

Transformation 2013

PBL

Planning Form

Guide

PBL Title: A Sketch Is Worth A Thousand Words

Teacher(s): Jeanne Morriss

School: Jack C. Hays High School

Subject: Criminal Investigations

Abstract: A student death has been reported at Hays High School. The cause of death is trauma to the head. The manner of death is undetermined. Did the student trip or was the student pushed? The custodian was within 50 feet of the crime scene but claims to have seen nothing. The key to determining the truth lies in the sketch.

MEETING THE NEEDS
OF STEM EDUCATION
THROUGH PBL UNITS

Step 1: Begin with the End in Mind

- *Does this PBL meet the criteria for STEM student needs (21st century skills, TEKS, TAKS)?*

Section 1

Summarize the theme or “big ideas” for this project based learning unit.

A crime scene sketch graphically portrays the scene of a crime and items within the crime scene that are of interest to the investigation. The sketch provides the best means of indicating distances or spatial relationships for all evidence item locations and other objects at the scene.

Section 2

Identify the TEKS/SEs that students will learn in the PBL (two or three).

§111.34. Geometry

(G.2) Geometric structure. The student analyzes geometric relationships in order to make and verify conjectures.

(G.3) Geometric structure. The student applies logical reasoning to justify and prove mathematical statements.

(G.4) Geometric structure. The student uses a variety of representations to describe geometric relationships and solve problems.

§125.115. Protective Services.

(1) The student knows the employability characteristics of a successful worker in the modern workplace.

(5) The student applies the concepts and skills of the trade to simulated and actual work situations.

Section 3

Identify key performance indicators students will develop in this PBL.

§111.34. Geometry

2(B) The student makes conjectures about angles, lines, polygons, circles, and three-dimensional figures, choosing from a variety of approaches such as coordinate, transformational, or axiomatic.

3(E) The student uses deductive reasoning to prove a statement.

§125.115. Protective Services.

2 (a) demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and citizens.

5 (b) demonstrate knowledge of criminal investigation procedures.

Section 4

Identify the 21st century skills that students will practice in this PBL (one or two).

Acquiring and evaluating information, creative thinking, logical reasoning, interpersonal communication, objectivity, problem solving, and decision-making.

Section 5

Identify STEM career connections and real world applications if content learned in this PBL.

Integration of math, technology and engineering principles through the crime scene documentation process.

Career Connection: Crime Scene Investigation

Step 2: Craft the PBL

- *Have you posed an authentic problem or significant question that engages students and requires STEM knowledge to solve or answer?*

On Monday evening, at approximately 6:00 p.m., a call was made from room C-217 (Mrs. Morriss classroom) in the Career and Technology building at Hays High School. The complainant, Mr. Joseph Scott, called 911 indicating that he found a male student on the ground not breathing. He further indicated that the student appeared to have suffered a head injury. He believed that the student tripped and fell over a mop that was laying on the floor. Apparently, the student's head hit the corner of the teacher's desk. Mr. Scott claims that he was in the adjacent teacher's office at the time of the accident and the student was not in his line of sight. The deceased has been identified as Jeff Burdine, a junior at Hays High School. The body is located in the front of the classroom. You are an investigator with the Hays County Crime Scene Investigation Team and have been called upon, along with your 2 partners, to sketch this crime scene. The sketch should reflect the appropriate sketching method given the scene. You will later use the sketch to enter measurements and other information into the CAD program and create a 3D recreation of the crime scene. The objective is to determine how the student may have died and whether or not Mr. Scott's story is plausible.

Step 3: Map the PBL

Look at the *major* product for the PBL and analyze the tasks necessary to produce a high-quality product. What do students need to know and be able to do to complete the tasks successfully? How and when will they learn the necessary knowledge and skills?

Performance Indicators (Refer to Step I, Section 3)	Already Learned	Taught before the project	Taught during the project
1. Use conventional units of measurements such as inches, feet or yards.	X		
2. Determine scale by taking into account size of room and/or outdoor area.		X	X
3. Determine which plotting method is best given the geography of the crime scene and the availability of reference points.		X	X
4. Use a compass to determine true north and a protractor to find proper angles when determining coordinates.	X	X	X
5. Prepare a legend containing all pertinent information.		X	X
6. Ability to use CAD program			X

Step 4: Plan the PBL 5E Lesson

TASK 1:

Enter the PBL Title and TEKS/TAKS objectives for your 5E lesson in the template provided.

TASK 2:

Describe the activities that occur throughout the 5E learning cycle. Provide explicit instructions in the 5E lesson plan, such that a first year teacher can easily understand what is expected and execute the PBL unit. Provide discussion facilitation questions if applicable. Use the planning forms provided on the following pages to complete each section of the 5E lesson. Refer to Step 3: Map the PBL to help you identify relevant activities to include in the 5E learning cycle that focus on what students need to know and be able to do to complete the PBL.

TASK 3:

Identify and define the products and artifacts for each phase of the PBL 5E learning cycle. *Artifacts are evidence of the student's thinking. Products could include culminating products or products that provide checkpoints for progress through the learning cycle.* The table below shows some examples of artifacts and products. Many additional possibilities exist. Use the planning forms provided on the following pages to complete the 5E lesson.

ARTIFACTS

Notes
Journal entries
E-mail records
Chat records
Records of conversations, decisions, revisions
Interviews using a structured set of questions
Short, reflective paragraphs
Library search record
Telephone logs
Purchase receipts
Samples
Minutes of meetings
Discarded ideas
Prototypes
Group process reports

PRODUCTS

Research papers*
Reports*
Multimedia shows*
Presentations within the school*
Exhibitions outside the school*
Proposals
Outlines
Plans
Blueprints
Drafts
Edited drafts
Revised drafts
Models
Product critiques
Videos
Final versions of papers
Field guides
Biographies
Websites
Flow charts
Design Briefs

**indicates culminating projects*

PBL Title: A Sketch is Worth A Thousand Words

TEKS/TAKS objectives:

§111.34. Geometry

(G.2) Geometric structure. The student analyzes geometric relationships in order to make and verify conjectures.

(G.3) Geometric structure. The student applies logical reasoning to justify and prove mathematical statements.

(G.4) Geometric structure. The student uses a variety of representations to describe geometric relationships and solve problems.

§125.115. Protective Services.

(1) The student knows the employability characteristics of a successful worker in the modern workplace.

(5) The student applies the concepts and skills of the trade to simulated and actual work situations.

Engage Activity: Identify/focus on instructional task, connect between past & present learning experiences, lay groundwork for activities (ex. Ask a question, define a problem, show a surprising event, act out a problematic situation)

The particular subject area is introduced to the students with common examples that have meaning in their lives.

- Teacher will engage students by showing examples of crime scene sketches based on the investigations of Sherlock Holmes. Various sketches have been reproduced by Thomas Handratty, a forensic expert, and can be found online at <http://www.redbirdstudio.com/CrimeScenes/index.html>. The teacher will also provide two handouts, courtesy of Sirchie Finger Print Laboratories, Inc. The first handout is a rough sketch of a homicide crime scene and the second handout is a finished sketch and scale drawing of the same scene.
- We will review the importance of thorough and accurate crime scene documentation. Students have learned in the previous lesson(s) when and how to take field notes, what to record in the field notes and how to photograph the crime scene. Students have also learned the steps in sketching a crime scene and various plotting methods. This lesson will reinforce to students that sketches are a major component of crime scene documentation and a vital supplement to photographs and field notes.
- Students will be introduced to the design challenge in another location. (the crime scene will be in their regular classroom). They will have the opportunity to pose questions, discuss and form a plan with their group. They will complete the “What I know” and “What I want to know” portion of the KWL chart during the introduction to the design challenge.

- Possible questions that may be asked by students prior to the challenge:

Was anything moved or touched prior to the police arrival? Assume that the door was open upon arrival and the custodian used the telephone to call 911.

Once we leave, can anything be added to the sketch? No, nothing should be added. Make sure you have included all the measurements, and have made all the relevant notations.

After we have completed the CAD design of our crime scene, can the original sketch be destroyed? No. The rough sketch may be needed in court at a later date. Without the original sketch, defense attorneys may claim that changes were made in later versions.

Engage Activity Products and Artifacts:

1. *Artifacts (KWL charts, journal entries, etc) are evidence of the student's thinking.*
2. *Products (flow charts, data tables, models, etc) include checkpoints for progress through a design challenge.*

KWL Chart

K	W	L
What I Know	What I Want to Know	What I Learned

Engage Activity Materials/Equipment

Design Challenge handout, KWL chart, pen/pencil

Engage Activity Resources

Crime Scene Documentation:

Bennett, W. W. and Hess, K. M. *Criminal Investigation*. 7th Edition. Thomson Wadsworth, 2007.

Ogle, R.C. *Crime Scene Investigation and Reconstruction*. Person Education, Inc. 2004

KWL Chart

http://www.educationworld.com/tools_templates

Explore Activity: Students get involved with phenomena and materials; students work in teams to explore through inquiry.

Directed laboratories are conducted so the students can experience the principles in a controlled manner. This experience is crucial to success in solving design challenges.

*Students will work in groups of three. Two students will take the measurements while one sketches the crime scene. Each measurement is verified by the individual preparing the sketch and the member having the end of the tape showing measurement.

*Students should choose measure the length and width of the room and use one of three plotting methods to plot objects and evidence. (Based on previous class instruction).

Triangulation method:

Triangulation measures from two fixed objects to evidence or objects at the scene. By drawing a line that connects the two fixed reference points and extending a line from each of the reference points to the object being measured, a triangle is formed. A minimum of two reference points must be established. The degree of angle formed at the location of the object or evidence can be measured with a protractor. By calculating the reduced distances on a scale drawing and scribing arcs from the fixed points indicated, the point at which the arcs intersect is the exact location of the object.

Rectangular-coordinate method:

Uses two adjacent walls as fixed points from which distances are measured at right angles. The objective is to locate objects or evidence from one wall at right angles and then from the adjacent wall at right angles. Each measurement is best made to the nearest walls not parallel to each other.

90-Degree Method

Typically used for measuring indoor crime scenes. To establish the position of an object in a room, measurements are taken from two different walls within the room that are perpendicular to one another. The tape measure is held perpendicular to the wall.

Explore Activity Products and Artifacts:

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2. *Products (flow charts, data tables, models, etc) include checkpoints for progress through a design challenge.*

Lab Worksheets

DATA TABLE 1

Measurements of room where crime occurred

Length of room	Width of room

DATA TABLE 2

Measurement of physical evidence from fixed points

Name of object	Fixed point 1	Fixed point 2	Distance of object from fixed point 1	Distance of object from fixed point 2

Explore Activity Materials/Equipment

Graph paper, clipboard, a disposable pencil with an eraser, a straight edge (good 12 inch plastic ruler), a compass for the direction of North, crime scene templates, and protractor and a 100 foot steel retractable measuring tape.

Explore Activity Resources

Plotting methods

Bennett, W. W. and Hess, K. M. *Criminal Investigation*. 7th Edition. Thomson Wadsworth, 2007.

http://www.tcleose.state.tx.us/GuideInst/PDF/2106_Crime_Scene_03.pdf

Data Table

Walker, P. and Wood, E. *Crime Scene Investigations: Real-Life Science Labs for Grades 6-12*. John Wiley & Sons, Inc. 1998

Explain Activity: Students discuss observations, ideas, questions and hypotheses with peers, facilitators, groups. Learners apply labels to their experiences – thus developing common language, clarification/explanation of key concepts

Delivery of the content begins with a discussion of the principles illustrated by the Hands-On examples. In this way, the participants' intuition is tapped to introduce terms and concepts that they may have heard. This approach leads naturally to an in-depth discussion of the science and mathematics concepts underlying the particular subject area.

- **Class Discussion**

Teacher Questions:

Did you start the sketch clockwise or counterclockwise? Why?

Did you sketch your outline with North pointing to the top? Why is this important?

Did you measure wall to wall or baseboard to baseboard? Which way is better and why?

For the legend, how did your group assign objects and evidence?

Possible student questions and reactions:

What is the difference between a rough sketch and a finished scale drawing? A rough sketch is a free-hand outline of the crime scene and the objects and evidence within the scene. The rough sketch is made at the crime scene and is not usually drawn to scale. The finished sketch is more precise and is completed after the scene has been processed. It is prepared in ink and may be drawn to scale, using exact measurements. Color designations and plastic overlays can also be added.

Opinions differ on whether to include the location of evidence in the rough sketch. Why do you suppose this is the case? Some courts have withheld the introduction of the sketch until the evidence has been approved.

How did you determine scale? By taking the longest measurement at the scene and dividing it by the longest measurement of the paper used for sketching.

What are some common errors to avoid when measuring? Sagging of the tape, misinterpreting the numbers, and confusing the zero point of the tape.

How accurate should your measurements be for evidence items? Measurements should be made to the nearest one-half inch.

What other factors influence the decision to use one plotting method over another? Other factors include weather, the availability of personnel, and the number and type of obstructions between the reference points and the evidence or objects being measured.

What is an advantage of the triangulation method? The ease of the measurements. All measurements from the first reference point can be made at one time.

Explain Activity Products and Artifacts:

- 1. Artifacts (KWL charts, journal entries, etc) are evidence of the student's thinking.**
- 2. Products (flow charts, data tables, models, etc) include checkpoints for progress through a design challenge.**

Completed Rough Sketch and KWL Chart-Complete the "What I learned" section

Explain Activity Materials/Equipment

KWL Chart, Pen/Pencil

Explain Activity Resources

KWL Chart

http://www.educationworld.com/tools_templates

Bennett, W. W. and Hess, K. M. *Criminal Investigation*. 7th Edition. Thomson Wadsworth, 2007.

Elaborate Activity: Expand on concepts learned, make connections to other related concepts, apply understandings to the world. (ex. Extend & apply knowledge).

At its heart, engineering is the application of science and mathematics to design solutions to problems for humanity. Thus, providing design opportunities to students is a key component of STEM education.

Opportunities to be creative in open-ended situations peak the interest of many students, providing an answer to the ubiquitous question: “Why do we need to know this?”

- On Day 2 & 3, students will be able to incorporate their rough sketch into a CAD drawing. We will be able to see our plotting methods come to life.
- Teacher will introduce an online tutorial on “Creating a 3-D Homicide Diagram” from The CAD Zone.
- Then, students will be able to “view” their crime scenes and see the location of objects evidence. They can view what the witness claims to have seen or not seen.

Possible student questions:

When did computer-aided design become a tool for crime scene investigators? CAD software for crime and accident scene diagrams was first introduced in the early 1990’s. It was considered a technological advance for criminal investigators but the complicated software was not user-friendly and proved to be very challenging. CAD software programs have improved dramatically since then.

What are some features of the program? Some forensic diagramming applications have easy to use drawing programs for the inexperienced user. However, there are a number of features that the experts use, including crash reconstruction programs, bloodstain pattern analysis feature, and ballistics data. Some programs are even capable of producing 3-D animations from actual data.

Have the CAD diagrams proved useful in court? Yes, as long as the rough sketch was well prepared, the value in court is tremendous. The diagrams help judges, juries and witnesses visualize the crime scene.

Elaborate Activity Products and Artifacts:

1. *Artifacts (KWL charts, journal entries, etc) are evidence of the student’s thinking.*
2. *Products (flow charts, data tables, models, etc) include checkpoints for progress through a design challenge.*

CAD Diagram

Elaborate Activity Materials/Equipment

Rough Sketch, CAD software

Elaborate Activity Resources

Bennett, W. W. and Hess, K. M. *Criminal Investigation*. 7th Edition. Thomson Wadsworth, 2007.

www.cadzone.com

Evaluate Activity: Ongoing diagnostic process to determine if the learner has attained understanding of concepts & knowledge (ex. Rubrics, teacher observation with checklist, student interviews, portfolios, project products, problem-based learning products, assessments).
Leads to opportunities for enrichment through further inquiry and investigation.

Each group will present their sketch to the class. The other groups will make notes on the KWL chart.

- By re-creating an accurate model of the crime scene, based on the rough sketch, students should be able to ascertain that it was actually possible to observe something happening inside the classroom. From the reconstruction, students should be able to determine that the custodian has been lying and could have seen the murder. In addition, the placement of the body and the evidence might suggest that the student was pushed and did not trip and fall.
- Tools used to measure student success:
 - Teacher observations
 - Assessment for the lab activity (using rubrics below)
 - Student peer evaluations and self-evaluations
 - Test covering crime scene documentation, including sketching, photography methods, and field notes.

Evaluate Activity Products and Artifacts:

1. *Artifacts (KWL charts, journal entries, etc) are evidence of the student's thinking.*
2. *Products (flow charts, data tables, models, etc) include checkpoints for progress through a design challenge.*
3. *What is the final product (working model, portfolio, presentation, etc) you will require?*

Presentation
KWL chart

Evaluate Activity Materials/Equipment

KWL Chart, Presentation materials (rough sketch and CAD drawing), Lab worksheet

Evaluate Activity Resources

None.

Step 5: Plan the Assessment

State the criteria for exemplary performance for each artifact/product of each section of the 5E lesson.

- *Do the products and criteria align with the standards and outcomes for the PBL?*

<p>Engage Artifact(s)/Product(s):</p> <p>KWL Chart- The “What I know” and “What I want to know” sections demonstrate critical thinking that is clear, insightful, in depth, and relevant.</p>
<p>Explore Artifact(s)/Product(s):</p> <p>Lab worksheet-Measurements are accurate. All of the pertinent evidence and objects are included.</p>
<p>Explain Artifact(s)/Product(s)</p> <p>Rough Sketch –The scene is observed and a planned prior to sketching. Scale is determined properly and distances are measured accurately. The area is outlined and the objects and evidence are located within the outline. Proper plotting method is used. Sketch is identified with appropriate legend and scale. Sketch is reassessed prior to leaving the scene.</p> <p>KWL Chart -The “What I learned” section demonstrates critical thinking that is clear, insightful, in depth, and relevant.</p>
<p>Elaborate Artifact(s)/Product(s):</p> <p>CAD Diagram-The crime scene recreation is consistent with the rough sketch, showing in detail the position of the objects and evidence and the final resting position of the body.</p>
<p>Evaluate Artifact(s)/Product(s):</p> <p>Presentation-Demonstrates an awareness of audience and is sophisticated. Each member of the team is able to present information in a logical and articulate manner.</p>

Step 6: Create Rubrics

Team: _____

KWL Chart-25 points

Completion of Required Sections: What you know, What you want to know and What you learned	10 points
Organization-All notes and ideas are kept in logical sequence	5 points
Neatness-Overall chart is very neat and legible	5 points
Writing includes accurate spelling, grammar, and punctuation.	5 points

Group Activity-Sketch-40 points

All team members clearly and effectively participated in the activity	10 points
Rough sketch completed neatly and legibly	5 points
Sketch is labeled with letters assigned to evidence and numbers assigned to objects	5 points
Legend included with name of victim, complainant, location, date, time, etc	5 points
Scale used in appropriate-outside limits are placed	5 points
Plotting method correctly applied (ex: measured from fixed objects)	10 points

Lab Worksheet-20 points

Room is measured accurately	5 points
All objects and evidence is recorded	5 points
Points of measurement are fixed	5 points
Distance of objects are measured accurately	5 points

CAD drawing-Presentation-20 points

The presentation holds audience attention and maintains eye contact.	5 points
The CAD drawing is exactly based on rough sketch- nothing is added or deleted	10 points
Group decides whether or not the custodian's story is plausible and sketch supports theory	5 points

Teacher Comments:

Grading Scale:

90-100= A Excellent; all goals and performance criteria met.

80-89 = B Good; most goals and performance criteria met.

70-79 = C Needs Some Improvement; most goals and performance criteria met.

Step 7: Create Story Board

Highlight each day's activities and identify the expected completion time for each activity.

Story Board

	Day 1	Day 2	Day 3	Day 4	Day 5
Week 1 Activities	<ul style="list-style-type: none"> ▪ Lesson on crime scene sketch and plotting methods 	<ul style="list-style-type: none"> ▪ Design challenge and crime scene 	<ul style="list-style-type: none"> ▪ CAD software 	<ul style="list-style-type: none"> ▪ CAD software 	<ul style="list-style-type: none"> ▪ Presentation ▪ Reflection