

ANALYSIS OF PHYSICS CONCEPTS IN FOLK GAME ‘LOMPEK KODOK’ ASSISTED BY VIDEO TRACKER SOFTWARE AS PHYSICS TEACHING MATERIAL

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ABSTRAK

Studi literatur menunjukkan bahwa terdapat konsep fisika dalam permainan tradisional yang dapat diintegrasikan ke dalam pembelajaran fisika. Konsep-konsep ini dieksplorasi melalui penelitian deskriptif dan eksperimental. Penelitian ini mengeksplorasi dan menganalisis konsep-konsep fisika pada permainan rakyat Bengkulu berbantuan *software* Tracker khususnya pada permainan ‘Lompek Kodok’. Lompek Kodok adalah permainan yang dimainkan dengan cara melempar pecahan keramik kemudian melompat dengan satu kaki pada kotak yang telah digambar di tanah. Permainan ini mirip dengan permainan ‘Engklek’ di Pulau Jawa. Dibantu dengan *software* Tracker, dapat diketahui kecepatan minimal melempar agar pecahan keramik masuk ke setiap kotak. Permainan ‘Lompek Kodok’ dapat digunakan dalam pembelajaran fisika khususnya gerak parabola. Guru dapat merancang lembar kerja peserta didik dengan melakukan kegiatan penyelidikan ilmiah, merekam kegiatan tersebut, dan menganalisisnya menggunakan perangkat lunak Tracker.

Kata kunci—Konsep Fisika, Permainan Lompek Kodok, Tracker, Bahan Ajar Fisika

ABSTRACT

Literature studies show that there are physics concepts in traditional games that can be integrated into physics learning. These concepts are explored through descriptive and experimental research. This research will explore and analyze physics concepts in Bengkulu folk games assisted by video tracker software, especially in game ‘Lompek Kodok’. Lompek Kodok is a game played by throwing ceramic shards and then jumping with one foot on a square that has been drawn on the ground. This game is similar to game ‘Engklek’ in Java. Assisted by Tracker software, minimum throwing speed can be found out so that ceramic shards enter each square. The game ‘Lompek Kodok’ can be used in physics lessons, especially projectile motion. Teachers can design student worksheets by carrying out scientific investigation activities, recording these activities, and analyzing them using a video tracker software.

Keywords—Physics Concept, Game of Lompek Kodok, Tracker, Physics Teaching Material

I. INTRODUCTION

Physics as part of science, its concepts can be observed in traditional games. The concept of mechanical energy is found in the traditional game of Engrang (1), the concept of rigid body equilibrium in the traditional game Gasing (2), and as well as the concept of projectile motion in the traditional Acehnese game Geulengkie teu peu poe (3).

Physics concepts in traditional games can be used as physics teaching material so that students are more interested in learning physics and are able to understand physics material well (1,2). By integrating physics concepts into traditional games, physics learning will become more meaningful (4,5). This is also a way to preserve folk games. Learning with a cultural approach can be a way of inheriting culture because it provides students with an understanding of the environment and activities carried out by society (2).

To integrate Bengkulu folk games with physics learning, it is first necessary to analyze the physics concepts contained in Bengkulu folk games. Analysis of physics concepts can be carried out in detail if the analysis process is not only carried out based on a literature review but also through a series of experimental activities (experiments). The truth of a relationship between a physical quantity and an unknown parameter value can be determined through experimentation (6). Analysis of physics concepts in traditional games using experimental methods was carried out by Nurmasyitah, Virnalita, and Lubis who tried out the Acehese game *geulengkue teu peu poe*. When trying out the game, observations are made and experimental data is collected. The experimental data is then graphed and analyzed. This series of analysis processes was carried out manually without the help of technology. This makes the analysis process more difficult and time consuming. To overcome this problem, it is necessary to carry out analysis with the help of a video tracker (7).

Video tracker-assisted analysis makes it possible to observe movements that occur very quickly that cannot be observed with the human eye (8). Salah satu software video tracker (pelacakan video) yang paling baik digunakan untuk menganalisis video kejadian fisika adalah Program Tracker dari physlets.org (9). Trackers have the ability to track the movement of an object so that various required information can be obtained, such as graphs, tables and equations of motion. Trackers can improve graphic interpretation and thoroughness in experiments (10). Through the use of video tracker-assisted analysis, it is hoped that the movements in Bengkulu folk games can be analyzed for physical concepts more easily and precisely, especially in game *Lompek Kodok*. *Lompek kodok* is a game of throwing *Gundu* or ceramic shards at square images that have been made on the ground, then jumping on one foot. The throwing process is analyzed for its physics concepts using a video tracker.

Based on the description that has been put forward, this research was carried out with the aim of finding out 1) how to analyze physics concepts in folk game *Lompek Kodok* assisted by video tracker, 2) what are the results of the analysis of physics concepts in folk game *Lompek Kodok* assisted by video tracker, and 3) how to design the results of the analysis of physics concepts in folk game *Lompek Kodok* assisted by video tracker as physics teaching material.

II. METHODS

The research method used in this research is a descriptive method. In this research, descriptive methods were used to explain the results of experimental studies on physics concepts in Bengkulu folk games and the design of basic physics teaching materials based on local wisdom that had been prepared.

The research procedure can be explained as follows: a) Literature study was carried out by reviewing physics textbooks and related research articles, b) In the experimental stage, experiments were carried out by trying out the Bengkulu folk game *Lompek Kodok* by changing variables that might have an influence, such as mass of *Gundu* or ceramic shards and the distance of the square pictures. Every game will be recorded. The results of experimental observations will be recorded, c) In the computational stage, video analysis of game experiments was carried out using Tracker software. The results of these computational observations will be recorded, d) Stages of synthesizing results, synthesis of results is carried out based on literature studies, experimental stages, and computational stages.

III. RESULTS AND DISCUSSION

Lompek Kodok

Lompek Kodok is a Bengkulu regional language which in Indonesian is 'Lompat Katak'. The participants consisted of female children aged around 6 to 12 years. Sometimes there are also boys who join in. But this game is actually a girl's game. The amount can be up to six children. Tools/Equipment: Each person provides broken glass or ceramic shards, of different shapes or colors or Dutch money made of copper. And a picture on the ground or on a cement floor.

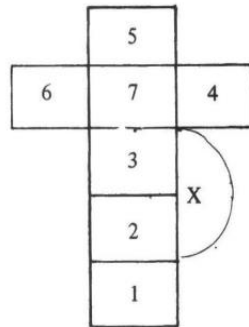


FIGURE 1. Lompek Kodok game plan in the shape of an airplane

Numbers 1, 2 and 3 on the plan are stairs. 4, 5 and 6 are wings. 7 is the middle, a place for two feet to stand on, and the oblique X is the help ladder. Before the player jumps, the player must throw broken glass or ceramic shards (Gundu) that has been prepared at the target ladder. The players do rock-paper-scissors first to determine their turn. Then everyone put their Gundu on the floor first stairs. The first winner jumps with one foot to stairs 2, 3, 4, 5, 6 and jump with both feet to place 7. Stair 1 cannot be stepped on because there were Gundu. Jump with the other leg to step 3, 2 bend down to take the pile on step 1, while still standing on the other leg. If while jumping your feet hit the line; player dead. The player throws her Gundu on ladder 2. This second ladder is not allowed stepped on because there was a Gundu. If the player is still small, she will jump sideways. Oblique is to use the helper ladder on the right. Continue to the 3rd stair and so on. If you throw Gundu, Gundu doesn't go in: or it hits the line, then the game is over. Also if when jumping the player hits line, the player also dies. The player throws her Gundu slowly to stair 3. Because the second stair is empty, she can jump there and so on to class 7th. Please remember that where there are Gundu, the stairs must not be stepped on or must be jumped. If the picture or Lompek Kodok has been surrounded, she moves to the next stage (11).

Literature Study Stage

The Lompek Kodok game is similar to the game Engklek in Java and Baingkaan in South Kalimantan. The main physics concepts that can be explored in the traditional game Engklek are parabolic motion (12); work and energy; momentum and impulse; and rigid body balance (13,14).

The analysis results by (13) showed that when throwing Gundu, a parabolic or projectile motion is formed. Here's the picture.

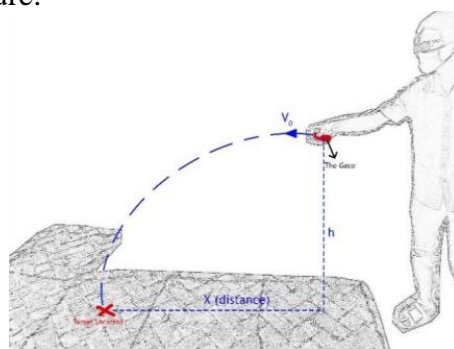


FIGURE 2. Projectile Motion from Throwing of Gaco (Gundu) (13)

Figure 2 shows an illustration of Gundu's parabolic motion according to Rizki et al. (13). By using a video recorder and video tracker, the projectile motion of the Gundu can be seen clearly.

Experiment Stage

The experimental activity referred to in this research is trying out the game Lompek Kodok. While trying out the game, recording is done using a video recorder on a smartphone. The following are the tools used in the game experiment.

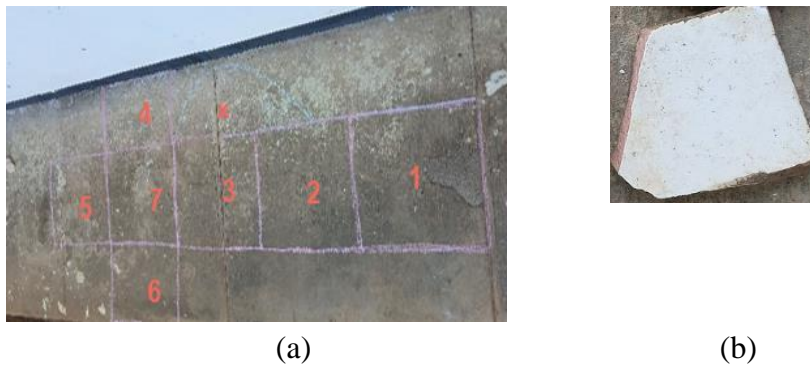


FIGURE 3. (a) Real plan of Game Lompek Kodok. (b) Ceramic shard
There are six scenes in video. The scenes consist of throwing to stair 2, 3, 4, 5, 6, and 7.

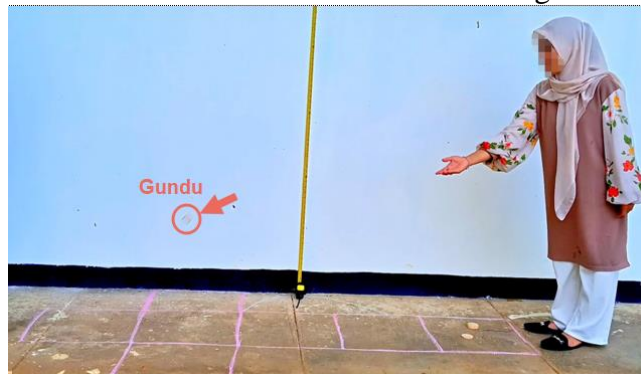


FIGURE 4. a Scene from Experiment Video of Game Lompek Kodok

Computational Stage

After being recorded, the video is transferred to a laptop and then analyzed. The experimental video of the game Lompek Kodok was analyzed using the Tracker application from physlets.org.

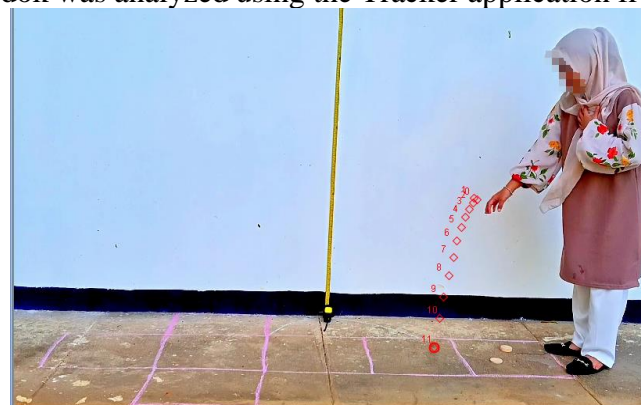


FIGURE 5. Projectile Motion of Throwing Gundu to Stair 2

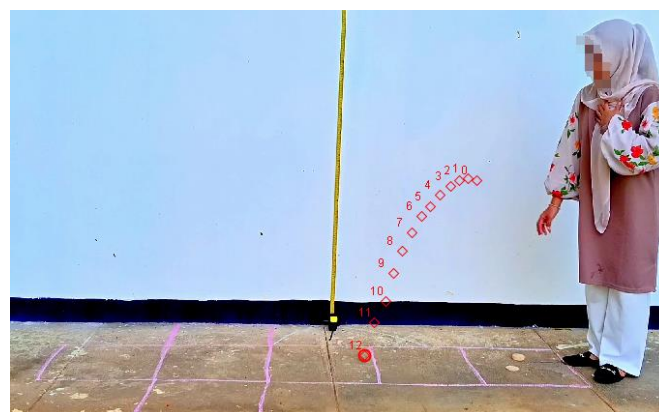


FIGURE 6. Projectile Motion of Throwing Gundu to Stair 3

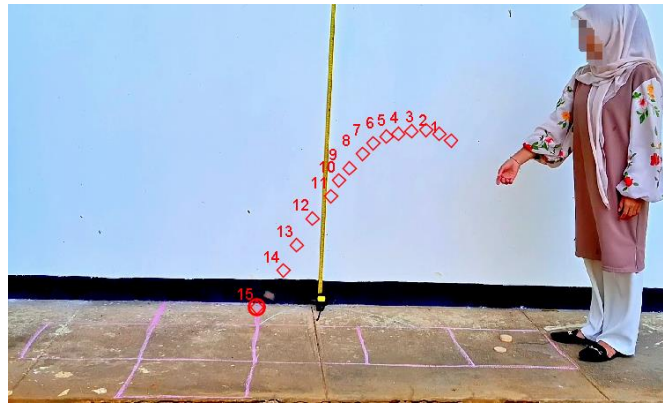


FIGURE 7. Projectile Motion of Throwing Gundu to Stair 4

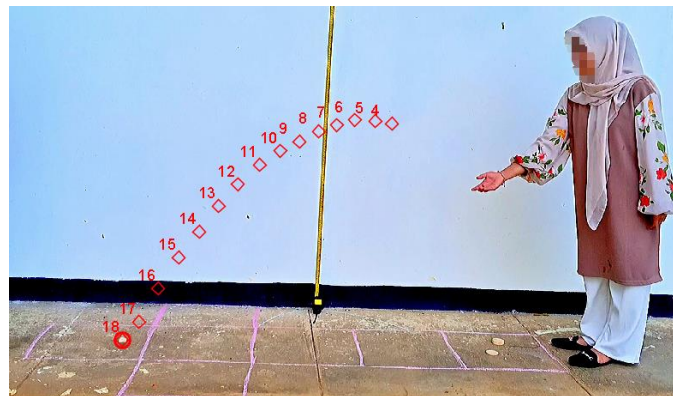


FIGURE 8. Projectile Motion of Throwing Gundu to Stair 5



FIGURE 9. Projectile Motion of Throwing Gundu to Stair 6

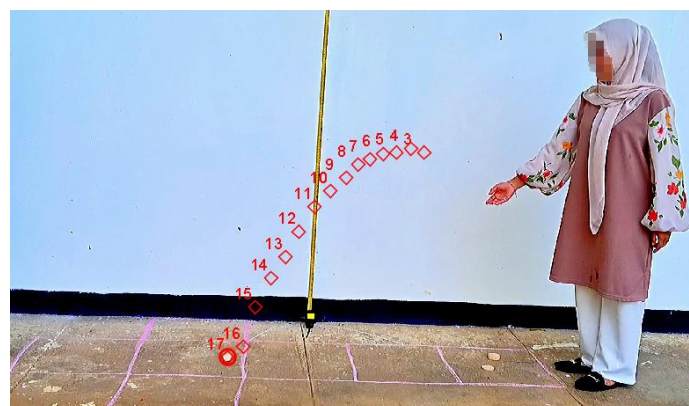


FIGURE 10. Projectile Motion of Throwing Gundu to Stair 7

Figure 5-10 shows clearly Gundu's movements. This movement forms a parabolic trajectory. Through the Tracker application, not only can you see Gundu's movements clearly, but you can estimate Gundu's initial speed when thrown.

TABLE 1. Initial Speed of Gundu at 0,033 s

Stair	v _x (cm/s)	v _y (cm/s)	v (cm/s)
2	26,79	26,79	37,89
3	122,7	0	122,7
4	193,5	125,8	230,80
5	263,1	166,2	311,20
6	174,1	113,8	207,99
7	172,0	165,1	238,42

Table 1 is a table of the initial speed of Gundu's throw at 0.033 seconds. This is because at exactly 0.0 second, Gundu has not started moving. The speed column on the x-axis (v_x) and y-axis (v_y) is obtained directly from the Tracker software. However, the speed column (v) is obtained from calculations using the following formula.

$$v = \sqrt{v_x^2 + v_y^2} \tag{1}$$

Based on table 1, it can be seen that the greatest initial speed is when throwing to the 5th stair and the smallest when throwing to the 2nd stair. This is in accordance with the plan where the second stair is the closest stair and the fifth stair is the furthest stair.

Physics Teaching Material

The game Lompek Kodok or Engklek can be developed as a teaching material for physics, especially projectile motion. Teachers or lecturers can develop teaching materials in the form of student worksheets or undergraduate student worksheets. These worksheets can be developed using an integrated STEM approach with Ethnoscience or Ethno-STEM. Ethno-STEM is a learning approach that tries to combine physics with local wisdom, science, technology, engineering and mathematics (15). Here is the content design of worksheet.

TABLE 2. Content Design of Worksheet based on Ethno-STEM

Content	Description
Ethnoscience	Learning indigenous knowledge about folk game Lompek Kodok
Science	Learning physics concept especially projectile motion
Technology	Using Tracker software for analyzing projectile motion in game Lompek Kodok
Engineering	Designing size of stair or square plan, developing strategies to select Gundu
Mathematics	Solving problem with mathematics formula about Gundu's projectile motion

Table 2 shows that recommendation of content design of worksheet. Teachers or lecturers can design experimental activity, then request students to record video and analysis with Tracker software. For using this design, they must design learning scenario and allocate the learning time.

IV. CONCLUSION

Based on result and discussion, it can be inferred that there is physics concept in Lompek Kodok, projectile motion. Using tracker software, it helps us to see motion form of Gundu very clear. Gundul's initial speed can also be known. The largest initial speed value is when throwing to the fifth stair, and the smallest when throwing to the second stair. The Lompek Kodok game can be developed as a physics teaching material using an ethno-STEM approach assisted by Tracker software.

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