The Power of Curiosity

Inquiry-based instruction improves the learning experience in K-12 education

Research shows when people are curious about something, not only do they learn better, they learn more. It should come as no surprise, then, that inquiry-based learning is proving to be an effective education model. In fact, one research study found inquiry-based learning produces increases in affective and cognitive outcomes.[1]

Benjamin Franklin may have summed up inquiry-based learning best when he said, "Tell me and I forget, teach me and I may remember, involve me and I learn." Inquiry-based learning occurs when students discover and construct information with the teacher's guidance. It is a learner-centered model that arouses students' curiosity and motivates them to seek their own answers. As a result, learning tends to have more meaning to students.

Incorporating inquiry-based learning strategies into instruction can improve student achievement in ways beyond the academic success typically measured by assessments. While assessment scores provide us a measurement for student academic growth, true student achievement is more importantly measured through a variety of methods and factors. Can students collaborate effectively with their peers? Are their decisions and choices productive and successful? Are they authentically engaged in learning?

Some benefits include:

- Developing information literacy and critical-thinking skills
- Obtaining a deeper understanding of specific content
- Promoting self-directed learning

Increasingly, technology is the foundation of an effective inquiry-based lesson. By integrating technology, teachers give their students tools to capture their ideas, conduct research and collaborate. Many districts and classrooms consider laptops and mobile devices when implementing technology for inquiry-based learning, but few consider digital imaging solutions. However, digital cameras, printers and video offer more creative tools that enable students to create and critique within the classroom without using data on their personal phones.

How can schools help support this model in their classrooms? This Center for Digital Education (CDE) paper offers sample lesson plans that embody curiosity and inquiry. Each lesson incorporates an essential question as a goal and encourages teachers to develop activities, inviting students to discover what they want to know and pursue answers. These sample lessons and conversation prompts can be used during planning sessions with classroom teachers looking to enhance their lessons, drawing upon inquiry-based strategies with the integration of technology. The National Education Technology Plan emphasizes Universal Design for Learning (UDL) and these lessons follow the UDL format.

Getting Started with Inquiry-Based Lessons

What questions can a teacher start with in creating inquiry-based lessons? Prior to sharing content, consider pushing student thinking forward by asking:

✓ ***What do you wonder about?***

✓ ***Does this suggest any new ideas to you worth investigating?***

✓ ***What connections can you make?***

Teachers may be concerned that students won't have questions. If this is the case, following are some recommendations to address this concern:

✓ ***Post a topic as a statement prompt or a question.***

✓ ***Observe where students generate theories or consistent interests.***

As a lesson or unit draws to an end, the following actions can deepen student learning and be utilized for assessment:

✓ ***Assign a content-specific reading assignment and encourage students to bring questions generated from the reading.***

✓ ***Provide a starter statement to initiate conversation among students, during which the teacher remains silent, capturing who contributes.***

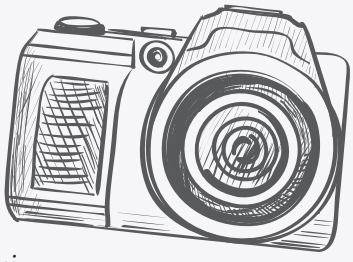
✓ ***Charge students with encouraging peers to share their thoughts.***

✓ ***Wrap up the discussion by having students write reflections about their understandings from the discussion.***

Content: Social Studies

STANDARD: *Individuals have rights and responsibilities*
ESSENTIAL QUESTIONS: *What role can photographs play in revealing injustice? What role can they play in encouraging people to take action against injustice?*

*** Can be integrated with English Language Arts standard and lesson from page 4**



STEP 1:

Establish Clear Outcomes

- ✓ Understand that people experience injustices
- ✓ Understand how people address injustice
- ✓ Recognize how experiences are shaped by membership in groups defined by race, gender, socioeconomic status, culture, ethnicity or ability

STEP 2:

Anticipate Learner Variability

Have a clear understanding of the barriers associated with the curriculum as its related to learner variability within their environment. Questions you want to ask yourself: Given the environment and the content, what is the anticipated learner variability? Based on that variability, what barriers to learning can you anticipate throughout the learning process? What are your design considerations and constraints?

STEP 3:

Measurable Outcomes & Assessment Plan

- ✓ Describe what injustices have occurred in history while making a contemporary parallel to a modern day injustice
- ✓ Have students capture images and print pictures of modern day injustice examples
- ✓ Compare and contrast the photographs of a historical injustice event to a modern day event
- ✓ Have students manipulate the color and focus of the images through software, or experiment with different photo effect 'scene modes' in the camera, and then print images again for review

Assessment Strategies: **Think Aloud, Journaling, Socratic Seminar**

STEP 4:

Instructional Experience

- ✓ Print photographs to be displayed around the room
- ✓ Have students describe what they see in a historical photograph
- ✓ Understand that photographs are not merely reflections of reality, but images that convey meanings
- ✓ Identify the mood of a photograph and determine what elements contribute to creating that mood, including color
- ✓ Analyze light, color and shadow, and how they contribute to a photograph's meaning
- ✓ Using photo editing software, manipulate the color and focus of the photograph and compare/contrast the meaning from the original
- ✓ Analyze the composition of photographs and how photographers shape meaning by how they crop images

Instructional Strategies: **Think Aloud, Journaling, Socratic Seminar**

STEP 5:

Reflection & New Understandings

How can students capture, through photography, a message conveying action against injustice? What role does color play in the photograph vs. a black and white photograph? How does perception of injustice change when color is added to the photograph?

Suggested Resources/Materials:

- **Historical photographs (either primary resources or printed)**
- **Digital camera(s)**
- **Software that can edit images (for cropping and color) or utilize the digital camera's special shooting modes for photo effects like black and white, sepia, soft focus and more**
- **Classroom printer (with capability to make photo-quality color or black and white prints)**
- **Photo paper**

Content: English Language Arts

STANDARD: *Supporting visual literacy: include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points*

ESSENTIAL QUESTION: *How do photographs convey meaning?*

*** Can be integrated with Social Studies lesson from page 3**

STEP 1:

Establish Clear Outcomes

- ✓ Describe what they see
- ✓ Describe what other image or personal experience they can recall related to this image
- ✓ Describe the photographer's purpose

STEP 2:

Anticipate Learner Variability

Prior to planning the instructional experience, teachers should have a clear understanding of the barriers associated with the curriculum as its related to learner variability within their environment. Questions you want to ask yourself: Given the environment and the content, what is the anticipated learner variability? Based on that variability, what barriers to learning can you anticipate throughout the learning process? What are your design considerations and constraints?

STEP 3:

Measurable Outcomes & Assessment Plan

- ✓ Students "read" a visual artifact (photograph) and describe it in a small group
- ✓ Students create multiple meanings as they describe the image(s)
- ✓ Students take and print their own images to generate conversation and visual literacy after working in small groups

STEP 4:

Instructional Experience

- ✓ Display a variety of photographs depicting historical events
- ✓ Jot down one word associated with each image (resource-implementing visual grammar: http://nsli.ednet.ns.ca/units/uopattach/uopnm/imcomm.pdf)
- ✓ Describe what all the images have in common
- ✓ Compare answers with classmates

Instructional Strategies: **Think Aloud (example here: https://vimeo.com/10118244); Visual Thinking (example here: https://vimeo.com/9827533); Tool from the National Archives: http://www.archives.gov/education/lessons/worksheets/photo.html**

STEP 5:

Reflection & New Understandings

Compare and contrast a historical event recreated with modern day events/characters/objects in photographs.

Suggested Resources/Materials:

- **Historical photographs (either primary resources or printed)**
- **Digital camera(s) for capturing contemporary parallel images of historical events**
- **Software that manipulates images (cropping and color)**
- **Classroom printer (with capability to make photo-quality color or black and white prints)**
- **Photo paper**

Content: Science

STANDARD: *Waves and their applications in technologies for information transfer*

ESSENTIAL QUESTIONS: *How do we measure visible light? Can you capture and measure the spectrum of light in a photograph?*

STEP 1:

Establish Clear Outcomes

- ✓ Develop and use a model to describe that waves are reflected, absorbed or transmitted through various materials.

STEP 2:

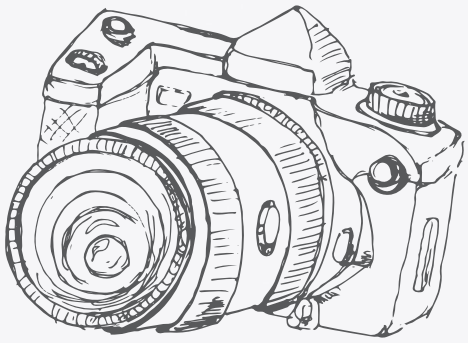
Anticipate Learner Variability

Prior to planning the instructional experience, teachers should have a clear understanding of the barriers associated with the curriculum as its related to learner variability within their environment. Questions you want to ask yourself: Given the environment and the content, what is the anticipated learner variability? Based on that variability, what barriers to learning can you anticipate throughout the learning process? What are your design considerations and constraints?

STEP 3:

Measurable Outcomes & Assessment Plan

- ✓ Photograph and describe the spectrum as coming from the light source provided
- ✓ Create a video describing their model reflecting, absorbing and transmitting waves
- ✓ Students can identify relevant components — type of wave, and various materials used to transfer information



STEP 4:

Instructional Experience

Ask students the following questions:

- ✓ How do we see light?
- ✓ How do we measure light?

Students build a pinhole camera. Examples of how to build a pinhole camera can be found here: https://www.youtube.com/watch?v=M15uXt6JjTQ

Working with cameras, both pinhole (analog) and digital, students can explore wave behavior — capturing evidence of the range of visible light and the spectrum (rainbow) within the photograph.

STEP 5:

Reflection & New Understandings

Explore the following: sound waves, water waves, microwaves and radio waves. Discover what materials reflect, absorb or transmit light better.

Suggested Resources/Materials:

- **Prism(s)**
- **Pinhole camera materials (see above link)**
- **Digital camera(s) with capability to capture videos and still images**

Content: Math

STANDARD: *Solve real-world and mathematical problems involving area, surface area and volume*

ESSENTIAL QUESTIONS: *How does the square footage of a house compare to the volume of a house? Are both important and/or necessary considerations when building a house?*

STEP 1:

Establish Clear Outcomes

- ✓ Understand the difference between area and volume
- ✓ Understand how to find both area and volume of a given space

STEP 2:

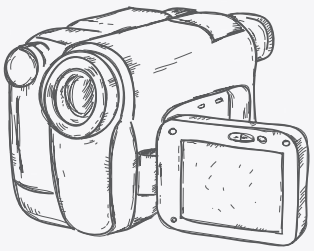
Anticipate Learner Variability

Prior to planning the instructional experience, teachers should have a clear understanding of the barriers associated with the curriculum as its related to learner variability within their environment. Questions you want to ask yourself: Given the environment and the content, what is the anticipated learner variability? Based on that variability, what barriers to learning can you anticipate throughout the learning process? What are your design considerations and constraints?

STEP 3:

Measurable Outcomes & Assessment Plan

- ✓ Students video themselves starting with area of a 2-dimensional shape and building to a 3-dimensional shape
- ✓ Students print video frames on a single photo to analyze results
- ✓ Watch the video from another group: What questions can they generate from the video?
- ✓ Distinguishing: Are area and volume the same (2-dimensional measure vs. 3-dimensional measure)? Describe the differences or similarities.

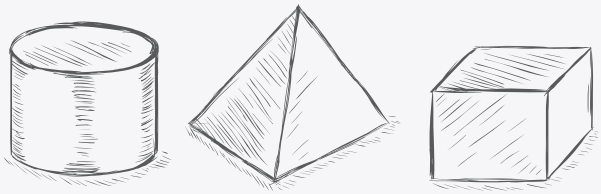


STEP 4:

Instructional Experience

Working in small groups, create a video depicting a 2-dimensional area taking shape and becoming a 3-dimensional object. Lay down a sheet of paper (or similar flat object) and increase the volume by building upon the flat object with more pieces of the same material until a 3-dimensional shape starts to take shape; video team members adding the layers to build volume. Engage small groups in discussions involving: What did we increase? What other dimensions have we added?

Instructional Strategy: **Think Aloud**



STEP 5:

Reflection & New Understandings

Have students apply understanding of area vs. volume to additional shapes (example: circle and cylinder, square to a cube).

Suggested Resources/Materials:

- **Digital cameras with video capabilities to capture video of building upon 2-dimensional shapes**
- **Classroom printer with capability to print a series of video frames on a single photo page in chronological order**
- **Photo paper**
- **Video editing software to manipulate videos (clipping video segments, adjusting volume)**

Conclusion

Students are entering a workplace vastly different than that of their parents. Employers want individuals with the ability to assemble, unify and evaluate information, as well as communicate that information. Technology, used as a tool to communicate and collaborate, is commonplace. More traditional learning models utilizing narrowly defined tasks, routine or memorization do not develop the collaborators, writers, critical thinkers and speakers needed by today's employers. To effectively prepare students, they must experience rigorous, relevant and technology-integrated projects within the classroom. Incorporating appropriate technologies — such as digital cameras, printers and video — within well-designed inquiry-based lessons provides an enriched learning environment for students and helps districts achieve these goals.

Inquiry-based instruction shifts the role from teacher-driven instruction to student-driven inquiry. It embraces the messiness of learning, fostering questions and exploration of ideas. Some may ask, "Doesn't this already occur naturally in the classroom?" If we are defining the path to knowledge for students by simply presenting fixed facts, then the response is no — curiosity loses out to memorization and regurgitation. Curriculum coverage does not equate to student learning. It's critical for educators to continuously help students become more curious over time.

Curriculum coverage does not equate to student learning. It's critical for educators to continuously help students become more curious over time.

Keeping curiosity as a priority when promoting and supporting effective learning environments can stimulate interest and engagement among all learners. Utilizing these sample lessons with integrated technology and inquiry-based strategies fosters curiosity, improves student outcomes and ultimately better prepares them for the 21st-century workplace.

The lesson plan template used for the sample lessons comes from the UDL work of Dr. Loui Lord Nelson and Dr. James Basham. For more information on the UDL instructional planning process, see: http://udl-irn.org/instructional-process/

This piece was developed and written by the Center for Digital Education custom media division, with information and input from Canon U.S.A., Inc.

Endnote

[1] *Herman J. M. & Knobloch, N. A. (2004). Exploring the effects of constructivist teaching on students' attitudes and performance. Proceeding of the 2nd Annual North Central Region AAAE Research Conference. Lafayette, IN: 21-35.*

Produced by: CENTER FOR DIGITAL EDUCATION

The Center for Digital Education is a national research and advisory institute specializing in K-12 and higher education technology trends, policy and funding. The Center provides education and industry leaders with decision support and actionable insight to help effectively incorporate new technologies in the 21st century.

www.centerdigitaled.com

For: Canon SEE IMPOSSIBLE

Canon offers a diverse selection of quality, brand name imaging equipment for all of your educational needs. From Digital SLRs for photojournalism to photography and Video equipment for professional development to media production, Canon is the one stop solution for turning your creative ideas into reality.

Canon U.S.A., Inc., headquartered in Melville, New York, is a leading provider of consumer, business-to-business, and industrial digital imaging solutions to the United States, Latin America and the Caribbean markets (excluding Mexico). Canon U.S.A. is committed to the highest level of customer satisfaction and loyalty, providing 100 percent U.S. based consumer service and support for all of the products it distributes.

For more information, please visit www.usa.canon.com/educationsales, email us at education@cusa.canon.com, or call 866.50.CANON.

© 2016 e.Republic. All rights reserved.