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DEVELOPING OF COGNITIVE ASSESSMENT INSTRUMENS OF HIGH ORDER THINKING SKILLS IN SMALL BALL GAME MATERIAL

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Abstract. The Instrument of Higher Level Thinking Skills in Small Ball Games is an assessment instrument in sports subjects, especially in the sports of tennis, table tennis and badminton. This instrument is used to measure students' Higher Level Thinking abilities. This study aimed to: (1) produce a test instrumen that is feasible and meets the requirements for use in measuring the Higher Order Thinking Skills of students majoring in Sports Education, and (2) find out the characteristics of the instrumen of Higher Order Thinking Skills on Small Ball Game material of students majoring in Sports Education. This study used a modification development model from Wilson, Orindo, and Antonio, consisting of three stage: (1) designing the tests, (2) conducting test trials, and (3) taking test measurements. The population in this study was 308 students. The sampling technique was carried out using a total sampling technique. The trial subjects in this study consisted of 152 students, while measurement subject consisted of 156 students. Test instrument products were assessed by experts through a content validation sheet, where there are 2 experts, namely measurement experts (test construction experts) and sports education experts (material experts). Analysis was carried out using Item Response Theory with the help of the QUEST program. The results of the analysis in this study indicate that the test instrumen is feasible and meets the requirements for use in measurements. The conclusions in this research are a) The test instrument has been proven to be valid by experts; b) The test instrument has questions that are in the good category based on the results of the unidimensional test analysis; c) The test instrument is in the high category based on the information function.

Keywords: Test Instrumens, Assessment, Higher Order Thinking Skills, Small Balls

I. INTRODUCTION

In the last few decades, students have been required to think a lot at a higher level in accordance with Bloom's taxonomy theory which emphasizes high-level thinking which includes analysis, evaluation and creation (Abuhassna et al., 2020; Nye et al., 2023; Quinlan & Pitt, 2021). This level is also called High order Thinking skill (Hamzah et al., 2022; Misrom et al., 2020; Setiawati, 2022). High-level thinking is really needed in the learning process, including in Physical

Education, in order to achieve a quality learning process and be able to solve learning problems with creativity.

Learning small ball games in currently places more emphasis on students' psychomotor skills, namely the basic techniques of small ball games which include tennis, table tennis and badminton (Suryadi et al., 2023). Also about the rules of the game, as well as a combination of basic techniques. Apart from that, creative thinking skills are of course also needed in small ball games such as tennis, table tennis, and badminton, both in theory and practice (Insani et al., 2024a; Oktadinata et al., 2024; Rambe et al., 2024;

Sasmita et al., 2023). In learning Sport Education small ball material, the ability to think creatively is closely related to creativity and the ability to solve problems in the field (Adrizal et al., 2024; Arfi et al., 2024). This of course also supports the development of psychomotor aspects possessed by students. Therefore, the portrait of students' creative thinking at school needs to be seen from the assessment of creative thinking.

According to Revalina et al (2024) assessment is considered as the use or application of various tools and methods to obtain various information regarding the achievement of learning outcomes and student competencies, in other words, assessment is a description of the actions carried out to obtain information regarding knowledge, a person's skills or attitudes. Assessment, according to (Ockta et al., 2024; Umar et al., 2023; Yuliana et al., 2023) is a process of processing and collecting information to obtain student learning achievement results. Applying appropriate assessments in measuring the final results in Sport Education learning can improve the quality of education, in other words, a quality measuring instrument is needed to obtain competency in a field in Physical Education. According to (Amin et al., 2023; Insani et al., 2024b; Rambe et al., 2024) the term assessment is closely related to evaluation which means a method that can reveal student learning outcomes. So this assessment aims to see how well students have achieved in learning, in terms of their creative thinking abilities. In educational assessment, the measurement theories used are classical and modern measurement theories. Test scoring in classical measurement is based on answering the questions correctly. Scoring is done by giving a value based on the number of correct answers to each item which is then added up to obtain a raw score. According to Nusri et al (2024), scoring models in classical theory like this are considered less relevant to use, because the level of difficulty at each step tends to be ignored or not taken into account. In analyzing responses to a measurement of creative thinking ability, an appropriate assessment model is needed, one of which is using item response theory. Measurement has an important role in revealing the achievements of students' learning processes.

Based on observations in the field, the Sport Education learning process in college prioritizes learning in the field rather than in the classroom, the teacher only provides a little learning material then continues with field practice. Lecturers rarely carry out the learning process in class by looking at cognitive aspects and only based on how students develop psychomotor and effective aspects, so that students do not and rarely use their thinking skills at a creative level. Even though the cognitive aspect is very important to support students' psychomotor abilities. In the curriculum, Sport Education learning is also required to think at the analytical, creative, evaluating and creating levels of students, this can support the promotion of cognitive levels with creative thinking (Pitnawati et al., 2023). If this is achieved then all cognitive aspects have been applied in the learning process.

In reality on the ground, the researcher made observations at several University and conducted interviews with Sport

Education Lecturers so that information was obtained that during the process of assessing Sport Education learning outcomes, especially in small ball game materials, the test instruments used by Lecturers were only limited to remembering (C1) and understanding (C2), have not yet reached the realm of creative thinking level which includes analytical thinking (C4), evaluation (C5), and creating or making a work (C6). It should have been explained in the Core Competencies and Basic Competencies that all cognitive aspects must be implemented during the Sport Education learning process according to Bloom's taxonomy. In line with Adrizal et al (2024) opinion, there are still many Lecturers who have not implemented cognitive assessment instruments that refer to the curriculum which supports all cognitive aspects of students' creative thinking abilities. Therefore, researchers are interested in seeing students' creative thinking abilities in Sport Education, especially the small ball game material.

The facts in the field so far are that Lecturers in developing questions often ignore the characteristics of instruments that can measure students' high-level thinking abilities, especially in Sport Education learning, so that students are at a disadvantage because Lecturers only provide assessments based on the correct answers in each question item answered by the participants. students without looking at the level of difficulty in each question item. Therefore, from this background, the researcher wants to conduct research on the development of a cognitive assessment instrument Instruments of Higher Order Thinking Skills in Small Ball Games material for students of Physical Education.

II. METHODS

This type of research is development research using a quantitative approach. The model used in this instrument development research is the modified model of Wilson, Oriondo, and Antonio. The stages of developing an instrument in the form of a test with the modified Wilson, Oriondo, and Antonio model are as follows, (1) design (2) trial (3) test measurement. This research aims to develop a Cognitive Assessment Instrument for Higher Level Thinking Abilities in the Small ball Game Material for The Students of Physical Education. The form of the instrument is in the form of a test instrument that has high-level thinking ability questions that have been developed.

This research was conducted in February at Several University with the major of Sport Education in Jambi Province. The trials were carried out at Universitas Bungo and measurements were carried out at Universitas Jambi. The population in this study was 308 students. The sampling technique was carried out using a total sampling technique. The subjects of this research were Students of Physical Education, Jambi Province. Determination of test subjects is based on high and low average scores on the National Examination for the 2018/2019 academic year. Meanwhile, the minimum sample size used for the Rasch model (1-PL model) is 150-250 (Linacre, 1994). The trial was carried out at Universitas Bungo with a sample of 152 students based on National Examination scores in the low category and

measurements were carried out at Universitas Jambi, totaling 156 students in the high category. The object studied is a picture of students' high-level thinking seen using test instruments.

The procedure carried out in this research starts from (1) Initial product development: which consists of several stages, namely, a) Determining the test objectives. In the first stage in initial test development, the thing that must be done is determining the test objectives. The purpose of the test in this research is to determine the creative thinking abilities of Students of Sport Education as measured with the help of the test instruments that have been developed; b) determining competencies, after determining the test objectives, the next stage is determining the competencies that will be tested based on core competencies (KI) and basic competencies (KD) in Sport Education subjects. There are also Sport Education Core Competencies (KI) and Basic Competencies (KD) in small ball game material; c) Determine the material, the material developed is small ball game material consisting of tennis, table tennis and badminton; d) compiling a test grid. A test grid is needed to compile question items that can be categorized as good. The grid is in the form of a matrix containing the specifications of the test items. In preparation, the grid is used as a reference in writing questions, resulting in questions with relatively the same level of difficulty. (2) Product trial: After the product has been successfully developed, the next stage is product trial, carried out at Universitas Bungo Regency, which based on the National Examination results in 2018/2019 is in the low category. This instrument testing activity involved 152 students. The tests carried out were the unidimensional assumption test, model fit test, and item difficulty level test. (3) Product Revision: After knowing the characteristics of the instrument, the next step is to revise the product being developed. From the results of the trial analysis on the 30 question items that have been tested, all of the question items meet the criteria and can be used for measurement. (4) Final Product Study: Data from ability measurements are then interpreted through ability theta to obtain information regarding the creative thinking abilities of Students of Physical Education. The results of the interpretation will be in the form of values which are then interpreted in the form of categories or predicates. A total of 156 students were then included as samples in measurements using creative thinking ability instruments. The measurement results were then analyzed using the Quest program.

Data collection techniques are carried out using tests. Students are given a test of high-level thinking abilities in the form of a cognitive instrument for high-level thinking abilities regarding the small ball game. Students provide responses in the form of answers to the multiple choice questions that have been provided, each question has five answer choices. Responses from all students were then collected and analyzed. Data obtained from student responses in the form of scores were then analyzed using item response theory with the help of the Quest program to determine the characteristics of the test instrument.

The test instrument used in this research must be able to measure high-level thinking accurately, therefore the Sport

Education high-level thinking test instrument that has been prepared was validated. All items that are developed are arranged based on a grid and are in accordance with the material contained in the curriculum, so that content and theoretically they can meet validity requirements. The scores obtained from the experts' assessments will produce a content validity coefficient. The experts involved are material experts, language experts and test construction experts. The Aiken V formula is used to produce quantitative data from the results of expert assessments (Aiken, 1980; Azwar, 2015). Analysis of higher order thinking ability test data begins by looking at the characteristics of the test instrument using item response theory (IRT) using the QUEST program. According to Subali & Suyata (2011), there are 3 advantages of using the QUEST program, namely, a) it can analyze data using classical and modern theories, b) it can analyze polytomous and dichotomous data, and c) the results of modern theoretical analysis are in accordance with the maximum likelihood model using the 1PL.

In analyzing data using the Item Response Theory (IRT) approach, a unidimensional assumption was tested through model fit analysis. A test item can measure only one ability if the test item is unidimensional. Automatically, the local independence assumption can be said to be fulfilled if the unidimensional assumption can be met. The test items will be unidimensional with an indication that the data fits the Rasch model. In order to know that the Rasch model can predict the response of each respondent, the outfit mean-square (OMS) and infit mean-square (IMS) statistics are used. OMS and IMS statistics are measures of the level of match between predicted values by the model and observational data. A test item is considered fit for the model if it obtains an OMS and IMS value of around 0.5 to 1.5 (Linacre, 2002). Range of OMS and IMS values, implications for measurement: Damage to the measurement system if OMS and IMS >2.0 ; It has no significance for measurement if OMS and IMS: $1.5-2.0$; Has benefits for measuring if OMS and STI: $0.5-1.5$; Not useful but does not impair measurements if OMS and IMS: <0.5 . In addition, interpretation of item characteristics in the form of item difficulty level is based on the criteria: Very difficult, Difficult, Medium, Easy, Very easy (+2,0, +0,5, 0, -0,5, -2). Next, the test information function will state the reliability index by adding up the information function of all existing test items.

After analysis, the test will provide meaning. The results of the students' answers that have been completed are then analyzed to obtain data regarding the high-level thinking abilities of students in . Test analysis was carried out using item response theory (IRT) 1 PL. The data measurement results are presented in 2 things, a) ability (ability frequency distribution graph), and 2) percentage chart (ability level category). To be able to determine students' high-level thinking abilities, categories are determined based on Azwar (Azwar, 2010) theory which is presented as follows.

TABLE I
 ABILITY INTERVAL

Ability Interval	Levels
+ 1.5 <	Very high
+ 0.5 < + 1.5	High
- 0.5 < + 0.5	Medium
- 1.5 < - 0.5	Low
0 < - 1.5	Very low

III. RESULTS AND DISCUSSION

a. Validation of Creative Thinking Instruments

The purpose of validation is to determine the suitability of the test items. To determine the appropriateness of each test item, a review of the correctness of the concept, language used, and writing techniques is carried out. From the review carried out by experts, there are several suggestions for improvements to the test items. The test items that have been developed are reassessed by several experts which are then proven by content validation. The results of the analysis show that all the test items developed are valid, because the material that has been tested is in the curriculum and is also essential. This can be seen from the average Aiken index obtained at 0.837. In Table 2 below, the calculation results using the Aiken formula are presented:

TABEL II
 CONTENT VALIDITY OF THE AIKEN INDEX

Item Number	Rater 1	Rater 2	Rater 3	lo 1	lo 2	lo 3	Total	Indeks Aiken
Item 1	3	4	3	2	3	2	7	0.778
Item 2	4	4	4	3	3	3	9	1.000
Item 3	3	4	3	2	3	2	7	0.778
Item 4	3	3	4	2	2	3	7	0.778
Item 5	3	4	4	2	3	3	8	0.889
Item 6	3	3	3	2	2	2	6	0.667
Item 7	4	4	3	3	3	2	8	0.889
Item 8	3	4	3	2	3	2	7	0.778
Item 9	4	4	4	3	3	3	9	1.000
Item 10	3	4	3	2	3	2	7	0.778
Item 11	4	4	4	3	3	3	9	1.000
Item 12	3	3	3	2	2	2	6	0.667
Item 13	4	4	3	3	3	2	8	0.889
Item 14	3	3	3	2	2	2	6	0.667
Item 15	4	4	4	3	3	3	9	1.000
Item 16	4	4	3	3	3	2	8	0.889
Item 17	3	4	3	2	3	2	7	0.778
Item 18	4	4	4	3	3	3	9	1.000
Item 19	3	4	3	2	3	2	7	0.778
Item 20	4	4	3	3	3	2	8	0.889
Item 21	4	3	3	3	2	2	7	0.778
Item 22	3	3	3	2	2	2	6	0.667
Item 23	3	4	4	2	3	3	8	0.889
Item 24	4	4	3	3	3	2	8	0.889
Item 25	4	4	3	3	3	2	8	0.889

b. Information function and Measurement Error

Test reliability and error in measurement can usually be calculated through information function methods. The

information function is needed to determine the suitability of the question items to the model, so that it can make it easier to select the question items. From the item parameter analysis carried out on the developed test instrument, the information function value was 17,631 with a measurement error value of 0.238 and the ability was at 0.05. This shows that the test instrument can be done well and correctly by students who have an ability of 0.05 to 4. It can be concluded that the upper limit of the interval is at theta 3.8 while the lower limit of the interval is at theta -3.1. These results explain that the test will be better if given in the ability range -3.1 — 3.8, because in this interval the measurement error that can occur will be smaller. According to Bashoori & Supahar (2018) The standard error of the test and the results of the information function indicate the reliability of a test device. A test device can be said to be reliable for use by test takers if it is at an ability level of -3.1 (low category) to 3.8 (high category).

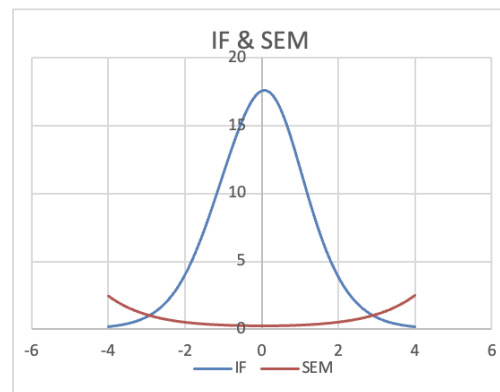


Figure 1. Information Function and Measurement Error

After the instrument testing activities are carried out, the test participants' answer sheets are then scored and then analyzed. Trial analysis was carried out using the Excel, SPSS and Quest programs with the aim of obtaining good instrument characteristics. From the results of instrument testing carried out on 30 questions with a sample of 152, factor analysis results were obtained with the help of the SPSS program. Test items that meet the criteria in factor analysis can be seen from the KMO value obtained, which is 0.830 and the significance level is 0.000. These results indicate that the analysis criteria for item response theory can be continued. The results of the analysis can be seen in Table 3 below.

TABEL III
 KMO AND BARTLETT'S TEST

Ability Level	Number of Students	Persentase (%)
Very high	0	0.00
High	33	21.15
Medium	119	76.28
Low	4	2.56
Very low	0	0.00
Total	156	100

Based on the results of factor analysis, it can be seen that 1 dominant factor was formed in the test instrument questions.

Basically, the unidimensional assumption cannot be strictly fulfilled because there are other confounding factors. Therefore, an instrument can be said to be unidimensional if there is a factor that is most dominant over other factors (Hambleton et al., 1991). There is only 1 dominant factor in the instrument from the results of the unidimensional assumption analysis, with an eigenvalue of 7.025 and a cumulative percent of 23.418%. The following is presented in scree plot.

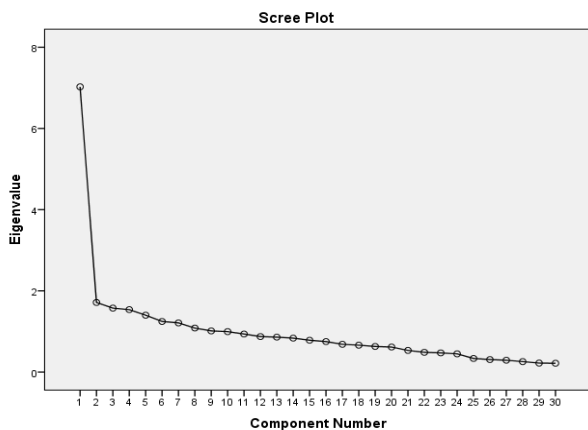


Figure 2. Scree Plot

Items in the test can be said to be suitable or fit for the model if they meet the previous requirements. Statistically, apart from the outfit, the suitability of the model can also be seen through the MNSQ infit in the value range 0.77-1.33. It can be concluded that the 30 items in the instrument are all fit for the model. This can also be seen from the model fit map which shows that not a single item is out of line, so it can be said that the items in this instrument are fit to the model. In Figure 3 below, the model fit map analyzed using the Quest program is presented.

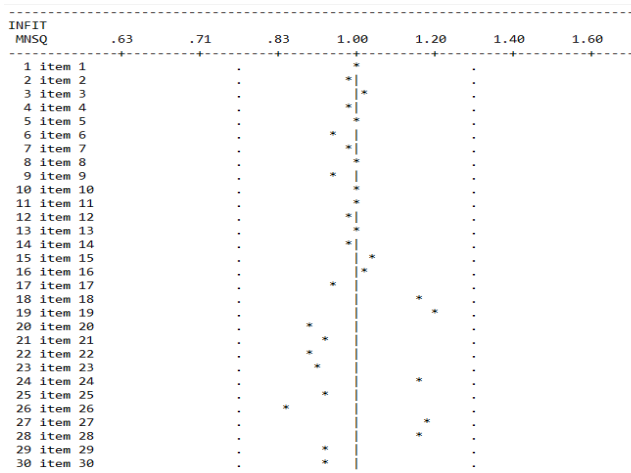


Figure 3. INFT MNSQ (Fit Model)

The level of difficulty of the questions can be seen based on characteristic analysis. The level of difficulty shows the quality of the questions. Items are said to be good if they have an item difficulty level between -2.00 to +2.00 (Retnawati,

2017). The results of the analysis using the Quest program show that the difficulty level value for each question item is in the good category, namely in the value range -1.28 to 1.51, this shows that the item difficulty level parameters have met the good criteria.

Based on the results of data analysis, it shows that there are 0 students at the Very High ability level with a percentage of 0.00%, the High ability level is 33 people with a percentage of 21.15%, the Medium ability level is 119 people with a percentage of 76.28%, the ability level is Low is 4 people with a percentage of 2.56%, and Very Low ability level is 0 people with a percentage of 0.00%. For more details, see Table 4 below.

TABEL IV
 STUDENT ABILITY LEVEL

Ability Level	Number of Students	Persentase (%)
Very high	0	0.00
High	33	21.15
Medium	119	76.28
Low	4	2.56
Very low	0	0.00
Total	156	100

The description of Sport Education's high level thinking abilities in the small ball material of students at Universitas Jambi which is described in table 4 shows that students who are at the Medium level of ability reached 76.28%, indicating that more than half of the students involved in the sample have thinking abilities. high level to Medium level. Meanwhile, those at the High level only reached 21.15%.

In the Sport Education learning process, Lecturers should not only emphasize psychomotor aspects but also cognitive aspects which include analyzing (C4), evaluating (C5), and creating (C6) based on the results of the research. Lecturers can use this developed instrument to measure students' high-level cognitive thinking abilities in Sport Education subjects, because this instrument has good characteristics and has been tested. For Lecturers who want to carry out their own development of cognitive instruments for high-level thinking skills for Sport Education subjects, they can take advantage of the steps arranged in developing this instrument in order to obtain an instrument that has good characteristics and has been tested. Tentu, berikut adalah pembahasan dalam bentuk paragraf:

The results of this study show consistency with previous studies in terms of validation and reliability of test instruments. The validity of the content of the instrument obtained through the Aiken Index with an average score of 0.837 is in line with the results of previous research which shows that the Aiken Index is an effective tool in assessing the validity of the content of test items. With these scores, all test items are considered valid because they reflect material relevant to the curriculum. Furthermore, the analysis of the information function showed that the test instrument had an information value of 17.631 and a measurement error of 0.238, which showed that this instrument was able to measure students' abilities with good accuracy in the ability range of -3.1 to 3.8,

consistent with the findings Arfi et al (2024) which underscores the importance of the ability range to assess the reliability of the test. The analysis factor that produced one dominant factor with an eigenvalue of 7.025 and a cumulative percentage of 23.418% also supported the unidimensionality of the instrument, although there were several interfering factors, similar to the results found by the (Pitnawati et al., 2023). In addition, the results of the analysis of the characteristics of the items show that the difficulty level of the items is in a good range, between -1.28 to 1.51, in accordance with the test item quality standards set by the (Hambali et al., 2024). However, although the instrument shows good characteristics, there are some limitations that need to be noted. The study used a relatively small sample (152 participants) and only 30 test items, which may not be fully representative of the diversity of abilities and the broader educational context. These limitations could affect the generalization of results to larger populations. Therefore, further research is recommended to involve larger and more diverse samples and consider the addition of test items to improve the representativeness and accuracy of the results. In addition, further research can also explore the validity of the construct and long-term reliability of these instruments to ensure that the tests remain valid and reliable in different contexts.

IV. CONCLUSIONS

The cognitive instrument for high-level thinking skills in small ball material is in the form of multiple choice questions consisting of 30 test items developed in the categories of analyzing (C4), producing (C5), and creating (C6) which have good characteristics and meet the requirements for use. in measurement tests. The cognitive instrument for high-level thinking abilities on small ball material has the following characteristics: a) The cognitive instrument for high-level thinking ability on small ball material has been proven to have validity by experts; b) The Sport Education high-level thinking ability cognitive instrument on small ball material has questions that are in the good category based on the results of the unidimensional test analysis. c) Cognitive instruments for high-level thinking abilities in small ball material based on the information function are in the high category; d) Analysis of the measurement of students' high-level thinking abilities shows a picture of different levels, where the majority of students' thinking abilities are at a medium level, and there are no students at a very high or very low level.

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