

Authentic Assessment in Physics Learning Using Physics Chess Game for Senior High School

Yuni Rochmawati and Sri Wahyuni

Universitas Jember, East Java, Indonesia

Email: sriwahyuni.fkip@unej.ac.id, {yunifisika, yunirochmawati}@gmail.com

Abstract—Authentic assessment is an assessment of the existing curriculum 2013 include an assessment of attitudes (affective), knowledge (cognitive), and skills (psychomotor). In practice, teachers find it difficult to assess because many aspects are assessed. This article aims to help teachers take students' score includes assessment of attitudes (affective), knowledge (cognitive), and skills (psychomotor). Physics chess game becomes the media in making the value of the students. Physics chess game is a game that uses chess board that contains questions of physics. So, using a chess game physics, teachers can get the value of the attitude (affective), the value of knowledge (cognitive), as well as the value of the skills (psychomotor) students.

Index Terms—affective, authentic assessment, cognitive, curriculum 2013, physics chess game, psychomotor

I. INTRODUCTION

Learning is "a changed behavior" or behavior changes. Learning is a process of interaction of learners with educators and learning resources in the learning environment [1].

In 2013, the Ministry of Education and Culture of Indonesia implementing the curriculum 2013 as a guide in the learning process. One of the most emphasized in the curriculum 2013 is an assessment. In curriculum in 2013, the assessment focused on authentic assessment where the assessment includes an assessment of attitudes (affective), knowledge (cognitive), and skills (psychomotor). The previous curriculum, authentic assessment has been applied, but more focused on cognitive assessment.

In the process of studying physics, students have difficulty. The difficulty in studying physics, students due to the physics of matter are solid, memorizing, and counting, as well as the learning physics in the classroom is not contextual. Students do not like physics, due to the physics learning in the classroom teachers do not pay attention to the students [2]. And it makes the students feel bored in physics.

Almost everyone knows chess, not least the students. Weapons of chess is mainly about strategy, with emphasis on the middle game. Strategy means abstract thinking and planning, as opposed to tactics, which are the individual operations used to implement the strategy. Tactics are specific, the strategy is general. Tactics tend

to be immediate, strategy long-term [3]. In physics chess game, we ignore the rules of chess in general. However, students are still required to have a good playing strategy. Students must be able to think critically in doing physics problems in a short time.

II. THEORY

In each lesson, the teacher always assessing student learning outcomes. Assessment is the process of collecting information or data used to make decisions about learning. Assessment includes gathering evidence about the achievement of learners [4].

The assessment standards of education are the criteria on the mechanisms, procedures and instruments of assessment of learning outcomes of students [5]. Educational assessment as a process of collecting and processing information to measure achievement of student learning outcomes include authentic assessment, self-assessment, assessment-based portfolios, quizzes, daily tests, midterm exam, final exam, a test level of competence, examination quality level of competence, national exams, and school exam [6].

Authentic assessment is a form of assessment that requires students to show attitude, using the knowledge and skills gained from learning in performing tasks in real situations [7]. Authentic assessment invites the students to use academic knowledge in the real-world context for meaningful goals [8]. Some characteristics of authentic assessment of which is as follows:

1. Assessment is part of the learning process.
2. Ratings reflect the outcome of the learning process in real life.
3. Using various instruments, measurement, and methods appropriate to the characteristics and essence of the learning experience.
4. Assessment should be comprehensive and holistic covering all aspects of the learning objectives [9].

Authentic assessment in curriculum 2013 focused on science through capability-based assessment be output through the process, portfolio and output assessment completely and thoroughly [10].

Assessment attitude (affective) is an assessment conducted to measure the level of achievement of competence attitudes of learners that include aspects of receiving or giving, respond, assess or appreciate, organize or manage, and character [6]. Affective assessment directs the behavior of individuals with values

that are considered good and have been introduced earlier [11]. Affective categorized as important is honesty, integrity, fairness, and freedom [12].

The Cognitive assessment conducted to measure the achievement indicators of learning outcomes in terms of intellect, the ability to dig and process information or knowledge [13]. In cognitive the assessment, the tools to retrieve data that is an oral test and a written test that includes memorizing, understanding, applying, synthesizing, and evaluating the material [14].

Skills competency assessment is conducted teacher assessment to measure the level of achievement of competence skills of learners that include aspects of imitation, manipulation, precision, articulation and naturalization [6].

Chess is a game that many peoples like it. Chess is a game of skill played by two people on a board of sixty-four squares. The board is the same one use for checkers [15]. Leonard Barden said that chess is also played a great deal in school [16]. For the student, chess has many benefits. Al Lawrence said on his book, chess players improved test scores, critical-thinking skills, problem-solving abilities, social skills, and self-confidence [17]. Based on Al Lawrence’s book, chess is a game that is suitable to be applied in the classroom. With the benefits of chess by Al Lawrence’s book, chess can be a motivator for students in the learning, especially physics lesson.

Why had physics? Many students feel physics is a difficult lesson. Student difficulties in learning physics one of which is the lack of ability of students in solving physics problems, both to solve the problem through practicum physics or mathematical calculation. Sometimes, the one who possess all the necessary skills, may feel that such problem is not attractive enough to them, and the tedious calculations involved do not allow their “creativity” (genius?) to shine through [18]. In solving physics problems, students are required to creativity. Where the students feel that physics is a difficult lesson, and ultimately make the students will not to study physics.

In Indonesia, physics become subjects who had the lowest score on the national examination. Based on the national exam in 2012, the average value of physics is the lowest value when compared with the subjects of biology, chemistry, and mathematics [19] (Fig. 1).

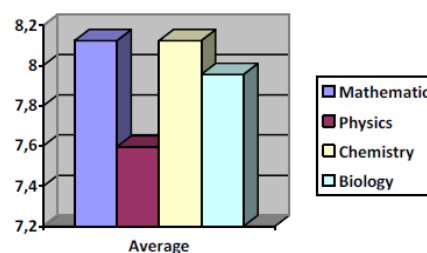


Figure 1. The average of national exam in Indonesia

TABLE I. VALUE OF NATIONAL EXAM IN INDONESIA

City / Province	Mathe- matics	Physics	Chemistry	Biology
Jakarta	8.23	7.88	8.32	7.89
West Java	8.56	8.01	8.62	8.29
Central Java	8.38	7.78	8.62	8.39
Yogyakarta	7.74	7.14	8.08	7.78
East Java	8.86	8.46	8.86	8.64
Aceh	8.31	7.77	8.10	8.12
Riau	8.17	7.73	8.46	7.70
Jambi	8.23	7.51	8.18	8.16
Lampung	8.42	7.99	8.42	8.40
Bali	9.12	8.60	8.81	8.61
South Sumatera	8.44	7.93	8.43	8.36
West Kalimantan	7.65	6.75	7.75	7.65
Central Kalimantan	7.49	6.91	7.65	7.60
South kalimantan	8.12	7.37	8.38	7.48
East Kalimantan	7.82	7.19	8.07	7.76
North Sulawesi	8.59	8.10	8.46	8.10
Central Sulawesi	8.16	7.30	8.29	7.96
South Sulawesi	8.59	7.61	8.48	8.18
Southeast Sulawesi	8.44	7.75	8.16	7.90
West Nusa Tenggara	8.31	7.88	8.36	7.86
East Nusa Tenggara	7.55	6.50	7.69	7.35
Papua	7.84	7.53	7.97	7.70
Bengkulu	8.34	8.31	8.25	8.22
North Maluku	7.92	7.71	8.05	7.92
Bangka Belitung	7.68	7.24	8.24	7.95
Gorontalo	7.08	6.62	7.71	7.45
Banten	8.02	7.85	8.02	7.84
Riau Island	7.76	7.02	8.08	7.87
West Sulawesi	8.19	8.00	8.15	7.83
West Papua	7.74	7.44	7.79	7.72

Besides in Indonesia, the students in Nigeria was also felt that physics is difficult subjects. Based on the research that has been done by Stella Y. Erinosh in Nigeria, there are several reasons students feel the physics is difficult subjects [20].

TABLE II. PREDOMINANT REASONS FOR STUDENTS FINDING PHYSICS DIFFICULT

Category of Reason	Responses (%)
Nature subject:	
1. To many formulas/laws/content to memorize	35
2. Theoretical	43
3. Problems not easy to solve	45
4. Too much hard/ difficult formulae/ laws/ concept/ contents	46
5. Content not easily understood	41
6. To many calculations	47
7. Physics not enjoyable	27
Teaching/teacher	
1. Constructing meanings of teaching concepts	42
2. Too little practical work	39
3. Teacher not helpful/friendly	22
4. Worked examples simpler than class exercise	37
Curriculum/assessment	
1. Textbooks not easy to follow	19
2. Examination questions hard	36
3. Syllabus too wide	23

III. INSTRUCTIONAL DESIGN OF PHYSICS CHESS GAME

Physics chess game is a game about physics problem using chessboard, but in this game we ignore the rules of chess in general. In the chess there will be questions and answers, as shown in the Fig. 2.

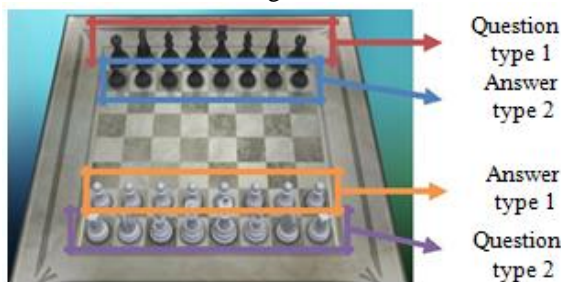


Figure 2. Design of physics chess game

A. How to Play

In the classroom, students are divided into small groups of four students. Each group is required to bring chess and each group will play the game of chess physics 2 times where every game progresses there are 2 students play while two other students will assess students who are playing. Teachers provide questions and answers for each student each group. Each student attaching questions and answers on a piece of chess as shown in the Fig. 2, the design of this physics game of chess. Keep in mind that physics is a game of chess, we ignore the rules of chess in general.

After preparation is complete, students can start this physics chess game. Each group decides who will start the game first. Once completed is determined, the

students elected to start the first game could be giving out a question that has been affixed to the chess pieces. Other students had to answer questions given to provide answers also already affixed at chess, and will continue alternately.

For example, there are students A, B, C, D in group 1. Group 1 agreed that student A and B will start the game, students C and D will assess student A and B. Student A asking questions type 1 to students B. Student B answered questions type 1 which has been given by running a chess piece that has been attached to the correct answer according to student B. The game continues until the question of type 1 and type 2 run out and apply to other groups with a theme or subject the same to classmates.

B. How to Take Assessment

In physics chess game, there are three assessments will be performed, ie assessment attitude (affective), knowledge (cognitive), skills (psychomotor).

For assessment of attitudes, data retrieval using assessment between student. In a group, when students A and B play physics chess game, the students C and D will assess students' attitudes toward A and B as well as students C and D play physics chess game, student A and B to be assessed.

While for the assessment of knowledge, chess amount obtained is the value obtained by the students. When students submit questions for the student A and student B and student B answer correctly, then the chess piece that contains questions from students A belong to B. But if the students B answered incorrectly, then the chess student B which contains the answers submitted become the property of the student A. After the game is completed, the number of chess pieces owned by each student into the student's final grades to the formula:

$$Value = \frac{a}{b}$$

where a is number of chess pieces acquired and b is the number of questions given to each student.

For skills assessment, data collection is using performance assessment. On a question that sticks to chess, there will be problems where students have to solve with simple practice. On this simple practice, students are required to be able to finish and find answers in a short time. So students have to really understand the concept of the material test.

IV. DISCUSSION

The emphasis on curriculum 2013 is an authentic assessment. Where the authentic assessment there are three domains that should be assessed, the attitude (affective), knowledge (cognitive), and skills (psychomotor). In practice, both teachers and students having problems. Many teachers who have difficulty in assessing as many are to be assessed, given in the previous curriculum are not much considered. For students, students demanded more active and capable of self-learning. Because in the learning process, teacher as a mediator.

Physics became one of the subjects that are considered the most difficult by students. Many reasons that make students consider physics is difficult, one of which is a test that is considered difficult. Students feel too much formula to be done to resolve the matter.

Therefore, in this paper, we want students to feel happy with physics, especially when examinations. In physics chess game, students are required to solve the problems of physics in a short time. Not only able to do it, but students are also assessed regarding his attitude and there are some physical problems that must be done with simple practice. Besides the students do not feel bored, students are also trained to be able to assess his objective, as well as help teachers take their students grades. And of course with physics chess game, the teacher will be easier to take the data value of students.

V. CONCLUSION

Authentic assessment is an assessment outlined in the implementation of the curriculum 2013. There are many aspects that must be achieved and assessed. It is certainly enough to make teachers and students find it difficult.

Physics chess game became one of the innovations in making the student's assessment. With the physics chess game, is expected to complete the students are motivated to learn about physics as well as to increase student's creativity in solving problems of physics. Thus, physics is no longer a difficult subject for students, and no longer be subject to the lowest value on the national exam. Because physics is always related to everyday life, so it is necessary for students to know and understand about physics.

ACKNOWLEDGMENT

The authors wish to thank my family and my supervisor Sri Wahyuni, S.Pd., M.Pd. This work was supported in part by Universitas Jember, Indonesia.

REFERENCES

- [1] A. Chalil and L. Hudaya, *Based Learning Disposition*, Jakarta: PT, Balai Pustaka (Persero), 2008, ch. 1.
- [2] G. B. Samudra, I. W. Suastra, and K. Suma, "The problems faced high school by singlaraja's students in studying physics," *e-Journal Ganesha Education University Graduate Program*, vol. 4.
- [3] B. Pandolfini, *Weapons of Chess*, New York: Fireside Book, 1989, ch. 1.
- [4] R. H. Mansur, *Assessment of Learning Outcomes*. Bandung: Wacana Prima, 2009, ch. 1.
- [5] Research and Development—The Ministry of Education and Culture, *The Assessment Standards of Education*, 2013.
- [6] Kunandar, *Autentic Assessment*, Jakarta: PT, Raja Grafindo Persada, 2013, ch. 2, p. 35.
- [7] Mansur, "Implementation of authentic assessment curriculum 2013 in High School," *E-Buletin Media Education LPM South Sumatra*, 2015.
- [8] E. B. Johnson, *Contextual Teaching and Learning*, California: Corwni Press, 2002, ch. 7, p. 288.
- [9] Ngadip, "Concept and types of authentic assessment," *E-Jurnal Education Office Surabaya*, vol. 1.

- [10] N. Kusmijati, "The Application of Authentic Assessment in Effort to Motivate Learners," in *Proc. A National Conferences on the Research and Dedication LPPM UMP*, 2014.
- [11] B. Wahyudiono, *Rank 1st isn't Everything*, Jakarta: Raih Asa Sukses, 2012, ch. 3, p. 62.
- [12] R. H. Mansur, *Assessment of Learning Outcomes*, Bandung: Wacana Prima, 2009, ch. 1, p. 19.
- [13] H. J. Warwanto, A. P. Thomas, S. Nazarius, and Prasetya, *Education of Religiosity*, Yogyakarta: Kanisius, 2009, ch. 3, pp. 67-68.
- [14] M. Chatib, *Human School, School-Based Multiple Intelligences in Indonesia*, Bandung: Mizan Pustaka, 2009, ch. 5, p. 168.
- [15] B. Pandolfini, *The Rules of Chess*, USA: Russell Enterprises, 2010, ch. 1.
- [16] L. Barden, *An Introduction to Chess Moves and Tactics Simply Explained*, New York: Dover Publications, 1964, ch. 1.
- [17] A. Lawrence, *Chess for Everyone: A Step-by-Step Guide to Rules, Moves, and Winning Strategies*, China: Morris Book Publishing, 2010, ch. 1.
- [18] P. Gnadig, G. Honyek, and K. Riley, *200 Puzzling Physics Problems with Hints and Solutions*, USA: Cambridge University Press, 2001, ch. 1.
- [19] Research and Development - The Ministry of Education and Culture. (2012). *Results of National Exam*. [Online]. Available: <http://118.98.234.22/sekretariat/hasilun/index.php/hasilun>
- [20] S. Y. Erinosh, "How do students perceive the difficulty of physics in secondary school? An exploratory study in Nigeria," *International Journal for Cross-Disciplinary Subjects in Education*, vol. 3, pp. 1510-1515.



Yuni Rochmawati was born on June 13, 1994, in Sidoarjo, East Java, Indonesia. In 2006, graduated from elementary school. In 2009, graduated from junior high school 1 in Sidoarjo. And 2012 was graduated from senior high school 2 in Mojokerto. Currently studying undergraduate degree Physics Education, the faculty of teacher training and education Universitas Jember.

In 2014, active in scholar organizations of Physics Education as secretary of education and regeneration, became treasurer birthday physics education, treasurer of the new scholar orientation physics education, treasurer of leadership training and secretarial physics education, health part of new scholar orientation faculty level, as well as the events section on physics scientific week. In 2015, became head of education and regeneration, treasurer of the arena of creative scholar in the forum physics students eastern Java, the committee voting the chairman of the executive of scholar faculty level, the committee of new scholar orientation university level, the event coordinator of physics scientific week, part of the secretariat in the new year islam, and the committee voting chairman of the physics scholar associations.



Sri Wahyuni was born on December 15th 1982 in Sidoarjo. She is Lecturer of Physics Education Department, Universitas Jember. She graduated in 2004 from Physics Education Department Universitas Jember. In 2010 She graduated from post graduated science education Universitas Negeri Surabaya with thesis about developing virtual laboratory based teaching material in junior high school.

In 2013 and 2014 she got grant for research from DIKTI (Directorate of Higher education) about developing macromedia flash based teaching material for improving student's critical thinking skills in junior high school.

She became member of ALSI (Assosiation of Lesson Study Indonesian), organization that care about learning and teaching of Indonesia. She became participant or member in national conference. The title of scientific articles, under the title "Developing WEB-Based Performance Assesment in Integrated Science Course" and published as Indonesian Journal of Science Education.