ORIGINAL SCIENTIFIC ARTICLE

DEVELOPMENT OF PHYSICAL EDUCATION LEARNING OUTCOMES ASSESSMENT INSTRUMENTS FOR VOLLEYBALL MATERIALS BASED ON GAME PERFORMANCE ASSESSMENT INSTRUMENT

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Abstract

Study purpose. The basic assumption of this development is that there is no Game Performance Assessment Instrument (GPAI) based on physical education (PE) learning outcome assessment, so researchers are trying to develop the instrument. The teacher has not used the GPAI instrument in assessing the PE learning outcomes for volleyball material. The purpose of the study was to develop a valid and reliable assessment of PE learning outcomes for volleyball based on GPAI.

Materials and methods. This type of research is research and development. The subjects used were PE learning expert lecturers and volleyball expert lecturers with a minimum qualification of 5 Doctoral degrees. The field test was conducted on 18 junior high school students. The instrument uses a questionnaire with a score of 1-4 with the terms "Very Appropriate (score 4)", "Agreed (score 3)", "Not Appropriate (score 2)", and "Very Not Appropriate (score 1)". The validity data analysis technique uses Aiken validity, and reliability tests are carried out using Intraclass Correlation Coefficients.

Results. Based on the results of the research and the results of the data analysis that has been carried out, it is concluded that the instrument for assessing the learning outcomes of PE on volleyball material in Junior High School based on GPAI that was developed is valid and reliable, with V Aiken ≥ 0.87. Furthermore, the reliability of the PE learning outcomes assessment instrument for volleyball material in GPAI-based junior high schools was 0.797 in the "High" category.

Conclusions. The researcher hopes that the resulting product in the form of an assessment of PE learning outcomes for volleyball material in junior high schools based on the GPAI can be a guide or reference for evaluating students on volleyball material.

Keywords: learning outcomes assessment instrument, physical education, volleyball, GPAI.

Introduction

One of the compulsory subjects taught is physical education. Physical education has a comprehensive goal that includes physical, cognitive, affective, emotional, social and moral aspects (Chng & Lund, 2018; Ciotto & Gagnon, 2018). Assessment in physical education has an important role in the learning process (Borghouts et al., 2017). The purpose of the assessment is to find out how successful the teacher is in the successful implementation of the learning process, which can provide feedback for the teacher in planning the next learning process (Alena et al., 2019; Nieminen et al., 2021; Snead & Freiberg, 2019). The current physical education teacher must make and use various forms of appropriate assessments in a lesson according to the material and situation at hand (Tolgfors, 2018). Of course, an appropriate evaluation system is needed so that students can clearly describe and demonstrate all the achievements that have been obtained by students in the learning process in accordance with the actual situation in the field.

One of the physical education materials at school is volleyball. The volleyball game has several basic techniques, service, passing, smash, and block (Junior, 2018; Zonifa, 2020; Pekas et al., 2019). So far, the instruments used by

teachers to assess volleyball skills in students are only in the form of individual volleyball technical skills tests. The teacher conducts an upper passing test, a lower passing test, a smash test, and a service test. The assessment of students' playing skills basically requires careful observation during the game. Without exception the evaluation of physical education subjects, thus students are always in a controlled state, so that students have an overview of the volleyball playing skills that will be carried out. Assessment of student learning outcomes in physical education learning refers to process assessment and product assessment (learning outcomes). The learning process can be said to be effective if the behavior changes that occur in students at least reach the optimal level.

Teachers must also be able to closely study student interactions during group learning (García-López & Gutiérrez, 2015). Griffin has created an assessment instrument called the Game Performance Assessment Instrument (GPAI). GPAI is a multi-dimensional system designed to measure the ability to play in a particular sports (Barquero-Ruiz et al., 2020; Dania et al., 2021). The five-game elements of the GPAI, decision-making (decision making), skill execution (skill execution), support (support), game performance (game performance), game involvement (game involvement), are used to assess students' game performance, and these are individually evaluated elements of video game playing tapes (Ben Khalifa et al., 2020; Bergmann et al., 2022; Mahedero et al., 2021).

The GPAI instrument was developed to measure "game performance behavior that demonstrates tactical understanding, as well as a player's ability to solve tactical problems by selecting and applying appropriate skills" (Guijarro et al., 2021). To characterize gameplay performance in the game invasion, it is necessary to identify game components that cannot specifically be observed performance (Araújo et al., 2019). The GPAI test is a convenient assessment instrument for assessing execution skills, learner support, and decision-making strategies (García-Ceberino et al., 2020).

GPAI is essential in various games, such as volleyball, soccer, basketball, softball, rugby, or field hockey. Measuring a single component of game performance, together with other experts (i.e., coach, teacher) with knowledge in all four game categories (invasion, net/wall, strike and attack, and target), demonstrated seven tactical components (baseline, adjustment, decision making, execution) (skills, support, cover, guard/mark) related to effective playing performance (Lund & Kirk, 2019). Two advantages of using the GPAI are to evaluate a person's ability in sports, such as (a) the GPAI is easily adapted for various types of sports, and physical activities, (b) the GPAI can measure skills in processing the ball, but also skills without mastering the ball (measuring skills in ball processing) (offensive or defensive) (Aryanto et al., 2020).

This research develops a valid and reliable GPAI volleyball learning instrument. The development of valid and reliable instruments will assist teachers and other learners in peer assessment in classroom settings. In addition, connecting what is taught with what will be assessed helps students to focus on what is essential, making the teaching-learning cycle better (Ibáñez et al., 2019). Physical education teachers need an instrument for assessing physical education learning

outcomes for volleyball in junior high schools based on GPAI so that they get more detailed results in the evaluation. The aim is to assist teachers and coaches in observing and recording performance behavior during the game.

Materials and methods

Study participants

The subjects used were physical education learning expert lecturers and volleyball expert lecturers with a minimum qualification of 5 Doctoral degrees at Yogyakarta State University. The field test was conducted on 18 students of Junior High School. The instrument uses a questionnaire with a score of 1-4 with the provisions of "Very Appropriate (score 4)", "Agreed (score 3)", "Not Appropriate (score 2)", and "Very Not Appropriate (score 1)". There are 20 questionnaire grids. Assessment of physical education learning outcomes for volleyball based on GPAI using indicators Decision Making (DM) (5 items), Skill Execution (SE) (5 items), Support (S) (5 items), Guard/Mark (G/M) (5 items), Base (B) (5 items). More details are presented in Table 1.

The study was conducted in accordance with the ethical principles of the Helsinki Declaration for human research and was approved by the Research Ethics Committee of the Yogyakarta State University.

Study organization

This type of research is research and development. Research and Development is a research method used to produce specific products, and test their effectiveness of these products (Amran et al., 2018). This research follows a cyclical step. Among the current development models, one of the learning product design models often used in research and development is the Lee and Owens development model, namely ADDIE (Analysis, Design, Development, Implementation, and Evaluation) (Aka, 2019).

Statistical analysis

Data from the assessment results by expert validators and practitioners from the assessment instrument validation sheet were analyzed to determine the content validity of the authentic assessment instrument. The content validity of the instrument was analyzed using Aiken Validity. The formula proposed by Aiken is as follows (Aiken, 1985):

$$V\ Aiken = \sum s\ /\ n[c-1]$$

S   = r – lo
Lo = lowest rating score (eg 1)
C   = highest rating score (eg 4)
r   = the score given by the assessor

The reliability test was carried out using the Intraclass Correlation Coefficients (ICC) reliability. This reliability test shows the level of agreement between experts or raters in assessing each indicator on the instrument. The ICC will provide an overview in the form of a score about the degree of agreement given by the expert or rater (Douglass et al., 2021).

Table 1. Assessment grid for physical education learning outcomes for volleyball based on GPAI

Assessment Aspect	Indicator	Sub Indicator	No Item
Decision Making (DM)	Making the right decisions on basic movements in volleyball games	Passing	1
		Spike	2
		Blocking	3
		The accuracy of the use of basic movements	4,5
Skill Execution (SE)	Efficient execution of selected skills	Passing down	6, 7, 8
		Top pass	9
		Spike	10
		Blocking	11
Support (S)	Provide proper support for teammates during the game	Cooperation	12, 13
		Responsibility	14, 15
Guard/Mark (G/M)	Keep your opponent right when defending	Supervise the movement of the opponent and do Blocking	16
		Cover	17
		Back defense	18
Base (B)	Return to the original position according to their respective tasks, either attacking or defending	Responsibility	19
		Cover	20

Results

After validation by experts, there are various suggestions for improvement. Offers for improvement from experts become a reference for researchers to make improvements to the products developed. Product revisions were carried out on the product development assessment of physical education learning outcomes for volleyball based on GPAI based on input and advice from experts.

Table 2. Aiken validity analysis

No	Σ s	n	C-1	Aiken
1	14	5	3	0.93
2	14	5	3	0.93
3	14	5	3	0.93
4	14	5	3	0.93
5	14	5	3	0.93
6	14	5	3	0.93
7	14	5	3	0.93
8	15	5	3	1.00
9	14	5	3	0.93
10	14	5	3	0.93
11	14	5	3	0.93
12	14	5	3	0.93
13	13	5	3	0.87
14	14	5	3	0.93
15	13	5	3	0.87
16	14	5	3	0.93
17	14	5	3	0.93
18	14	5	3	0.93
19	14	5	3	0.93
20	14	5	3	0.93

The assessment carried out by experts on the physical education learning outcomes assessment instrument for volleyball based on GPAI uses a questionnaire and is intended to find the validity coefficient based on the Aiken Validity. The results of the expert assessment are in Table 2.

Based on Table 2 above, the Aiken Validity value for items 1-20 is V Aiken 0.87. These results indicate that all items of the GPAI-based assessment instrument for developing physical education learning outcomes for volleyball in junior high school based on GPAI are valid.

Next, calculate the reliability of the GPAI learning outcomes assessment instrument for volleyball based on GPAI using ICC. Based on Table 3 above, it shows the ICC output with inter-rater reliability, $r_{xx} = 0.797$. These results indicate that the reliability of the physical education learning outcomes assessment instrument for volleyball in junior high schools based on GPAI is in the "High" category.

The final product in the form of an assessment instrument for physical education learning outcomes for volleyball based on GPAI is then disseminated. The product dissemination stage is intended so that the product can be used in various components and can be used by teachers to assess the learning outcomes of physical education volleyball material in junior high school. The product will be packaged in a soft file in the form of Microsoft Word or Portable Document Format (PDF) and designed to be easy to use. The product is also disseminated through various media, so that it can be accessed easily, so that teachers can use it effectively and efficiently to assess the learning outcomes of physical education on volleyball material.

Based on the results of the analysis, it shows that the assessment of expert judgment on the assessment instrument for physical education learning outcomes for volleyball in junior high schools is based on GPAI, all items are valid, with

Table 3. Results of Intraclass Correlation Coefficients (ICC) Reliability

	Intraclass Correlation[a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.164[b]	0.032	0.667	4.928	4	76	0.001
Average Measures	0.797[c]	0.399	0.976	4.928	4	76	0.001

Table 4. The final product of the physical education learning outcome assessment instrument for volleyball based on GPAI

Aspect	Statement Items	4	3	2	1
Decision Making	Students are able to give the ball to a friend who is in an empty room to make it easier to attack				
	Students are able to make the right decisions to cross the ball into an empty opponent's area				
	Students are able to make the right decisions to cover attacks from opponents				
	Students are able to receive services with various/one of the basic movements so that the ball does not fall on its own field				
	Students are able to receive smashes with various/one of the basic movements so that the ball does not fall on its own field				
Skill Execution	Students are able to receive/receive service by passing down well				
	Students pass the ball accurately by using the basic motion of passing down to other friends				
	Students are able to receive the opponent's smash using down passing well				
	Students pass the ball accurately by using the basic motion of passing over to other friends				
	Students are able to hit hard and hit the target into the opponent's defense				
	Students are able to perform basic blocking movements when opposing players spike				
Support	Students always pay attention to the opponent's service when receiving the first ball				
	Students are always ready to receive the second or third ball				
	Students provide support in the form of shouting to friends who receive the ball				
	The closest player always approaches the friend who is receiving the ball				
Guard/Mark	In a defensive position when the ball is on the opponent's side, the student in front is in a position to monitor the movement of the opponent's spiker and prepare to block the opponent's attack				
	In a defensive position, students who are in the back position are ready to cover a friend who is blocking				
	Students who are in the back position are always ready to defend if the opponent spikes hard				
Base	At the time of the first serve made by the opponent, students occupy their respective rotation positions				
	In an attacking situation, the student in the back position covers the spiker who tries to pass the ball into the opponent's area and then prepares to receive it back if the spike results can be blocked by the opponent.				

V Aiken ≥ 0.87. Furthermore, the reliability of the physical education learning outcomes assessment instrument for volleyball in junior high schools based on GPAI is 0.797 in the "High" category.

The results of the final product of the physical education learning outcomes assessment instrument for volleyball based on GPAI are in Table 4.

After an assessment is made based on the volleyball game indicators based on the game performance assessment instrument (GPAI), it can be calculated student learning outcomes with the formula:

$$\frac{\sum score}{\sum score\ maximum} \times 100\%$$

The example of the assessment table and the assessment criteria given to students to assess the physical education learning outcomes of volleyball games are in Tables 5 and 6.

The field test was conducted on 18 students of Junior High School. At the large-scale trial stage, the teacher assesses students' volleyball abilities using the instruments that have been developed. Previously, the researcher explained how to use the physical education learning outcomes assessment instrument for volleyball based on GPAI. The results of the assessment are in Table 7.

When displayed in the form of Assessment Norms, the physical education learning outcomes assessment instrument for volleyball based on GPAI in the field test is presented in Table 8.

Based on Table 8 above, it shows that physical education learning outcomes in volleyball material at GPAI-based Junior High Schools in large-scale trials were in the "very low" category of 16.67% (3 students), "low" of 44.44 % (8 students), "high" 38.89% (7 students), and "very high" 0.00% (0 students). Based on an average score of 58.13,

Table 5. Table of assessment of physical education learning outcomes for volleyball materials based on GPAI

No	Name	DM	SE	S	G/M	B	Total	Score
1								
2								
3								
Total Score								
Mean								

Table 6. Criteria for physical education learning outcomes for volleyball game materials

No	Score Interval	Criteria
1	72-100	Very good
2	63-71	Good
3	44-62	Poor
4	25-43	Very Poor

Table 7. Results of the assessment of physical education learning outcomes in volleyball material

No	Name	DM	SE	S	G/M	B	Total	Score
1	AA	12	16	11	9	5	53	66,25
2	AB	10	10	6	4	4	34	42,50
3	AC	9	11	7	5	2	34	42,50
4	AD	12	15	9	6	4	46	57,50
5	AE	14	12	8	7	4	45	56,25
6	AF	13	15	12	9	6	55	68,75
7	AG	13	16	11	7	4	51	63,75
8	AH	10	10	7	4	3	34	42,50
9	AI	10	15	9	6	4	44	55,00
10	AJ	14	15	9	7	6	51	63,75
11	AK	13	12	8	6	4	43	53,75
12	AL	12	12	8	6	6	44	55,00
13	AM	15	18	12	9	6	60	75,00
14	AN	13	13	8	9	4	47	58,75
15	AO	13	18	9	8	6	54	67,50
16	AP	11	14	9	6	6	46	57,50
17	AQ	13	18	11	9	6	57	71,25
18	AR	12	10	8	5	4	39	48,75
Total								1046,25
Average								58,13

Table 8. Norms of assessment of physical education learning outcomes material GPAI-based volleyball on field tests

No	Score Intervals	Criteria	Frequency	Percentage
1	72-100	Very high	0	0.00%
2	63-71	High	7	38.89%
3	44-62	Low	8	44.44%
4	25-43	Very Low	3	16.67%
Total			18	100%

the physical education learning outcomes assessment instrument for volleyball based on GPAI is in a low category.

Discussion

In developing test instruments, it is necessary to pay attention to the four basic concepts that exist, Validity, Reliability, Objectivity, and Norms (Cabrera et al., 2021). Valid means the instrument can be used to measure what should be measured (Supena et al., 2021; Sürücü & Maslakçi, 2020; Clark & Watson, 2019), reliable means an instrument which, when used several times to measure the same object, will produce the same data (Hayes & Coutts, 2020; Elliott et al., 2020). Instrument validation is a fundamental stage in instrument development and evaluation. Validity is the accuracy of the test on its components and the suitability of the score with its interpretation. The validation process includes gathering evidence to show the scientific basis for interpreting the score as stated in the purpose of using the assessment instrument. In other words, the score of the assessment results can be interpreted according to the purpose of using the instrument. However, the step to get the right interpretation is to validate the instrument first.

There are several ways to prove the validity of an instrument, most of which are grouped into 3 categories: content, based on criteria, and constructs (Suartama et al., 2019). An instrument is said to be valid if the content of the assessment instrument is comprehensive, relevant, and does not go beyond the limits of the measurement objective. Determining the content of the instrument is considered valid and can be proven based on a rational analysis of the content of the instrument, whose assessment is based on individual subjective considerations. The right individuals to determine content validity are those who are considered experts in the components being measured so that the results obtained can be accounted for. The validity of using Aiken has a high value, so it can be concluded that the use of Aiken provides a good level of validity and reliability.

The GPAI-based learning outcome assessment instrument for volleyball materials in Junior High School based on GPAI has criteria that are adjusted to the results of students' volleyball playing abilities. A high-quality skills assessment must be accompanied by clear, meaningful, and credible assessment criteria (Chen et al., 2017). Physical education teachers need to clearly describe the goals and assessment criteria and use developmental and age-appropriate assessments to ensure the educative nature of assessment in learning in addition to evaluation (Starck et al., 2018). Learning that can encourage students to be actively involved in improving motor skills. Accurate and comprehensive skill assessment is becoming increasingly important because it will provide an understanding of the relationship between motor ability level and the health (Logan et al., 2017). The use of assessment rubrics is very important in learning to moderate student learning outcomes and can be considered the most significant aspect for accurate and consistent assessment (Grainger & Weir, 2016). Assessment can be viewed as an ongoing part of teaching that occurs during the learning process, i.e., the main purpose of assessment is to provide feedback to students and teachers.

The GPAI is designed to measure game performance behaviors that demonstrate tactical understanding, as well as

a player's ability to solve tactical problems by selecting and applying appropriate skills. Criteria such as decision-making, skill execution, support, and adjustment are assessed during short games, sometimes through peer scoring (Backman et al., 2021). The product of this research is different from Mitchell et al., (2020) which uses a Likert scale of 1-5, while this study uses a modified scale of 1-4. Assessment of physical education learning outcomes for volleyball based on GPAI using indicators Decision Making (DM) (5 items), Skill Execution (SE) (5 items), Support (S) (5 items), Guard/Mark (G/M) (5 items), Base (B) (5 items). The advantage of GPAI is its flexibility. This research is adapted to the sport of volleyball, with descriptions and assessment criteria for students.

The results of this study are different from Ben Khalifa et al., (2020); Bergmann et al., (2022); Mahedero et al., (2021), they used five-game elements from GPAI, namely decision-making, skill execution, support, game performance game involvement, used to assess students' game performance. Furthermore, Mitchell et al. (2020) recommend seven tactical components (basic, adjustment, decision-making, skill execution, support, cover, guard/mark) related to effective game performance.

The results of the development of the Assessment of physical education learning outcomes for volleyball based on GPAI are a simple form of the test required to determine students' volleyball playing abilities. This is necessary because students' volleyball abilities are not the same. When the ability to play volleyball is known with certainty, the learning process or practice will be easier for grouping. The author hopes that this research can become a recommendation for further research to develop an Assessment of physical education learning outcomes based on GPAI, so that the physical education learning process becomes better.

Conclusions

Based on the results of the research and the results of the data analysis that has been carried out, it is concluded that the instrument for assessing the learning outcomes of physical education on volleyball material in Junior High School based on GPAI that was developed is valid and reliable, with V Aiken ≥ 0.87. Furthermore, the reliability of the physical education learning outcomes assessment instrument for volleyball material in GPAI-based junior high schools was 0.797 in the "High" category.

This research can help teachers and trainers in observing and recording performance behavior during the game. The observed aspects include behavior that reflects the player's ability to solve tactical game problems by making decisions, making body movements that are in accordance with the demands of the game situation, carrying out the type of skill he chooses.

The researcher hopes that the resulting product in the form of an assessment of physical education learning outcomes for volleyball material in GPAI-based junior high schools can be a guide or reference for evaluating students on volleyball material. Suggestions for future research, it takes time for the process of development, identification, and validation longer time to improve product quality. This GPAI-based volleyball learning outcome assessment instrument needs to be developed again to make it better.

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Conflict of interest

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РОЗРОБКА ІНСТРУМЕНТІВ ОЦІНЮВАННЯ РЕЗУЛЬТАТІВ НАВЧАННЯ ФІЗИЧНОГО ВИХОВАННЯ ДЛЯ ВОЛЕЙБОЛЬНИХ МАТЕРІАЛІВ НА ОСНОВІ ІНСТРУМЕНТУ ОЦІНЮВАННЯ РЕЗУЛЬТАТИВНОСТІ ГРИ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 8 табл., 5 рис., 42 джерела.

Мета дослідження. Основне припущення цієї розробки полягає в тому, що не існує інструменту оцінювання результативності гри (ІОРГ), побудованого на оцінюванні результатів навчання фізичного виховання (ФВ), тому дослідники намагаються розробити такий інструмент. Вчитель не використовував інструмент ІОРГ для оцінювання результатів навчання ФВ для волейбольного матеріалу. Мета дослідження полягала в тому, щоб розробити валідну та надійну оцінку результатів навчання ФВ для волейболу на основі ІОРГ.

Матеріали та методи. Це дослідження належить до типу «дослідження та розробка». Суб'єктами були викладачі-експерти з навчання ФВ та викладачі-експерти з волейболу з мінімальною кваліфікацією 5 докторських ступенів. Польове тестування проводили на 18 учнях середніх класів. В інструменті використовується опитувальник із оцінкою 1–4 бали з термінами «Дуже доречно (4 бали)», «Згоден (3 бали)», «Не доречно (2 бали)» та «Дуже не доречно (1 бал)». Техніка аналізу даних валідності використовує валідність Ейкена, а перевірки надійності проводять за допомогою коефіцієнтів внутрішньогрупової кореляції.

Результати. На основі результатів дослідження та результатів проведеного аналізу даних зроблено висновок, що розроблений інструмент для оцінювання результатів навчання ФВ на матеріалі волейболу в середній школі на основі ІОРГ є валідним і надійним, при цьому показник валідності Ейкена становить V ≥ 0,87. Крім того, надійність інструменту оцінювання результатів навчання ФВ для волейбольного матеріалу в середніх школах на базі ІОРГ становила 0,797 у категорії «Висока».

Висновки. Автор дослідження сподівається, що отриманий результат у формі засобу оцінювання результатів навчання ФВ для матеріалу з волейболу в середніх школах на основі ІОРГ може бути посібником або довідником для оцінювання учнів з матеріалу з волейболу.

Ключові слова: інструмент оцінювання результатів навчання, фізичне виховання, волейбол, ІОРГ.

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