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Development of multiple intelligence ability tests of basketball in high schools

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ABSTRACT

The study's objectives are to i) develop a test kit to determine the ability of multiple intelligences (MI) to play basketball in high school and ii) measure a student's MI test ability in playing basketball. The method used is the development of instruments with analysis, design, development, implementation, and evaluation (ADDIE). The study subjects comprised five schools in five districts in Yogyakarta, Indonesia. With a total sample of 1029 students. The results showed i) that test kits developed to assess students' MI abilities meet valid and reliable requirements. It can be seen from the validity of the contents of V-Aiken (0.96) and the validity of the construct, namely the loading factor > 0.3. With the analysis of the item classically, it detects that the level of difficulty and differentiability of the problem is good and according to the criteria; ii) the results of MI capability measurements show 55% of capabilities with the "high" category, 35% with the "medium" category, and 10% with the "low" category.

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1. INTRODUCTION

In the 21st century, science and technology are experiencing rapid development in various aspects of life. Related to results in the era of globalization, either directly or indirectly, the quality of human resources (HR) is needed to face challenges. Qualified HR can be obtained through the quality of education [1], [2]. So, efforts to improve the quality of education are essential factors determining the success and progress of nation-building. The results of the trends in international mathematics and science study (TIMSS) study aimed to assess the development of mathematics and natural sciences for students aged 13 years (junior high school level VIII), which is held every four years. In mathematics and science literacy, the 2020 TIMSS study's findings indicated that Indonesian pupils had not shown enough progress. With a score of 397, Indonesian students' mathematical literacy is only able to place 44 out of 49 nations, much below the 500 global averages. With a score of 397, science literacy is rated 45th out of 48 nations, remaining below the global average of 500 [3]. Based on the survey results, there was a decrease in the quality of competitiveness of Indonesian students in the international arena. Improving the quality of education in Indonesia is one of the government's efforts by reforming the curriculum and learning process and measuring in the form of assessments that aim to prepare students in education to face the challenges of the 21st century. Therefore, in the education system, improvements are made by adjusting learning objectives so that participants have life skills and skills.

The main realm in forming a healthy human being also requires aligning the three elements of student abilities developed in learning. Cognitive, affective, and psychomotor are the three domains in optimizing learner learning. The psychomotor realm's main objective is to contain behaviors that emphasize aspects of motor skills implemented in behavior and physical activity in daily education. Physical education (PE) is the foundation for the harmonious development of a personality and its sustainable intellectual growth [4]. These subject matters are to be maintained in the educational field to catalyze the growth of students' intellectual. PE lessons that use multiple intelligences (MI) theory positively affect students' cognitive, affective, and psychomotor domains [5]. In addition, [6] explained that student learning outcomes that cover three domains could be estimated using the student team achievement division (STAD) learning model by applying MI. The theory of MI provides an alternative for teachers to involve physical activity in learning that also activates other intelligences in a learning activity [7]. Gardner's theory of MI emphasizes that intelligence encompasses a wide range of abilities, including emotional and spiritual dimensions, as well as the capacity for imagination, creativity, and problem-solving [8]–[10]. Gardner's theory provides a framework for categorizing these abilities into different domains [11].

Intelligence is not only measured by intelligence quotient (IQ), but also by the ability to solve problems and create products in broader contexts and natural situations [12], [13]. Based on this opinion, the capacity of ability also includes various types of intelligence, including logical, emotional, social, creative, and analytical thinking [14]. MI theory makes a significant contribution to education in Indonesia. Teachers who apply MI in classroom learning have indirectly caused changes in the way they view and interact with students [15]. Physical activity and health can foster a child's self-confidence. Properly assessing children's sports activities will maximize brain performance, optimizing a person's intelligence. Various studies have developed valid and reliable assessment instruments to measure volleyball learning outcomes in PE classes. One study developed a game performance assessment instrument (GPAI) based on PE learning outcomes for volleyball, which was found to be valid and reliable [16]. Another study used the modified volleyball information system application to assess students' performance in volleyball skills, proving that the application can be used as an alternative assessment tool for teachers [17].

The application of the principles of MI is an aspect that determines the relationship between athletic identity and academic achievement [18]. Academic intelligence includes logical-mathematical thinking and linguistic abilities, while firm intelligence resides in spatial consciousness and kinesthetic intelligence. Similarly, applying the MI-based basketball game assessment model in high school is essential because a reliable and valid instrument is needed to assess MI in sports activities, especially basketball. Student success and learning achievement are strongly influenced by MI's abilities and sports activities [19], [20]. It is proven in a meta-analysis [21], which shows that the effectiveness of MI is directly proportional to student learning outcomes. The curriculum can guide teachers in creating lesson plans by providing them with a framework for lesson development and planning [22]. On the other hand, the MI curriculum provides alternative curricula that can be modified according to the conditions of students. In addition, each student has different potentials and advantages so that this potential can be optimized through an MI-based assessment. Meanwhile, Gardner's theory explains MI has an influence and implications for the application of technology and student learning motivation [23].

Further, innovation in teaching and learning activities is urged to maintain in delivering PE at school to optimize the learning outcome of this subject. Future PE students must be prepared for innovative activities [24]. The integration of other subjects (science and technology) is necessarily adjusted. And since it is a subject dedicated to physical activity, the delivering process in learning activities should involve a whole physical activity. A longer time of PE portion and as early age as possible PE trained and educated, the effectiveness of PE potentially obtained [25], [26]. Teachers face several barriers to improving the quality of learning based on MI. One of the challenges is students' lack of motivation, as online learning is often considered uninteresting [27]. In addition, there is a lack of attention from teachers to the intelligence possessed by each child, resulting in a failure to understand and analyze their unique abilities [28]. In addition, teachers' teaching methods and approaches may not match learners' expectations, leading to inefficient teaching and learning [29]. Another obstacle is the lack of appropriate activities and environmental interactions in the curriculum, which hinders the development of MI-based learning materials [30]. Based on the results of these previous researches, it can be concluded that teachers still have difficulty developing their creativity in developing the quality of thematic learning outcomes based on multiple intelligences of MI students.

In PE evaluations, scores on achievement tests in a particular subject matter area are the main criteria that can be viewed [31]. The achievement test operationalizes educational goals or objectives in such situations. When those goals are tied to the subject matter, the operationalization and construction of testing are relatively straightforward. Thus, it can be concluded that constructing a good instrument requires the operationalization of the theory and planned learning objectives. Therefore, the assessment and evaluation

process can be used to optimize learning outcomes by compiling diverse and new learning objectives and assessment techniques. The steps of test quality analysis can explain the general and specific aspects of the items on a test [32]. It can be concluded that the study of question items serves to find and find and correct errors in the question test items before the questions are given to students as a learning evaluation instrument so that the question items have high validity and reliability. The existence of a test kit that can measure MI ability in students will be able to provide solutions on how to develop MI skills in the game of basketball.

2. METHOD

2.1. Participants

The subjects were students in five schools in five districts in Yogyakarta province. Participants were involved in small-scale trials with a total of 174 students. Whereas for the extensive tests, 1029 students in senior high schools around Yogyakarta participated in this research. In addition, there were 17 PE teachers and five sports measurement and assessment experts to help the researcher measure and test the participants.

2.2. Procedure/test protocol/skill test trial/measurement/instruments

Tests, observations, in-depth interviews, questionnaire distribution, documenting of study findings, and discussions are the techniques used to discover issues and requirements. Furthermore, data were collected via questionnaires (written information) and oral guidance from measurement professionals, sports psychology experts, and sports coaching experts. This conversation technique is captured and applied in the evaluation of MI-based basketball games that have been improved to become MI-based basketball game evaluation tools. The grid of MI-based basketball game assessment instruments can be seen in Table 1. The tables show the scope of MI integrated into the basketball playfield. Nine indicators of MI are broken down into 26 sub-indicators. Further, the 26 sub-indicators will be derived into some statements of the questionnaire. Those indicators of MI are also used as essential information in delving into more supporting data.

Table 1. MI-based basketball game instruments

No.	Indicators	Sub-Indicators	Valuation
1	Linguistics	Understanding communication in basketball games.	Communication with teammates verbally.
		Practicingkan sound bahasa.	Provide code in passing the ball.
2	Mathematical	Understanding game time.	Estimated game time.
	logic	Understand cause-and-effect patterns.	Can estimate the team's chances of victory.
		Understand/know the quantification of the score.	Can calculate and estimate the score in a match.
		Understand the angle of the shot in the game.	Can estimate the angle of fire with the accuracy of the basketball hoop target.
3	Visual-spatial	Understand the area of the basketball court.	Arrange an object from the most significant size to the smallest.
		I am estimating the inner step toward the ring.	Estimate the dribbling time and shooting time precisely.
		Able to estimate passes to teammates.	Pass the ball according to the strategy of the game.
4	Kinesthetic	Coordination of the body.	Perform right-to-left or circular body movements.
		Body processing skills.	Perform ball dribble movements.
		The flexibility of motion.	Perform dribble and bending movements.
		Ground speed.	The player's running speed.
		Response to movement.	Respond to when the opponent is about to shoot with a block move.
5	Music	Able to understand the sound of game codes.	Understand the time off, the injury time, the time to get points, and the time the foul occurred.
		Musical reactions.	React with musical support or audience applause.
6	Interpersonal	Able to communicate.	Cooperation in scoring points.
		Able to negotiate.	Bargaining with friends.
		Able to provide motivation.	Motivate teammates.
7	Intrapersonal	Self-motivation.	Saying the motivational word, e.g., "Let's go, we certainly can!"
		Discipline in everyday life.	Coming training is not late.
8	Naturalist	Use healthy natural ingredients in the match.	Drink clean and healthy mineral water.
		Able to adapt to the new arena.	Able to adjust to the new field.
9	Existence/Religion	Pray to the God.	Pray or worship before competing.
		Can master/calm down?	Did not get angry quickly in the game.
		Do the game with sportsmanship.	Accept defeat with an airy chest or victory humbly.

2.3. Data collection and statistical analysis

Various methods carry out data analysis. The first stage is to construct an instrument design (content validity) constructed based on indicators developed from theory using the qualitative analysis approach. Drafts of research instruments and indicators are created by compiling instruments and question types derived from theoretical and prior research investigations. Ultimately, it is set up as a draft instrument, and the subsequent step is completed in Delphi. The instrument preparation stage involves creating a grid that is parallel to the variables to be measured [33]. This grid is adjusted to the scope of the assessment aspects [34]. The grids made and developed into the test and non-test items are assembled into standard instruments and then consulted with experts through the Delphi method with input from measurement experts (two people) and sports education experts (three people).

Then, quantitative descriptive analysis is carried out, namely testing the design of instruments obtained from the results of the test response, namely content analysis (construct validity) supported by quantitative data aimed at seeing the construction carried out with the exploratory factor analysis (EFA). Quantitative descriptive analysis determines the average and standard deviation of participants' scores. In addition, to select the assessment category, it is also necessary to decide on the classification of participants' abilities from the MI assessment. The following calculation is carried out to determine the percentage of achievement: percentage of right indicator (PRI)= total score sub-indicator I divided standard score (SkI) or can be formulated as (1).

$$PRI = x\ 100\%, \frac{\sum_1^n (JKS)_i}{Skj} \quad (1)$$

That is to say, the total score sub-indicator I is the frequency of each column multiplied by a weight, or it can be formulated as (2).

$$(\text{JSK})_\text{i} = FSI \times B \quad (2)$$

In this study of qualitative data, quantitative information gathered via evaluation tools is transformed into qualitative information on a 4-point scale. The steps in viewing the instrument construct are as follows: i) to prove the hypothetical conceptual model; ii) to the reliability of the instrument; iii) to prove assumptions response theory grain; iv) m end analyze the fit of the model; v) to an estimation of grain parameters; vi) to estimation error measurements; vii) estimating the ability of the test taker; and viii) to estimation the value of the information function. The last step is to measure the distribution and mapping of MI abilities of junior high school students in Yogyakarta.

3. RESULTS AND DISCUSSION

The test instrument consists of 28 test questions, namely knowledge items about the game of basketball, which include nine bits of intelligence, namely: i) linguistics, ii) mathematical logic, iii) spatial visuals, iv) kinesthetic, v) music, vi) interpersonal, vii) intrapersonal, viii) naturalistic, and ix) existence. The test instrument is in the form of multiple-choice questions with four choice options (a, b, c, and d). With only one correct answer key. Content validity is the validity estimated through testing the content of the test with rational analysis or through "professional judgment [35]. The stages of instrument preparation begin with compiling a grid whose assessment aspects are adjusted to the scope of variables to be measured based on the conceptual definition of the theory.

3.1. Instrument validity

The validation process produces i) the observation instrument is entirely used, while ii) the test instrument from 64 grains is summarized to only 28 items. The simplification is based on input from five experts, resulting in a more simplified instrument. The content validity coefficient is determined based on the assessment of a panel of n experts on a question item regarding the extent to which the question item represents the content being measured [36]. The following is the formula that Aiken suggested [37]. $V = \sum s/[n(c-1)]$; $S = r - Lo$; Lo = the lowest validity rating number (e.g., 1), C = highest validity assessment number (e.g., 5), R = number given by the appraiser. Here is the Aiken validity (V-Aiken) analysis results with four scales for the test instruments as listed in Table 2. Table 2 depicts the results which show that all items in the observation instrument are worth trying because the V-Aiken for each item is more than 0.5. Because the average V-Aiken is 0.96, an observation instrument with a V-Aiken coefficient this high is considered to have such validity. The following are the results of the V-Aiken test instrument analysis explained in Table 2.

Table 2. Results of the V-Aiken test instrument analysis

No.	Indicators	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	V-Aiken
1	Linguistic (manipulating grammar)	4	4	4	4	4	0.86666667
2	Linguistics (phonology or phonology)	4	4	4	4	4	0.93333333
3	Linguistics (semantics or meaning of language)	3	4	4	3	4	0.86666667
4	Linguistics (pragmatic dimension or practical use of language)	4	4	4	3	4	0.8
5	Mathematical logic (categorization or classification)	4	4	4	3	4	0.8
6	Mathematical logic (inference)	4	4	4	4	4	0.86666667
7	Mathematical logic (generalization)	4	4	4	3	4	0.8
8	Mathematical logic (hypothesis testing)	4	4	4	3	4	0.8
9	Mathematical logic (calculation)	4	4	4	3	4	0.93333333
10	Spatial (observation of the reality of objects)	4	4	4	4	4	0.93333333
11	Spatial (organizing information against objects)	4	4	4	4	4	1
12	Kinesthetic (coordination)	4	4	4	4	4	1
13	Kinesthetic (balance)	4	4	4	4	4	1
14	Kinesthetic (flexibility)	4	4	4	3	4	0.93333333
15	Kinesthetic (strength)	4	4	4	3	4	0.93333333
16	Kinesthetic (speed)	4	4	4	3	4	0.93333333
17	Music (reaction to the rhythm)	4	4	4	4	4	1
18	Music (reaction tone)	3	4	4	4	4	0.93333333
19	Interpersonal (feelings)	3	4	4	4	4	0.86666667
20	Interpersonal (motivation)	4	4	4	3	4	0.93333333
21	Interpersonal(temperament)	4	4	4	3	4	0.93333333
22	Interpersonal (intention)	4	4	4	4	4	1
23	Intrapersonal (encouraging yourself)	3	4	4	3	4	0.93333333
24	Intrapersonal (developing discipline)	4	4	4	4	4	0.93333333
25	Naturalist (response to the environment/adapt)	3	4	4	4	4	1
26	Naturalist (response to the environment/adapt)	4	4	4	4	4	1
27	Existence/religion (meaning of noble goals)	4	4	4	4	4	1
28	Existence/religion (meaning of noble goals)	4	4	4	4	4	1
	Average	3.82	4	4	3.57	4	0.96

3.2. Unidimensional tests

With a total of 122 students, an average of 87, a total variance of 154.1, and a standard deviation of 12.4, the descriptive statistical analysis revealed the details of the data. In the meanwhile, a mark of 0.561 was revealed by Kaiser-Meyer Olkin (KMO) and Bartlett's dimensional test data. The instrument's viability for one-dimensional testing is demonstrated by the KMO and Bartlett's test. Utilizing the SPSS 25 software, factor analysis was used to conduct unidimensional tests. Feasibility testing was done utilizing the Kaiser Meyer Olkin-measure of sampling adequacy (KMO-MSA) and Bartlett's tests on each instrument prior to a factor analysis. The requirements for factor analysis are KMO-MSAU > 0.5 and Bartlett's unidimensional test is significant, meaning that each test item only measures one ability [38]. Factor analysis in this research was used for unidimensional testing. Less than 0.05 was found in the results of the KMO and Bartlett analysis. Although the Bartlett test verifies the normality of the data used, the KMO-MSA test assesses the adequacy of the sample. Table 3 provides an overview of the results of the KMO and Bartlett tests.

Table 3. results of the KMO and Bartlett tests

Kaiser-meyer-olkin measure of sampling adequacy		0.861
Bartlett's test of sphericity	Approx. chi-square	1531.839
	Df	378
	Sig.	.000

The results of the empirical analysis in the explanation in Table 3 show that the Bartlett test sig is 0.000 and the KMO-MSA value is 0.861 or more than 0.5. Therefore, it can be said that all the findings of this study are noteworthy, which shows that factor analysis can be carried out using this instrument. An extraction process is carried out to obtain items that measure the exact dimensions so that several factors are generated. The factors formed in the model have eigenvalues, and factors with eigenvalues above 1.00 are retained [39]. The assumption of unidimensionality is considered fulfilled if the test contains one dominant component that measures a person's ability [40], so it is important to verify the assumption of unidimensionality when using the item response theory (IRT) model [41]. A similar assertion was made by [42], he said that if a measurement reveals a single dominant dimension, the reaction or grain characteristic would only have one or a unidimensional dominant dimension. Unidimensional incorporates a pre-requisite examination for performing additional data analysis. The outcome displays the same intentions, goals, or objectives as determined by the instruments created [43]. Furthermore, if the first-factor eigenvalue has a

value up to several times the Eigenvalue, the second factor, and so on, is almost the same. It is said that the unidimensional conditions are met.

The instrument produced assesses just one element of ability, as indicated by the total variance in Table 4 (32.992%) in the first component. This may be taken as the instrument measuring one feature with a dominating eigenvalue of 9.238%. MI tests in the cognitive domain are used to assess the skills. Following that, the outcomes of the EFA using the scree plot are displayed in Figure 1.

Table 4. KMO and Bartlett's test

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	9.238	32.992	32.992	9.238	32.992	32.992	5.355	19.126	19.126
2	2.912	10.400	43.392	2.912	10.400	43.392	2.742	9.791	28.917
3	1.486	5.308	48.700	1.486	5.308	48.700	2.596	9.272	38.190
4	1.378	4.923	53.623	1.378	4.923	53.623	2.291	8.181	46.371
5	1.121	4.004	57.628	1.121	4.004	57.628	2.097	7.491	53.861
6	1.031	3.681	61.309	1.031	3.681	61.309	1.821	6.502	60.364
7	1.030	3.677	64.986	1.030	3.677	64.986	1.294	4.622	64.986
8	0.971	3.469	68.455						

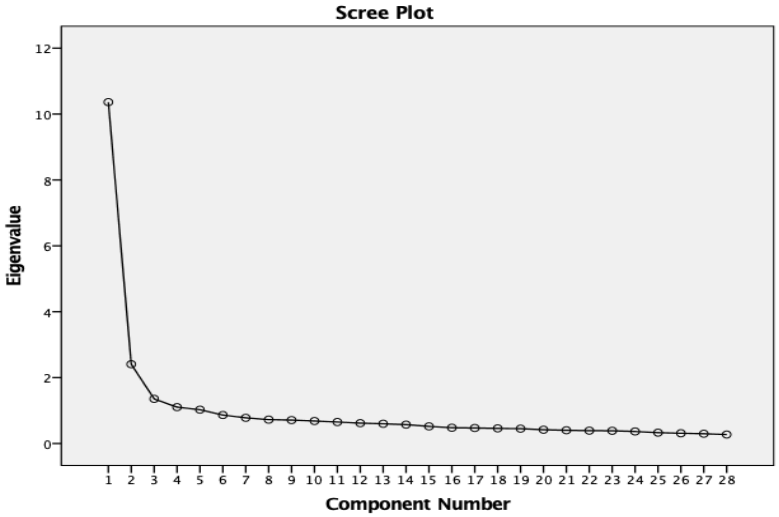

Figure 1. Scree plot unidimensional test instruments

3.3. Reliability

Next, the grains are analyzed use SPSS to assess the generated instrument's reliability. The value of Alpha cronbach in each output table received is the parameter used to assess reliability; if the Alpha index is more significant than 0.7 ($\alpha > 0.7$), then the instrument is reliable [44]. The limited-scale trial's Alpha coefficient resulted in a value of 0.919 (> 0.7), indicating that the instrument has already satisfied the high-reliability standards. These are the test instrument's reliability coefficient findings. Promising outcomes were observed in the validity of the contents and constructs for the MI observation instruments. They complied with the requirements in order to facilitate the subsequent procedure; an extended trial with participants from five schools across the Province of the Special Region of Yogyakarta, one school serving as a representation for each district. This can be seen in the development of tennis instruments with good reliability for MI-based professional athletes [45]. Table 5 shows that the reliability coefficient of the MI test instrument is 0.919 (> 0.65), so it meets the requirements for a good instrument.

Table 5. Instrument reliability

Cronbach's alpha	Cronbach's alpha based on standardized items	N of items
0.919	0.921	28

Meanwhile, the reliability every component's coefficient yielded a value greater than 0.6, indicating that every element's dependability rating falls into a good category. The table below provides a description of each component's dependability value. Each latent variable's reliability may be ascertained using the composite reliability value, also known as average variance extracted [46]. In what location is the component loaded into the variable and indicator? If the parameter estimations are correct, the composite reliability has the characteristics of a closer approximation. The dependability of each component of the two instruments is compared in the following analysis. The study creates both observation and test instruments based on the reliability of composite scores observed from each sub-component or indication. The process of determining the dependability of composite scores involves calculating the reliability based on each component's score [46]. The results of Table 6 show the estimates for each reliability score, which has a high score that is expected to influence or impact the total reliability. Each indicator has a reliability coefficient above 0.65, so it can be said that its reliability meets the requirements for a good instrument.

Table 6. Reliability results of composite scores for each component

Indicators	Composite test
Existence	0.905
Interpersonal	0.826
Intrapersonal	0.820
Kinesthetic	0.869
Linguistic	0.869
Mathematics	0.892
MI test	0.941
Music	0.857
Naturalistic	0.724
Spatial	0.823

The results of the composite reliability recapitulation in Table 6 show that the nine components of MI have good internal consistency, which is above 0.5. Then, it can be concluded that the composite reliability of MI evaluation instruments is good. At the same time, the overall reliability score for the test instrument is 0.941, which falls into the excellent category. It can be inferred from the two instruments that both observation and test instruments have a very high reliability coefficient so that advanced analysis can be carried out for broad-scale trials.

3.4. Discussion

Nine compound intelligences were formed from seven compound pieces of intelligence in a conceptual model that included some basic notions from howard gardner. Four Likert scale categories exist for each of the 28 observed items in the instrument specification. The covariance criterion for each item will next be examined. A decent covariance (factor loading) has a value of > 0.3 [47]. Two items of the 28 MI performance instruments have a loading factor value of < 0.3, namely item L1. Table 7 shows data from the confirmatory factor analysis (CFA) results of the MI test instrument, which shows that one item was invalid and discarded. Of all the items analyzed using CFA, two invalid objects were manipulated by language with teammates when playing. So, it can be concluded that the construct of the MI performance instrument is feasible to use.

Table 7. Valid bullet list

Category	Grain
Valid	L2, L3, L4, LM1, LM2, LM3, LM4, LM5, S1, S2, K1, K2, K3, K4, K5, M1, M2, INTER1, INTER2, INTER3, INTER4, INTRA1, INTRA2, N1, N2, E1, E2
Invalid	L1

3.4.1. Analysis of test items with classical theory

Item analysis was performed using classical test theory with 2PL (difficulty and power difference). From 28 items, the difficulty level of a good question item is between 0.3 to 0.7. In general, the difficulty index of an item should be in the interval of 0.3-0.7 [48]. At this interval, information about the student's abilities will be obtained to the maximum. In designing the difficulty index of a test device, it is necessary to consider the purpose of compiling the test device. To determine the differentiating power, the discrimination index, biserial correlation index, biserial point correlation index, and alignment index can be used. In the item analysis in this study, only a biserial point correlation index was used. A good biserial point index is greater

than or equal to 0.3. In test analysis with content-referenced measures, the item differentiating power index does not need to be a concern if it is not negative [49]. Here are the results of the analysis of classical theory with the R program for test instruments. Meanwhile, a good instrument must have an effective model that fits the indicator criteria of the nine compound intelligences [50], [51].

3.4.2. Model fit assessment indicators

Examining the goodness of fit (GoF) test is the next step toward demonstrating the developed model's fit. The combined performance validation of the outer model (measurement) and the inner model (structural) is provided by it. The values of the model range from 0 to 1, with the interpretations of 0-0.25 (minimum GoF), 0.25-0.36 (moderate), and > 0.36 (big).

Table 8 shows many differences between the tested data and the model between saturated and estimated models with standardized root mean residual (SRMR). The data indicates a 0.002 discrepancy between the data and the model, indicating a negligible difference. Thus, it may be said that the model suited the data that was evaluated. The degree to which the empirical correlation matrix deviates from the suggested model correlation matrix is gauged by the precise fit criteria that follow. With an output data point of 27.173 (> 2.00), indicating that the observed matrix and the model differ by 0.43, it may be determined that the difference is negligible and falls into the outstanding category. According to the analysis's findings, every empirical test criterion suggests that the data fits against the created model. While discussing valid and appropriate instruments, we can see from [52] that development with model analysis, design, development, implementation, and evaluation (ADDIE) shows that a creative curriculum assessment model based on MI developed for early childhood meets the validity, reliability, and conformity criteria of empirical data models. Likewise, MI can be optimally applied if combined with the right strategy, especially with the ability to know the process and creativity of students [53], [54]. Therefore, the development of MI can improve learning outcomes with various innovative and problem-based learning methods [5], [55].

Table 8. Model fit summary

Models	Saturated model	Estimated model
SRMR	0.130	0.132
d_ULS	27.173	27.603
d_G	N/A	N/A
Chi-square	Infinite	Infinite
NFI	N/A	N/A

3.4.3. Results of multiple intelligences ability

Measurements are carried out to determine how students' abilities are distributed and mapped in the Special Region of Yogyakarta Province. The total number of students assessed is 1029, with a three-level categorization formula. The data categorization for learners' MI abilities is described in Table 9.

Table 9. Model fit summary

No.	Categorization	Decision
1	28-75	Low
2	76-88	Keep
3	89-112	Tall

The measurement results show that the total average is 89.47, with the standard deviation value being 12.8. So, data categorization is as follows. It was seen that the MI capability that falls into the "High" category was 568 or (55%) of the total number of samples; for the ability "Medium," 358 (35%) of the participants. Finally, it is the "Low" category, with a total of 103 (10%) of the number of participants. This is relevant to [56] that physical activity has a significant relationship with a person's MI ability. Regular basketball practice will increase MI skills in students. Meanwhile, just like basketball, tennis can also be integrated with MI assessments to increase its athletes' professionalism [57]. Other research shows that a person's MI profile will affect their English as a foreign language (EFL) ability because language is an integral part of MI [58].

4. CONCLUSION

The conclusions of the development research are: this test instrument can be used because each indicator is already represented on nine main components: i) linguistics, ii) mathematical logic, iii) spatial visual, iv) kinesthetic, v) music, vi) interpersonal, vii) intrapersonal, viii) naturalistic, and ix) existence. The trial showed 28 eligible items, but only 27 items qualified for the construct validity criteria for the test instruments. It means 1 grain is discarded because it has a low loading factor (> 0.3). CFA test with P-value criterion has been used to evaluate the constructs of all instruments experimentally. The instrument can be considered to suit the model since the mean-square ensemble has performed well. Product viability tests along with content validity analysis revealed that the Delphi technique was employed by five experts who were chosen for the study. Therefore, the product is deemed viable for instrument testing with a total V-Aiken of 0.96. Cronbach Alpha has a reliability coefficient of 0.919. In the meanwhile, the validity of composite scores-which show that the findings of both the test and observation instruments meet the dependable standards (> 0.5) can be used to assess each component's reliability. The created product model's fit test reveals that there is a substantial difference in standardized root mean squared residual (SRMR) (square root) between the estimated and saturated models, based on the data evaluated. The examination of the test instruments using classical test theory revealed that item 10 only includes one low difficulty (straightforward) item. According to the measurement results, 55% of pupils can play basketball at their best using MI skills. Thus, it may be concluded that the MI evaluation in this basketball match merits study and usage as a benchmark for maximizing students' compound intelligence.

The suggestion from the results of this study is that PE teachers should try to use MI-based basketball game assessment instruments to detect students' weaknesses and optimize these abilities. It is devoted to the developed ability of nine compound bits of intelligence. The education and sports office should train PE teachers in professional development, and academic teachers can develop MI skills in high school. The results of the products that have been designed should be socialized by teachers through professional organizations (subject teacher community or Indonesian teachers' association) so that their benefits will be felt in real terms. MI researchers can use this product as an initial model for measuring and assessing MI-based basketball games. The contribution will be more optimal if added with moderate factors or variables that affect the MI ability of students.

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