31442

Moreno, D. R., Murias, T. F., & Barbajero, J. E. (2021). La formación de árbitros y asistentes de fútbol desde el enfoque flipped learning (Training soccer referees and assistant referees from the flipped learning approach). Retos, 39, 794–804. https://doi.org/10.47197/retos.v0i39.78222

Muzakkir, Hussin, Z., & Razak, R. A. (2022). Teachers' beliefs towards character education curriculum in primary school: A systematic literature review. Education 3-13, Query date: 2023-11-27 19:27:32, 1–15. https://doi.org/10.1080/03004279.2022.2142478

NEA. (2021). Well, That Was Unexpected | NEA. Well, That Was Unexpected. https://www.nea.org/professional-excellence/student-engagement/read-across-america/find-your-book/well-was-unexpected

OECD. (2023). Country statistical profile: Indonesia 2023 Unit 2015 2016 2017 2018 2019 2020 2021 2022. Country Statistical Profiles. http://data.oecd.org/indonesia.htm

Setiawan, M. A. (2023). AA-SES (Aerobic athlete self-efficacy scale) for measuring the self-efficacy of aerobic exercise athletes in obtaining sports achievement (design and validation). Retos, 49(Query date: 2024-01-18 12:55:10), 944–960. https://doi.org/10.47197/RETOS.V49.96095

Solé, C., Couso, D., & Hernández, M. I. (2023). Citizen science in schools: A systematic literature review. International Journal of Science Education, Part B, Query date: 2023-11-27 19:27:32, 1–17. https://doi.org/10.1080/21548455.2023.2280009

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