

Math and Photography

Life Learning Academy Project-Based Curriculum

Project Title: Photography and Math

Project Team: Justin Warren and Jamie Pillers

Subject Areas: Photography and Algebra 1

Project Overview:

The project is a curriculum developed by a photography teacher and a mathematics teacher in 2001. The curriculum was designed to (1) teach students about the connections between academic studies and the world outside the classroom, and (2) motivate students by drawing connections between art, mathematics, and the students' perceptions of the world.

The project consists of eight lessons given over roughly an eight-week period. Each lesson requires roughly 120 minutes of class time. The lessons can be broken into hour-long classes or given in longer "block" classes. The lessons emphasize learning problem-solving skills related to photography. During the project, students (1) study and discuss the content and meaning of photographs, (2) get hands-on experience with cameras and a photographic darkroom, (3) learn about some of the technical and mathematical problems involved with photography, and (4) prepare a public exhibition of their photographs.

Notes about equipment: The lessons require cameras, film and a darkroom. It's recommended that the teacher provide at least one camera for every two students. A darkroom is not absolutely necessary; a professional photo lab could print the students' photographs. If so, then Lessons 5 and 6 would require modification.

Educational Standards Addressed:

California State Visual Arts Standards

1. Students identify and use the principles of design to discuss, analyze, and write about visual aspects in the environment and in works of art, including their own. CA State [1], Artistic Perception, 1.1, p.152
2. Students research and analyze the work of an artist and write about the artist's distinctive style and its contribution to the meaning of the work. CA State [1], Artistic Perception, 1.3, p.152
3. Students analyze and describe how the composition of a work of art is affected by the use a particular principle of design. CA State [1], Artistic Perception, 1.4, p.152
4. Students solve a visual arts problem that involves the effective use of the elements of art and the principles of design. CA State [1], Creative Expression, 2.1, p.153

5. Students prepare a portfolio of original two- and three-dimensional works of art that reflects refined craftsmanship and technical skills. CA State [1], Creative Expression, 2.2, p.153
6. Students create an expressive composition, focusing on dominance and subordination. CA State [1], Creative Expression, 2.5, p. 153
7. Students create a two- or three-dimensional work of art that addresses a social issue. CA State [1], Creative Expression, 2.6, p. 153
8. Students articulate how personal beliefs, cultural traditions, and current social, economic, and political contexts influence the interpretation of the meaning or message in a work of art. CA State [1], Aesthetic Valuing, 4.1, p. 154
9. Students formulate and support a position regarding the aesthetic value of a specific work of art and change or defend that position after considering the views of others. CA State [1], Aesthetic Valuing, 4.3, p. 154
10. Students articulate the process and rationale for refining and reworking one of their own works of art. CA State [1], Aesthetic Valuing, 4.4, p. 154
11. Students employ the conventions of art criticism in writing and speaking about works of art. CA State [1], Aesthetic Valuing, 4.5, p. 154
12. Students assemble and display objects or works of art as part of a public exhibition. CA State [2], Creative Expression, 2.3, p. 156
California State Mathematics Standards
13. Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems. CA State [3], Algebra 15.0, p. 39
14. Students derive and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures. CA State [3], Geometry 8.0, p. 42
15. Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids. CA State [3], Geometry 11.0, p. 42

Project Goals and Rationale:

- Students develop photography and mathematics problem-solving skills.
- Students develop ability to work effectively in small workgroups.
- Students develop ability to apply abstract concepts to non-abstract problems.
- Students develop skills and confidence in working in a workshop setting. Students become familiar with basic darkroom procedures and techniques.

Project Objectives:

- Students will learn a vocabulary for viewing, discussing, and making photographs.
- Students will learn the basic mathematical methods and concepts used to control the photography process including circle measurement and the use of rates and ratios.
- Students will learn to use cameras and a photographic darkroom to make their own photographs.
- Students will learn how to produce documentary-style photographs.
- Students will learn how to prepare a public exhibition of their photographs.

Student Outcomes:

- Students will be able to view and critique photographs of their own and others.
- Students will be able to operate sophisticated camera and darkroom equipment to produce interesting photographs.
- Students will be able to use the mathematical concepts of rates and ratios to manipulate the photographic process to the student's advantage.
- Students will be able to produce and exhibit a portfolio of photographs expressing ideas of their own choosing.

Project Outline/Detailed Description:

See Project Outline.

Assessment Methods and/or Tools:

Please refer to Project Outline.

History of Project Development:

This curriculum is the result of a semester-long collaboration between the LLA photography and math programs. This collaboration was attempted because the LLA faculty has found that cross-curriculum projects create high levels of student engagement and acceleration of learning. In this case, the faculty felt that a project that integrates photography and mathematics offered an opportunity to help students: (1) see the connections between abstract academic ideas and practical real-world applications, and (2) more clearly understand the mathematical ideas of area, rate, and ratio.

Texts and Supplemental Instructional Materials:

1. *Visual Arts Content Standards for California Public School, Grades Nine Through Twelve, Proficient.* 2001, California Department of Education: Sacramento, CA.
2. *Visual Arts Content Standards for California Public School, Grades Nine Through Twelve, Advanced.* 2001, California Department of Education: Sacramento, CA.
3. *Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve.* 1999, California Department of Education: Sacramento, CA.

Lesson # & Stds. Ref. []	Content Outline	Teaching Sequence	Equipment and Materials	Preparation	Assessment
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Math and Photography Outline

<p>1 (120 min)</p> <p>[1, 2, 3, 8, 9, 11]</p>	<p>Looking at Photographs</p> <p>In this lesson, students: (1) look at an individual photograph to investigate its content and meaning, (2) look at several books of photographs to get a better sense of what is possible with photography, and (3) discuss some of the problems that photographers try to solve.</p>	<p>Introduce lesson: Discuss briefly what the 8-week project will cover: (1) looking at photographs in depth, (2) making photographs and critiquing them, (3) looking for patterns in the photographs that help understand meaning, and (4) problem solving. (5 min.)</p> <p>Using Worksheet 1, study an interesting well-made photograph and discuss its content and meaning. Hand out copies of the photograph and worksheet to each student. Students complete worksheet individually and then share what they found. Then encourage students to revise their worksheet based on what they heard in discussion. (45 min.)</p> <p>Using Worksheet 2, study a book of photographs and discuss its contents and meaning. Hand out worksheet and let each student pick a book of photographs. Students complete worksheet individually and then share what they found. Then each student presents to the whole class their book, its purpose, and five photographs in it that are the students' favorites. Students</p>	<p>A copy of Worksheet 1 and 2 for each student.</p> <p>Several copies (preferably one for each student) of a well made photograph that'll attract the students' interest.</p> <p>Several books of photographs showing as many styles or types of photography as possible.</p>	<p>If possible, provide enough photographs and books so that no more than two students are looking at them at once.</p>	<p>Students' completed worksheets and classroom discussion participation.</p>
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		<p>explain why they like the photographs. Then encourage students to revise their worksheets based on what they heard in discussion. (45 min.)</p> <p>If time allows, and if student photographs are available from previous semesters: Look at student photographs from previous semesters and discuss them. What do students think the intent of the photographer was? Describe the photographs with one or two words. Then ask students if they have any overriding interests that they'd like to guide their photography. (30 minutes)</p>			
<p>2 (120 min.)</p> <p>[1, 2, 3, 4, 8, 11]</p>	<p>Documentary Photography – Part 1</p> <p>In this lesson, students develop: (1) a definition of “documentary” photography, (2) a list of “do’s” and “don’ts” of documentary photography, and</p>	<p>Develop a definition of “documentary” photography. Ask students what they think documentary photography is. Write their initial ideas on the whiteboard. Hand out some books of documentary photography and let students study them. Ask students to report to the class what they found in the books. Discuss “do’s” and “don’ts” of documentary photography. Then ask students to complete the appropriate portions of Worksheet 3. Revisit students’ definitions of documentary photography and change them if necessary. (60 min.)</p>	<p>Copies of Worksheet 3 for each student.</p> <p>Several books of documentary photography.</p>	<p>Prepare for discussion of “do’s and don’ts” by looking over Lesson 3’s handout.</p>	<p>Student’s writing in Worksheet 3, their written project time schedule, and their participation in class discussions.</p>

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	(3) a plan for completing a documentary photography project.	Develop a documentary photography project plan. Students develop a list of school activities that might be good candidates for a documentary project. (Are they representative? Interesting? On-going at times available to photographer?) Ask each student to select from the class list of activities that interest him or her as a documentary project. Then ask students to write about why they like their choices. Students prepare a time schedule for their project. (It might be appropriate to ask students to get permission from any teachers whose classes might be affected by the photography.) (60 min.)			
3 (120 min.) [1, 3, 4, 6, 7, 10, 11, 13, 14, 15]	Documentary Photography – Part 2 In this lesson, students: (1) review their work from Lesson 2, (2) review the operation of a camera, including the mathematics	Begin the lesson by reviewing the students' ideas about documentary photography from Lesson 2, including the "do's and don'ts". Then give each student a copy of the "Documentary Photography Do's and Don'ts" handout. Discuss the handout, comparing it with the students' ideas from Lesson 2. Based on the discussion, modify the handout's list if appropriate. Hand out a pocket notebook to each student (make sure students clearly label the notebook with their name). Explain how they'll use the	Copy of "Documentary Photography Do's and Don'ts" handout for each student. One pocket notebook for each student.	Alert other staff and teachers that documentary photography projects are about to begin and that student photographers may be photographing	Students' participation in class discussion; students' behavior as they carry out their plan (Check with affected teachers after class has ended.); and students' success in completing their documentary plan

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	<p>involved, (3) carry out their documentary project plan, and (4) discuss and write about the experiences they had carrying out their plans.</p>	<p>notebooks to keep track of the subject of each photograph they take, problems they encounter during the documentary project and, if appropriate, how they solved the problems. (30 min.)</p> <p>Review basic camera operation, including use of the flash; appropriate apertures and shutter speeds for indoor and outdoor conditions; film loading and unloading. Remind students of the purposes of their pocket notebook. Make sure to remind them to photograph themselves or their names on the first frame of the film so that the roll is identified. (15 min.)</p> <p>Students carry out their documentary photography plan. If there are students without cameras, they should be asked to alert affected teachers that photographers would be visiting their classroom. These students should also be looking for activities that could be included in future projects. Students with cameras give them to students without cameras half way through class time. (60 min.)</p> <p>After students complete their photography, have a discussion about their experiences</p>		<p>classroom activities.</p> <p>Save students' writing about their experiences carrying out documentary plans. The writing will be used in Lesson 7.</p>	<p>(Did they photograph what they said they would photograph?).</p>

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		while they were carrying out their documentary plans, including any problems they ran into and how they solved the problems. Ask students to write a few paragraphs about the experience. (15 min.)			
<p>4 (120 min.)</p> <p>[3, 4, 6, 10, 11, 13, 14, 15]</p>	<p>Photographing Motion</p> <p>In this lesson, students: (1) conduct experiments that show the relationship between aperture and shutter speed, (2) investigate the mathematics behind the aperture, shutter speed, and f-stop connections, (3) discuss how aperture and shutter speed affect the camera's ability to capture motion, (4) carry out a</p>	<p>First conduct two experiments related to aperture and shutter speed.</p> <p>Experiment 1: Assemble students around the water source. Assign one student to be timer. Give another student a cup. Turn water on at a constant low flow rate. Ask students to put water in the cup for 3 seconds. Then ask students: "How could you put exactly twice as much water in the cup without changing the flow rate?" Discussion should lead to the idea that filling the cup for 6 seconds should result in twice as much water. Then ask students to fill the second cup for 6 seconds and show students that, by observation, the second cup contains twice as much water as the first. Now discuss with students: (1) "What could the water represent in photography?" [<u>Light</u> flowing into the camera.]; (2) "What part of the camera is like the flow rate of the water?" [<u>Aperture</u> controls the rate of light entering the camera.]; (3) "What part of the camera is</p>	<p>Copies of Worksheets 4 and 5 for each student.</p> <p>Stopwatch, 2 cups of the same size, and a flowing water source.</p> <p>Camera and film for each pair of students.</p> <p>Students' pocket notebooks.</p>		<p>Student participation in class discussions, completion of Worksheets 4 and 5, participation in the motion photography assignment, and students' writing about their experiences creating motion photographs.</p>

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	<p>motion photography assignment, and (5) write about the experiences they had carrying out the assignment.</p>	<p>like the stop watch?” [<u>Shutter speed</u> controls the time the light enters the camera.]; and (4) “How is this water experiment like a camera?” [<u>The amount of light exposing the film</u> is like the amount of water in the cup.] Now hand out a copy of Worksheet 4, discuss the worksheet questions to make sure everyone understands, and then ask students to complete it.</p> <p>Experiment 2: Draw a line across the length of the classroom whiteboard. Mark it off in approximately 2 ft. segments and label the marks “1”, “2”, etc. Then ask students to close their eyes. Ask one student to walk in front of the whiteboard while telling the other students to open their eyes and then close them one second later. Repeat the experiment, but with eyes open for two seconds. Now discuss the questions on Worksheet 5 and ask students to complete it. (40 min.)</p> <p>Discuss the mathematical relationships between aperture, shutter speed, and f-stop number. Remind students of the water experiment: “How could you double the amount of water in the cup?” [Double the flow time or double the flow rate.] “How</p>			

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		<p>could you double the amount of light entering the camera?” [Double the exposure time by slowing the shutter speed by half, or doubling the lens aperture by changing the f-stop.] Ask students to hypothesize how much more light is let into the camera when the f-stop number is decreased one stop, say from f-16 to f-11. Now ask students to prepare a table listing f-stop number, lens focal length, aperture diameter, and aperture area. For purposes of this exercise, have students use only a lens focal length of 50mm (the most common 35mm camera lens). Ask students to fill in the f-stop column of their table with the f-stops on their camera (likely 22, 16, 11, 8, 5.6, 4.0, 2.8). Then ask them to complete their tables by using the following equation: “f-stop equals lens focal length divided by aperture diameter.” Guide students to the finding that the aperture area (like the water faucet opening) doubles each time the f-stop is changed, and thus allowing double the light to expose the film. (20 min.)</p> <p>Discuss motion in photography. Remind the students of the results of the classroom motion experiment, i.e.: “The experiment</p>			

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		<p>showed us how the longer the camera lens is open, the more movement will be captured.” Show students examples of photographs that capture motion. Discuss how students think the photographers created the photographs and why the photographs created great viewer interest. (20 min.)</p> <p>Students carry out motion photography assignment. Group students into pairs. Give each pair a camera, roll of film, and their pocket notebooks. Make sure to remind them to photograph themselves or their names on the first frame of the film so that the roll is identified. Go over what f-stop and shutter speed combinations would likely capture motion. Ask each student to expose half the roll with motion photographs, using their teammate as a model. Then they switch roles. Finally ask students to write a few paragraphs about motion photography and their experiences trying to capture motion with a camera. (40 min.)</p>			

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5 (120 min.) [6, 12, 13]	<p>Darkroom Printing and Darkroom Chemistry Ratios</p> <p>In this lesson, students: (1) print photographs from their Documentary Project, and (2) investigate the concept of ratio by studying darkroom chemistry recipes.</p>	<p><i>[NOTE: If a darkroom is not available to the class, then the printing portion of this lesson can be skipped. Student film and proof sheets would have to be processed by a professional lab ahead of time. After students select negatives for printing from proof sheets, the film would have to be sent to the professional lab for printing, in preparation for Lesson 7.]</i></p> <p>Print documentary photographs. Guide students' viewing of their proof sheets to select several interesting negatives for printing. Remind students of their ideas of what makes documentary photography (Lessons 2 and 3). Students then make work prints of their chosen negatives. (60 min.)</p> <p>Review of ratio, as used in darkroom chemistry. Give each student copies of recipes for mixing darkroom developer, stop bath and fixer solutions. Let students read recipes, and then have a discussion of the purpose of the recipes. Ask each student to select one of the recipes and prepare a table containing columns for "Recipe steps", "Quantity", "1/4 Quantity",</p>	<p>Students' film (developed) and proof sheets from Lesson 3 (documentary photography).</p> <p>Darkroom supplies.</p> <p>Copies of recipes for darkroom chemistry.</p>	<p>Student film from Lesson 3 must be developed and proof sheets made for each roll of film. This must be completed before Lesson 5 begins.</p> <p>Darkroom chemistry must be prepared ahead of time.</p>	<p>Students' participation in classroom and darkroom activities; and completion of their photographs and ratio tables.</p>

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		<p>and “2 x Quantity.” Explain that photographers often have to modify the darkroom solution recipes to make smaller or larger quantities. Then ask students to complete their tables by calculating the quantities of materials needed for the $\frac{1}{4}$ recipe and the 2x recipe. Let students work with each other, comparing their findings. Ask students to share their findings with the class. Discuss the mathematics of reducing or increasing the recipes by multiplying a factor ($\frac{1}{4}$ or 2) times the constant ratios of recipe materials. (60 min.)</p>			
<p>6 (120 min.) [6, 12, 13, 14, 15]</p>	<p>Darkroom Printing and Golden Ratio Investigation</p> <p>In this lesson, students: (1) print photographs from their Motion Photography assignment, and (2) investigate the “Golden Ratio” and its impact on</p>	<p>[NOTE: If a darkroom is not available to the class, then the printing portion of this lesson can be skipped. Student film and proof sheets would have to be processed by a professional lab ahead of time. After students select negatives for printing from proof sheets, the film would have to be sent to the professional lab for printing, in preparation for Lesson 7.]</p> <p>Print motion photographs. Guide students’ viewing of their proof sheets to select several interesting negatives for printing. Remind students of the goals of the motion</p>	<p>Students’ film (developed) and proof sheets from Lesson 4 (motion photography).</p> <p>Darkroom supplies.</p> <p>Copies of Worksheet 6.</p> <p>Pictures of art and architecture that incorporates The</p>	<p>Student film from Lesson 4 must be developed and proof sheets made for each roll of film. This must be completed before Lesson 6 begins.</p> <p>Darkroom</p>	<p>Students’ participation in classroom and darkroom activities; completion of their photographs; and completion of the worksheet.</p>

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	the way photographs look.	<p>photography assignment (Lesson 4) before they make their final selections. Students then make work prints of several of their negatives. (60 min.)</p> <p>Study “The Golden Ratio” and its impact on photography. Handout a copy of Worksheet 6 to each student. Hand out rulers and ask students to measure the length and width of a classmate’s face. Then, on the back of the worksheet, students should make a table and record all of the face length and width data from the other students. Then ask students to calculate the face length divided by width and record this in the table as Length-to-Width Ratio. Develop a definition of Ratio with students. If necessary, have students look up some definitions of the word in math textbooks and dictionaries. Ask students to complete Worksheet 6. Compile the students’ findings for the face ratio, fence ratio, and rectangle ratio. The averages for all the students’ findings should be ratios of approximately 1.6 to 1. Explain to the students that this ratio is very close to The Golden Ratio. Discuss some of the interesting applications of this ratio in art and architecture. Then start a</p>	<p>Golden Ratio. The Golden Ratio is discussed at length in a number of mathematics survey-type texts, including those written by Martin Gardiner.</p> <p>Rulers (preferably some having only English units and others metric so that students see that ratio is system independent).</p>	chemistry must be prepared ahead of time.	

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		discussion with the students using the prompt: “Why would the ratio of face length-to-width affect what we think is beautiful in the world?” If time allows, hand out some pictures of art and architecture and ask students to look for evidence of The Golden Ratio. (60 min.)			
7 (120 min.) [1, 3, 8, 9, 10, 11]	<p>Photography Critique</p> <p>In this lesson, students: (1) develop a definition of “critique” and ground rules for conducting a critique, and (2) conduct a critique of the students’ documentary and motion project photographs.</p>	Develop the meaning and purpose of critique. Guide a student discussion of photograph quality. First remind students of the exercise they did back in Lesson 1 when they looked at other photographers’ work and how the students selected photographs as their favorites; then ask students what they think makes a photograph successful, interesting, or beautiful. Compile lists of their responses on the whiteboard. Then ask if there are differences in the lists, and why or why not. Guide students’ development of a definition of “critique” and a set of ground rules for conducting a critique of their photographs. They might start by looking at a dictionary definition. Then students should discuss what the purposes of a critique could be. When the discussion is completed, students should write a few paragraphs about the definition of critique,	All of the documentary and motion photographs produced by the students in Lessons 5 and 6. Copies of Worksheets 7 and 8.		Student participation in class discussions, completion of critique forms, and completion of their written responses to the two questions about their photography.

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		<p>its uses, and the ground rules for conducting a critique. (30 min.)</p> <p>Conduct a critique of the students' documentary and motion photography. Hand out Worksheets 7 and 8 to each student. Each student then in turn displays the photographs they made. Their classmates conduct a critique of the student's photographs, following the ground rules they developed earlier. The student photographer should take notes of his or her classmates' comments. Students then complete the appropriate worksheet for photographs they've viewed and critiqued. When the worksheet is completed, it should be given to the photographer. Each student completes this lesson by writing responses to the following questions: (1) What are at least three things you like about the photographs you've made in this class? (2) What are at least three things you'd change in your photography to make it better? (90 min.)</p>			

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<p>8 (180 min.)</p> <p>[5, 12, 14]</p>	<p>Prepare an Exhibition</p> <p>In this lesson, students:(1) select photographs from their documentary and motion photography projects to be exhibited, (2) mount and frame their photographs, and (3) create a layout plan for the exhibition.</p>	<p>Students select photographs for exhibition. Guide students to select roughly 12 photographs that they feel would best represent the work they did during this project. Students should write several paragraphs about why they selected these photographs. (20 min.)</p> <p>Students mount the photographs for exhibition. This could include cutting and attaching mat boards to the photographs and adding frames if available. (70 min.)</p> <p>Students plan the exhibition. Ask students to develop an agreed-upon plan for how all the student photographs should be hung in the exhibition space. Students will have to measure the space and determine how to fit all the photographs into it. (30 min.)</p> <p>Students hang the photographs per their plan. Once the exhibition has been completed, students should write a few paragraphs about their feelings about the exhibit, including what they like about it and what they might change if they were going to do it again next year. (60 min.)</p>	<p>All of the documentary and motion photographs produced by the students in Lessons 5 and 6.</p> <p>Photograph matting, framing and hanging materials.</p>	<p>The number of photographs selected by each student should be decided upon ahead of this lesson by selecting an exhibition space and determining how many photographs can be displayed there.</p> <p>Mat boards should already be cut to fit the student photographs.</p>	

Appendix 1

PROJECT WORKSHEETS

- Lesson 1: Worksheet 1, Looking at Photographs
- Lesson 1: Worksheet 2, Looking at a Book of Photographs
- Lesson 2: Worksheet 3, Documentary Photography Do's and Don'ts
- Lesson 3: Handout 1, Documentary Photography Do's and Don'ts
- Lesson 4: Worksheet 4, Aperture and Light
- Lesson 4: Worksheet 5, Motion in Photography
- Lesson 6: Worksheet 6, What Makes Things Look Beautiful
- Lesson 7: Worksheet 7, Documentary Photography Critique
- Lesson 7: Worksheet 8, Motion Photography Critique

LOOKING AT PHOTOGRAPHS

Study the photograph of _____ and answer the following questions:

1. Which different things did the photographer include in the photograph? Name as many as you can.

2. What's interesting or important that's NOT in the center of the photograph? Name as many things as you can.

3. What did you learn by looking at the image?

4. Choose one word that describes the photograph and write it below. Explain why you chose that word.

LOOKING AT A BOOK OF PHOTOGRAPHS

Select a book of photographs, look through it and then answer the following questions:

1. Find five pictures in the book you like best. Write below one word that describes each photograph.

	Page #	Descriptive word
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

2. Select one photograph that you think best explains what the book is about. Write one word below that describes the photograph.

Page # _____ Descriptive word _____

Explain why you think this photograph does a good job of representing the whole book.

DOCUMENTARY PHOTOGRAPHY DO'S AND DON'TS

As we discuss documentary photography in class, write notes about what you should and should not do as a documentary photographer.

DO

DON'T

DOCUMENTARY PHOTOGRAPHY DO'S AND DON'TS

DO:

- ... be careful to observe and photograph people or things without disrupting them.
- ... all you can to minimize changing or influencing the scene.
- ... try to draw as little attention to yourself as possible.
- ... be patient! Wait for real moments to photograph.
- ... anticipate events, actions, and changes in front of your camera so that you can get them when they happen.
- ... be ready to shoot when your shot is available.
- ... ask for permission to photograph people (before/after).

DO NOT:

- ... ask people to move or act a certain way for your picture.
- ... move objects around, even to get things out of your way. Move yourself instead.
- ... say “Hey, look over here!”, or “Smile”, or “Do that again!”, etc.

APERTURE AND LIGHT

1. You just watched an experiment about filling a cup with water. Explain how you can double the water in the cup two different ways:
2. How is filling the cup with water like allowing light to hit the film in your camera?
3. What can you adjust on your camera to control the amount of time that light hits the film?
4. What can you adjust on your camera to control the rate at which light hits the film?
5. What is the aperture of the camera?
6. Write below the numbers on your camera that describe the various apertures available.
7. The formula for f-stop is:
8. When you change the camera's aperture from 8 to 5.6, how much more light comes into the camera?
9. When you change the camera's aperture from 8 to 16, how much less light comes into the camera?

MOTION IN PHOTOGRAPHY

1. What is the camera shutter? What does it do?

2. Regarding the viewing experiment we did in class:
 - a) Describe what you saw when you blinked:

 - b) Describe what you saw when you kept your eyes open for a second:

 - c) Describe what you saw when you kept your eyes open for two seconds:

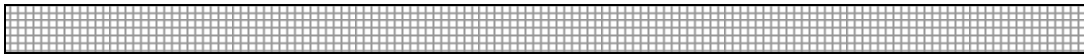
3. What numbers on your camera show shutter speed? Write all of them here, in order from fastest to slowest:

4. What does the shutter speed “100” mean?

5. Rewrite the shutter speeds from #3 above as fractions of a second:

WHAT MAKES THINGS LOOK BEAUTIFUL

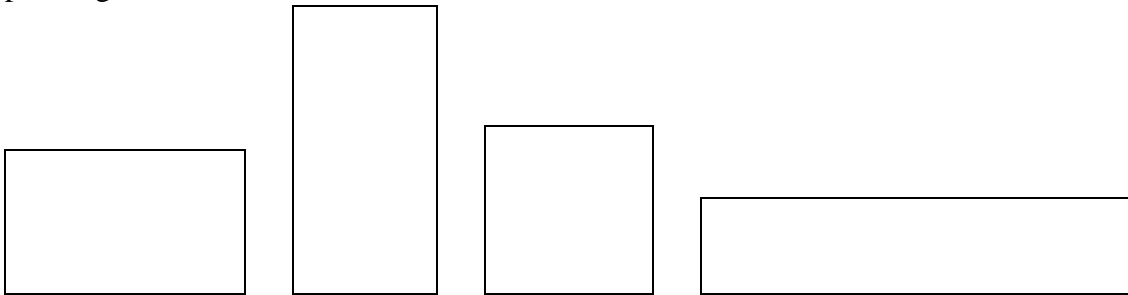
1. a) Imagine that the sketch below is the fence along the back of our school property that you see when you look out the back door. Sketch a tree in front of the fence at the place you think would look the best.



A

C

- b) After you've drawn your tree, draw a line through its centerline and label it **B**. Then measure distance **AB** or **BC**, depending on which is longest. Also measure **AC**. Then calculate the ratio of AC divided by AB (or BC).
- c) Collect the ratios calculated by your classmates and record them below. Then calculate the average of the ratios.
2. a) Look at the rectangles shown below. Pick the one that you consider the most visually pleasing.



- b) After you've picked your favorite rectangle, measure its length and width and calculate the ratio of length divided by width. Then average your ratio with your classmates. Show your calculations below.

DOCUMENTARY PHOTOGRAPHY CRITIQUE

1. Is the photograph an accurate representation of the school or a person in the school? Explain.

Critic:

Photographer:

2. Is it easy to tell what the photograph is about? If yes, why? If not, how could it have been done?

Critic:

Photographer:

3. Does the photograph show emotions? Explain. (If it's a photograph of people, does it seem to reveal what the people are feeling?)

Critic:

Photographer:

4. Did the photographer use anticipation or make a prediction in order to capture a special moment? Explain.

Photographer:

5. What problem(s) did the photographer solve to capture the moment in the photograph? How did she/he solve the problem(s)?

Photographer:

6. Is there anything in the photograph that doesn't belong there or is unnecessary?

Critic:

Photographer:

MOTION PHOTOGRAPHY CRITIQUE

1. What is the photograph about?

Critic:

Photographer:

2. Which of the following best describes the motion quality of the photograph?

- a) Subject is moving and the background is still.
- b) Both the subject and the background are moving.
- c) Subject is still while the background is moving.

Critic:

Photographer:

3. Which of one or more of the following were moving when the photograph was made: the camera, the subject, or the background?

Critic:

Photographer:

4. Is there anything in the photograph that doesn't belong there or is unnecessary?

Critic:

Photographer: