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THE DEVELOPMENT OF APPROPRIATE TEACHING MATERIAL TO 5E TEACHING MODEL THAT EXAMINES THE PROJECTILE MOTION

Abstract

The first aim of this study is to provide a teaching material to develop students' thinking skills. There are many kinds of experiment in physics lesson. In this paper authors just focus how to develop an experimental design based on projectile motion and how to explore the students' creative and critical thinking through projectile motion experiment. This lab for projectile motions will be investigating the properties of the x displacement of a projectile. Practical knowledge and school knowledge are becoming mutually exclusive; many students see little connection between what they learn in the science classroom with real life. Students should be able to apply what they learn in school to the various situations in real-life. So that, authors second purpose of this paper is to design an experiment that can integrate the students' understanding in the classroom with the application in the real life. To realize this second purpose, the 5 E teaching-model will be conducted to the projectile motion experiment. In the projectile motion experiment, students will be taught with respect to the sequence of 5E learning cycle model which are engagement, exploration, explanation, elaboration, and evaluation through the use of activities such as demonstrations and discussions. So the final of these exercises are designed to encourage students to see that their critical and creative thinking skills through 5 E model-teaching in the projectile motion experiment.

Keywords: Learning cycle model, science teaching, projectile motion

ATIŞ HAREKETİNİ İNCELEYEN 5E ÖĞRETİM MODELİNE UYGUN ÖĞRETİM MATERYALİNİN GELİŞTİRİLMESİ

Özet

Bu çalışmanın amacı, öğrencilerin düşünme becerilerini geliştirebilecekleri bir öğretim materyali ortaya koymaktır. Çalışmada öğrencilerin yaratıcı ve eleştirel düşünme becerilerini geliştirmek için yatay atış hareketi konusunda deneysel bir tasarım geliştirilmesi amaçlanmıştır. Atış hareketi boyunca uzanımın (yatayda yer değiştirme) nasıl değiştiği incelenmeye çalışılmıştır. Öğrenciler okul yaşamında kazanmış oldukları kavramsal bilgi ile yaşamdan gözlem sonucu kazanmış oldukları bilgiyi örtüştürmede problem yaşamaktadırlar. Gerçek yaşam ile okulda elde edilen bilgi birbirini destekler nitelikte olmalıdır. Böylelikle bu çalışmanın ikinci amacı öğrencilerin ifade edilen bağlantıyı kurabilmeleri için bir deneysel tasarım geliştirmek olmuştur. Bu nedenle girme, keşfetme, açıklama, genişletme ve değerlendirme basamaklarından oluşan 5E öğretim materyali hazırlanmıştır. Bu deneysel tasarım ile öğrencilerin yatay atış hareketi konusunda ve yaratıcı ve eleştirel düşünme becerilerinin gelişimi planlanmaktadır.

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Anahtar Kelimeler: Öğrenme halkası modeli, fen öğretimi, atış hareketi

INTRODUCTION

In accordance with its content, the objective of the course "science" is to enable individuals to comprehend what nature and the events in nature are and how they exist. Other objectives include providing them with the opportunity to develop certain skills, to display a scientific attitude towards daily life, to get involved in analytical thinking regarding their decisions and choices, to be creative, to have a critical perspective on events and situations, to inquire about things and to gain science and technology literacy. Therefore, science teaching is quite important. It is the constructivist approach that forms the basis of current curricula. In this respect, science teaching contains such methods as problem-based learning, project-based learning, cooperative learning and inquiry-based learning. Inquiry-based learning, in turn, includes "learning cycle models", which appear to be influential in teaching a given subject or course (Çelik, Özbek & Kartal, 2013; Özbek, Çelik, Ulukök Sarı, 2012).

Too much theoretical concern in physics classroom makes students just understand in front of the class but less understanding how does it work in the real life. In some countries physics lessons are limited in many cases due to different constraints to lecturing and rote learning with in short supply use of teaching materials and other practical activities. These limitations can make physics abstract and difficult for students to understand (Ornek & Zziwa, 2011). The teaching model should combine what is the concept in the book and how does it work in the real life. The teaching model should embrace the basic concepts and it's applications in the real life. Much time in the classroom is spent teaching information and basic skills in reading, listening and calculating. Very little is used to teach the students how to use correlated information basic skill in thinking, solving problems and creating new ideas (Feldhusen & Treffinger, 1985).

The most important things to gain the students' goals are how to increase their creative and critical thinking in classroom and how to make better connection between theoretical understanding and real problem in daily activities. It is important to design a experiment-based learning to embrace how the students experience the world, interact with each other, pose questions and problems, and construct knowledge. We also make a planning from how to organize the materials and students' activities, how the students' evaluation should be and the experiment model we present in this paper.

According to Basshan, Irwin, Nardone and Wallace (2005), critical thinking is the general term given to a wide range of cognitive skill and intellectual dispositions needed to effectively indentify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudices and biases; to formulate and present convincing reasons in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do. Put somewhat differently, critical thinking is disciplined thinking governed by clear intellectual standards. Among the most important of these intellectual standards are clarity, prevision, accuracy, relevance, consistency, logical correctness, completeness and fairness.

According to Scriven and Ricard Paul (1987), critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness. Critical thinking is important for the students' future, given that it prepares students to deal with a multitude of challenges which will appear in their lives, careers and at the level of their personal obligations and responsibilities (Tsui, 1999).

Creative thinking is the ability to think of a lot of ideas where is a problem or a need for ideas (Gallager, 1975). It is also being able to think of many different ideas, to think of unique or original ideas, and to develop or elaborate ideas. Sometimes it is asking good questions which clarify a problem. It is also being able to translate ideas into forms of communication or expression which make it possible for other people to grasp the ideas or solution to problems. Thus, it is necessary to find words or use art media, music, drama, or movement to express our ideas, solution, or feelings.

Critical thinking involves evaluation and consideration of the information available to the thinker. Critical thinking involves creative thinking because it requires the thinker to assimilate information and hypothesize solutions to problem. According to Feldhusen and Treffinger (1985), five basic steps are employed in the critical thinking process: recognizing problems, formulating hypotheses, gathering pertinent facts or data, testing and evaluation, and drawing conclusions.

Inquiry-based learning in science means that students develop understanding through using mental and physical skills to gather evidence about the natural and made world. This way of learning is consistent with the modern view of the nature of scientific activity and of how learning takes place. Learning through inquiry not only means that students learn with understanding, so that their knowledge is applicable, but also they learn about learning. Both of these are important outcomes of education if future citizens are to be scientifically literate (Harlen, 2004).

When inquiry-based teaching is practiced, teachers and students are involved in well defined actions, which differ in several respects from current classroom practice. This paper argues that interactions among students and between students and teachers are needed for inquiry-based learning, with the teacher having a key role. Thus bringing about the required change in students' experiences is a two-step process, in which teachers' understanding of the changes needed is the first step and the provision of opportunities for students' learning is the second. The main avenues for bringing about change are through the professional development (PD) of teachers, or the provision of classroom materials, or a combination of these. When change is attempted through these inputs, there are numerous other factors that impact on teachers, on teaching and on students, that act to dilute – and in some cases cancel- their effect. Thus there is a danger that when inquiry-based inputs are evaluated, the students' experiences may not be as intended (Harlen, 2004).

Learning cycle (LC) finds its place among inquiry-based teaching approaches. Abraham (1997) describes LC as being appropriate for teachers in developing; well-designed curriculum materials and instructional strategies in science education field. He also explains the model as "is derived from constructivist ideas of the nature of science, and the developmental theory of Jean Piaget". At the same time, Bybee, Taylor, Gardner, Scotter, Powell, Westbrook, and Landes (2006), mark the continuous effort of science teachers in developing instructional patterns in order to improve their students' learning. Bybee et al. (2006) also mentions, for fulfilling science teachers' aims, the systematic attempt of curriculum reformers to reveal research findings incorporating the materials which enhance the connection through curriculum, teachers, and students. Additionally, they states that "Recently, the use of coordinated and coherent sequencing of lessons -learning cycles and instructional models- has gained popularity in the science education community". Therefore, designing materials incorporating LC with context-based instruction have latent capacity to reconstruct science curricula around real-world problems so that students will construct knowledge and develop skills required for a science and technology rich world; teachers will improve their instructional practices.

5E instructional model of LC was used widespread while developing new curriculum materials for Biological Sciences Curriculum Study (BSCS) (Bybee, et al. 2006). According to Bybee et al. (2006), 5E instructional model takes its roots from constructivist philosophy of education and it supports inquiry-based science learning. In constructivism, the aim is making students to feel conflict with their existing thinking so that to think in a different way. Bybee et al. (2006), states that 5E model has been used in widely in curriculum development. There are five phases in a 5E model of instruction which are engagement, exploration, explanation, elaboration and evaluation. Based on the Bybee et al. (2006) description, each "E" of 5E is a phase which functions differently to support teachers' instruction and students understanding, attitudes, and skills.

The guided inquiries in this book are designed using the 5E Instructional Model, commonly referred to as the 5E model. The 5E model is a learning cycle based on a constructivist view of learning. Constructivism embraces the idea that learners bring with them preconceived ideas about how the world works. According to the constructivist view, "learners test new ideas against that which they already believe to be true. If the new ideas seem to fit in with their pictures of the world, they have little difficulty learning the ideas. If the new ideas don't seem to fit the learners' picture of reality then they won't seem to make sense. Learners may dismiss them or eventually accommodate the new ideas and change the way they understand the world" (Colburn, 2003).

Most recently, Bektaş (2011), investigated effectiveness of 5E LC model over conventional instruction. The topic was particulate nature of matter, and they investigated students' understanding and gender differences. Students treated with 5E LC model indicated significant mean difference on conceptual understanding and epistemological beliefs regarded with chemistry. They found no interaction with gender and treatment, gender and epistemological beliefs, and gender and conceptual understanding. They also collected some qualitative data, and the data supported students' responses to tests. Similarly, 5E model was also studied by Demircioğlu, Özmen and Demircioğlu in 2004. They investigated the impact of the model on solubility equilibrium after a six week period of instruction. They revealed that students in experimental group indicated better performance on relating events to daily life and misconceptions are remedied better.

The objective of a constructivist model, therefore, is to provide students with experiences that make them reconsider their conceptions. Then, students "redefine, reorganize, elaborate, and change their initial concepts through self-reflection and interaction with their peers and their environment" (Bybee, 1997). The 5E model provides a planned sequence of instruction that places students at the center of their learning experiences, encouraging them to explore, construct their own understanding of scientific concepts, and relate those understandings to other concepts. An explanation of each phase of the 5E model—*engage, explore, explain, elaborate,* and *evaluate*—follows.

Learning Outcomes

The objectives of this experiment are described below:

- The students will understand the phenomena of projectile motion.
- The students can describe the velocity profile of projectile motion.
- The students can make an equation correlation between initial height and x displacement.
- The students can explain why x displacement is depend or not on the initial height.
- The students can easily make an equation of x displacement according to initial height.
- The students can clearly understand does mass effect the x displacement of the projectile motion.

Hypothesis

Our hypotheses are:

1. The displacement of the ball is that it will increase with the initial height changes.
2. Mass will not effect the x displacement.

Variables within the experiment

Basically there are two kinds of variables such as dependent variable and independent variable. The variables within our experiment will be the displacement of Y which we will control as an independent variable. While all other except the displacement of x and time will be set to one state and will not change, such as initial velocity and initial angle (set to zero to eliminate this variable). The different mass of balls will be used to find out is mass effecting the x displacement.

Physical concepts

In this part you have to surely understand the physical concept of gravitational acceleration, energy balance and accelerated motion equation. Constant motion and accelerated motion will be combine to find out is there any effect of initial high on the x displacement. The horizontal motion just has constant motion and vertical motion has gravitational motion. Your correctly mathematical understanding will help you to solve the physical calculation of this experiment.

In the previous unit of work you learned about the nature of gravitational fields. You will now begin to learn about escaping the Earth's gravitational field in order to reach space. Your focus will be on examining the motion of an object projected into the air, but not propelled after launch like a rocket. This type of motion is called projectile motion. Before beginning this part you must have already studied certain concepts. Some of equations are provided to help you in understanding the concept.

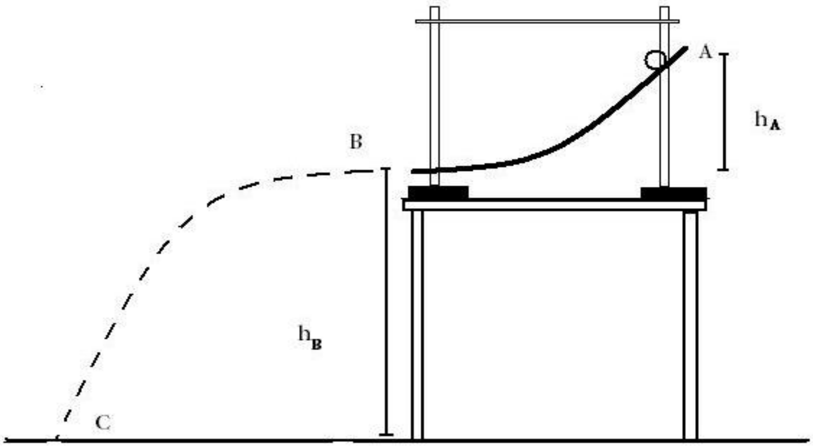

Figure1. Apparatus set up of our experiment.

The total energy at A position.

$$Et_A = mgh_A \text{ ……………………………….. } (1)$$

The total energy at B position

$$Et_B = \frac{1}{2} m v_B^2 \text{ ……………………………….. } (2)$$

The energy balance between A position and B position.

$$mgh_A = \frac{1}{2} m v_B^2$$

$$gh_A = \frac{1}{2} v_B^2$$

$$v_B = \sqrt{2gh_A} \text{ …………………………………… } (3)$$

The speed of v_B just has horizontal component of speed without vertical component of speed.

$$v_{Bx} = \sqrt{2gh_A}$$

$$v_{By} = 0$$

The different high from B position to C position is h_B, so that

$$h_B = v_{By} t + \tfrac{1}{2} g t^2$$

$$h_B = 0 + \tfrac{1}{2} g t^2$$

$$t = \sqrt{\frac{2h_B}{g}} \text{ ……………………………………….. } (4)$$

The x displacement

$$x = v_{Bx} t \text{ ……………………………………………… } (5)$$

The equation (4) → (5)

$$x = \sqrt{2gh_A}\sqrt{\frac{2h_B}{g}}$$
$$x = 2\sqrt{h_A h_B} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (6)$$

If equation 6 is changed to be logarithmic equation

$$\log x = \log 2\sqrt{h_A h_B}$$
$$\log x = \log 2 + \tfrac{1}{2}\log h_B + \tfrac{1}{2}\log h_A$$

In this experiment, h_B cannot be changed because it is the table's height. So in this experiment h_A is independent variable and x displacement is dependent variable.

DESIGN OF EXPERIMENT

Time Required

Approximately 2 lesson hours (about 45 minutes each) are needed, however some things can be assigned as homework to decrease the time spent in class.

Materials Needed

The needed materials are:

- 2 resort stands
- 1 hot wheel tracks
- 1 clamp
- Piece of carbon paper and sheet of line paper.
- Tape, clear tape
- Projectile (metal ball bearings)

Set Apparatus

Our set up for this lab was to use two retort stands placed one in front of the other. Then use clamps to clamp on to the end of a hot wheels race track approximately 30 cm above the base of the retort stand. Then using clear tape (which minimizes the friction when the ball goes over it) and tape the race track down on to the first rhetoric stand. The base length of our stand was 50 cm. Then Lay down the Piece of carbon paper to approximately where you think the steel balls would land, we placed a meter stick from the edge of where the balls are launched so we can quickly get the measurements.

Student Handout

This experiment provides some of student handout. All of student handouts can be found in the appendix.

1. Engagement worksheet
   - Introductory exercises (appendix A).
   - Experimental design graphic organizer (appendix B)
2. Exploration worksheet
   - Data record and calculation worksheet (appendix C)
   - Drawing a graphic (appendix D)
3. Explanation worksheet
   - Experimental design of vocabulary organizer (appendix E)
4. Elaboration worksheet
   - Elaboration test (appendix F)
5. Evaluation test
   - Exercises 1 (appendix G)
   - Exercises 2 (appendix H)

ACTIVITIES

The 5E model stands for engaging, exploring, explaining, elaborating, and evaluating. This is a step by step model of inquiry instruction. The treatment units began with an engage activity, which was a demonstration or attention getter to "hook the students" and capture their attention. Students were not told the explanation of the natural phenomenon that took place in order to stimulate their curiosity and lead them into laboratory exploration where they attempt to understand the topic.

After the initial *engage* section, students launched into a guided-inquiry activity in order to understand and explore the topic. Students engaged in hands on activities by following guiding questions and instructions. The teacher did not tell students if their answers were right or wrong, only helped facilitate the activities. The reason for this was to have students generate their own conclusions based on scientific observation. Often the *explore* section of the inquiry model took more times.

The *explain* portion of the treatment units began with a discussion about the results students observed in the laboratory. After the discussion, the teacher pointed out incorrect conclusions and redirected students back to the lab for additional data collection. Once all scientific observations were sound, the teacher explained to the class the interpretation of those results relating to the topic of study. Students at this point formally wrote down definitions and main ideas from the topic as well as a summary about what they learned. If necessary, students were able to use their books as resources at this point.

With the 5E model, the *elaborate* section took place next. The teacher elaborated about the concept and discussed real world applications of the concepts. Also the teacher gave the students example problems on the board. Homework questions and reading assignments took place at this point. Homework was then discussed and a formative quiz given the following day.

Based upon the results of the quiz, which was not graded, the teacher would either go back and re-teach critical concepts or move towards a new topic. After all topics in the unit had been covered, a review and summative assessment took place. This phase of the treatment unit would be the *evaluate* section, the final stage of the 5 E model.

Engagement

The purpose of this introductory stage, engage, is to capture students' interest. Here we can uncover what students know and think about a topic as well as determine their misconceptions. Engagement activities might include a reading, a demonstration, or other activity that piques students' curiosity.

Brainstorming by asking questions (open-ended questions to engage the students in the activity). For example, how can we measure the x displacement for projectile motion? Which physical quantities do you think can be used to measure the x displacement in the projectile motion?

What is projectile motion mean?

(Time: 30 minutes for discussion and soaking paper)

Teacher and class will discuss (examples):

- What is projectile motion?
- How profile of component speed for projectile motion?
- What will be happen if something released from the high?
- Is x component of motion moving with constant speed or accelerated speed?
- Is y component of motion moving with constant speed or accelerated speed?
- Is there any relationship between initial height and x-displacement?
- Can you give an example around us that can be explained as the principle of projectile motion?

Exploration

In the explore stage, we provide students with cooperative exploration activities, giving them common, concrete experiences that help them begin constructing concepts and developing skills. Students can build models, collect-data, make and test predictions, or form new predictions. The purpose is to provide hands-on experiences you can use later to formally introduce a concept, process, or skill.

By using the materials that describe before, students design an activity to measure the x displacement for projectile motion. They will explore how to measure the x displacement for projectile motion and this activity will be conducted by guidance.

Students should discuss the following questions with their group peers.

a. How do you think you could measure the x displacement of the trajectory of projectile motion in 2D?
b. How do you think the quantities that you will use might be related to each other?
c. Draw graph (s).
d. Briefly explain your reasoning behind the graph(s).

Explanation

In the explain stage, learners articulate their ideas in their own words and listen critically to one another. We clarify their concepts, correct misconceptions, and introduce scientific terminology. It is important that we clearly connect the students' explanations to experiences they had in the engage and explore phases.

Students' observations and methods that they use to find out is there any correlation between initial height and x displacement. For example,

- What kinds of approximations and simplifications did you make? Why?
- What difficulties did you encounter in conducting this activity?
- Is the value of x-displacement that you found close to the theoretical value of x displacement that calculated before? If not, what do you think the values you obtained were not the same or closer to the theoretical value of x displacement? Please explain.

In this part, students will discuss all factors affecting the results such as air resistance, friction, time measurement error (a stop-watch was used), and distance measurement error.

Vocabulary introduction and application:

1. Students will define the experimental design vocabulary using the vocabulary organizer. Students will need three copies of this organizer. The vocabulary terms they should define include independent variable, dependent variable, control, constant, hypothesis, qualitative observation, quantitative observation, and inference. Definitions are available in the critical vocabulary section of this lesson and in the vocabulary definitions listed in the supplemental information section of this lesson.
2. Students will review the Explore worksheet and match the vocabulary to the pieces of the experiment. Review answers with the class.
3. Students will read a second experiment description in the Explain worksheet and identify the pieces of the experiment using their vocabulary definitions.

Elaboration

At the elaborate point in the model, some students may still have misconceptions, or they may understand the concepts only in the context of the previous exploration. Elaboration activities can help students correct their remaining misconceptions and generalize the concepts in a broader context. These activities also challenge students to apply, extend, or elaborate upon concepts and skills in a new situation, resulting in deeper understanding.

Students are supposed to apply this concept in other contexts and extend their understanding and skills. This question can be asked. If you do this activity in another place to measure the x displacement, will you get the same value for the same condition? Or if you do in different media (not smooth surface of plane), will you get the same result of x-displacement?

Evaluation

The last phase of 5E learning cycle is evaluation. It is a vital for students to use the skills they have acquired and evaluate their understanding. Moreover, feedback should be received on the adequacy of their explanations by the students. At the beginning and throughout the 5E sequence, informal evaluation can occur. A formal evaluation after the elaboration phase is completed by the 12 teacher. Educational outcomes should be assessed as a practical educational matter. In this phase, teachers manage assessments to discover each student's level of understanding (Bybee, et al., 2006). Even though, "evaluation" is presented as the final stage of 5E learning cycle, it is possible for it to occur at each stage of the instructional unit. It did not need to be formal. It can be an instant question from the teacher or a unit test and assessment on specific information (Orgill & Thomas, 2007). Evaluation and assessment can happen at all phases of the permanent instructional process. Here are some of the means that help in this diagnostic process: rubrics (qualified and prioritized outcome expectations) determined hand-in-hand with the lesson design, teacher observation structured by checklists, student interviews, portfolios with specific aims, projects and problem-based learning products and fixed assessments. In communications between students, teachers, parents and administrators, concrete evidence of the learning proceed is very valuable seeing the evaluation process as permanent caused the constructivist philosophy to be a kind of cyclical structure. The learning cycle is open to change. In this cycle, questions lead to answers. Moreover, more questions and instruction is driven by both predetermined lesson design and the inquiry process (Bybee, 2001).

In the evaluate phase, you evaluate students' understanding of concepts and their proficiency with various skills. You can use a variety of formal and informal procedures to assess conceptual understanding and progress toward learning outcomes. The evaluation phase also provides an opportunity for students to test their own understanding and skills.

Students assess their knowledge and skills. They can be asked to conduct another activity to measure the x displacement in a different way so the activity permits evaluation of student development. For example, students can think about another way to measure the x displacement and design an activity to conduct to be able to measure the x displacement.

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Appendix A

Introductory exercises

1. What do you know about projectile motion?
2. Can you give one other simple sample of projection motion in the real life?
3. What will be happen if something released from the high?
4. What is the meaning of gravitation?
5. Can you give one simple sample of gravitation in the real life?

Appendix B

Experimental Design Graphic Organizer

Question :	What is the independent variable (IV)?
What is this about?	What is the dependent variable (DV)?
What am I measuring or observing? Units? Which formula will I use? (DV) : ________________________ ________ ____________________________________ (IV) : ________________________ ________ ____________________________________	
Hypothesis : If (IV) ____ Then (DV) ____	
How will data look if I am correct? ____ _ How will data look if I am wrong? ____ _	

Appendix C

Data record and calculation worksheet

Small ball		Big ball	
Displacement X (cm)	Height (cm)	Displacement X (cm)	Height (cm)

Write your calculation bellow:
____

Appendix D

Drawing a graphic

Draw the correlation between initial height and x displacement toward projectile experiment. (x displacement)-- (initial height)

After you draw the graphic correlation of initial height and x displacement, can you make simple mathematical correlation between initial height and x displacement?

Appendix E

Experimental design vocabulary organizer

Vocabulary

Standard definition:

In your own words:

Hint, clues or phrases to remember this word:

Vocabulary

Standard definition:

In your own words:

Hint, clues or phrases to remember this word:

Appendix G

Exercises 1

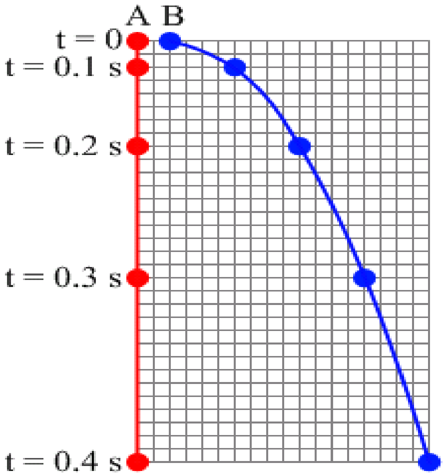
Mehmet wants to release a marble from a projectile surface. Assume that the projectile surface is so smooth so that there is no friction between marble and plane surface. He wants to calculate the effect of initial height of the marble on how the x displacement when it hits to the ground.

1. What is the independent variable of this experiment?
2. What is the dependent variable of this experiment?
3. What is the control variable? List the constants in this experiment.
4. How many trials were ran for this experiment?
5. Write a hypothesis for this experiment.

Appendix H

Exercises 2

Projectile motion is, in general, two-dimensional motion that results from an object with an initial velocity in one direction experiencing a constant force in a different direction. A good example is a ball you throw to a friend. You give the ball an initial velocity when you throw it, and then the force of gravity acts on the ball as it travels to your friend. In this section, we will learn how to analyze this kind of situation.



You release one ball (ball *A*) from rest at the same time you throw another ball (ball *B*), which you release with an initial velocity that is directed entirely horizontally. You release both balls simultaneously from the same height *h* above level ground. Neglect air resistance.

Step 1- Can you calculate the speed of red ball and blue ball when they hit the ground?
Step 2- Please calculate the time of the red ball from it was released till hit the ground?
Step 3- Please calculate the time of the blue ball from it was released till hit the ground?
Step 4- Which ball travels a greater distance before hitting the ground?
Step 5 - Which ball reaches the ground first? Why?