

## Who's Who in Fingerprinting with a Digital Microscope

Science

Intermediate: Grades 3 to 5

This learning sequence is based on “A Closer Look,” published in ISTE's *National Educational Technology Standards for Teachers: Preparing Teachers to Use Technology* (2002). This lesson has been repurposed for use with a digital microscope. *Repurposed with permission from National Educational Technology Standards for Teachers: Preparing Teachers to Use Technology, copyright © 2002, ISTE (International Society for Technology in Education), 800.336.5191 (U.S. & Canada) or 541.302.3777 (International), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute an endorsement by ISTE.*

### Purpose

Through this learning activity, students will focus on science as inquiry by:

- Researching
- Gathering and analyzing information
- Using a variety of technological and information resources, including a digital microscope
- Collaborating with classroom and global peers to investigate the scientific basis and impact of fingerprints as well as technological innovations in human identification.

### Description

Students work together in teams to learn about fingerprinting as an identification method. They analyze, compare, contrast, and classify characteristics of their fingerprint styles with those of their peers (e.g., whorl, accidental) with a digital microscope.

Then students create a class graph from the results. Students use their new knowledge to create a series of scenarios about a lost object on which they find partial fingerprints. Using the identification characteristics, students make conjectures about who the culprit is, eventually proving their theory through analysis.

### Activities Preparation

- Arrange for a local law enforcement agent to visit the class and show students how fingerprints are taken, analyzed, and shared through technology.
- Examine two Web sites: FBI Kid's and Youth Educational Page to ensure that they meet students' needs (see Tools and Resources). Additional sites may also cover fingerprint analysis.

<b>Activities: Procedure</b>	<b>Science Standards</b>	<b>NETS for Student Standards Grades 3-5</b>
<p>Introduce simple operating procedures of the digital microscope and its multimedia software features, including how to capture, edit, print, and make presentations from images.</p> <p><i>This is best done by using a computer that is attached to a projector for whole group viewing.</i></p>		
<p>As a class, introduce the idea and use of fingerprints. Complete an overview of the unit, describing the end products and the expected levels of achievement in terms of a tentative rubric. Include both a timeline and behavioral expectations.</p>		
<p>Students work in teams (approximately four per team) to fingerprint each other. To make a fingerprint: (1) use a graphite pencil to make a swatch of “ink” on a piece of paper, (2) have a student press a finger on the graphite and then press that finger onto the sticky side of a piece of cellophane tape, and (3) stick the tape onto a piece of paper for analysis.</p>		
<p>Have students look at their fingerprints through the digital microscope under different magnifications (always starting at 10X). Students print images of their fingerprints for classroom display and analysis. While taking the fingerprints, provide information on the rationale and development of the fingerprinting process. Check the FBI's Web site; its activities periodically change. If appropriate, use an online activity with students.</p>	<b>*5-8 SCI A1</b>	<b>1, 5, 9</b>
<p>Students create a class graph based on their own fingerprint characteristics. Be sure to debrief the class on the graph's results and present generalizations based on the graph.</p>	<b>K-4 SCI A1</b>	<b>5, 7, 9</b>
<p>When completed fingerprints are displayed, discuss the characteristics students see in the prints. Record their observations in a prominent place. Assign groups to research the legally described characteristics of fingerprints. Invite an expert from the local law enforcement agency to discuss the use of fingerprints in investigations. Groups research the historical development of fingerprinting and the reasons for its widespread use.</p>	<b>K-4 SCI F5</b>	<b>7, 8</b>
<p>In groups, students identify their own fingerprint characteristics. Groups put together a short presentation from the finger print images collected from the digital microscope. Students should be able to describe the fingerprints of the group in terms of the prints' characteristics, similarities and differences among individual prints.</p>	<b>K-4 SCI A1</b>	<b>3</b>

<b>Activities: Procedure</b>	<b>Science Standards</b>	<b>NETS for Student Standards Grades 3-5</b>
Have each team identify one person in the group who has lost an item. Write a scenario describing how the evidence contains partial fingerprints from the owner. (Caution: Review the groups' identifications of culprits, being sensitive to how "suspects" might perceive their roles.)	<b>K-4 SCI A1 5-8 SCI A1, C1</b>	<b>1, 5</b>
Have each fingerprint mystery solved by another group. Each group must provide a justification for its solution and any concerns it has about misidentifying the culprit. The fingerprint should be identified according to the characteristics learned by the class.	<b>K-4 SCI A1</b>	<b>5, 9</b>
Post scenarios and findings on the Web for other classes to investigate.	<b>K-4 SCI A1</b>	<b>7</b>
For further analysis, ask the students: <ul style="list-style-type: none"> <li>• Can fingerprints be altered?</li> <li>• How are fingerprints used in electronic identification?</li> <li>• Have you seen touch pads used for identification as part of a story in a movie? Do they really exist?</li> </ul>	<b>K-4 SCI A2, C3</b>	<b>3, 4</b>

\* Science standards indicate grade levels (K-4, 5-8, and 9-12) in front of the actual standard(s) number (e.g., K-4 SCI A2, C3, E1).

<b>Tools and Resources</b>	<b>Comments</b>
<p><b>HARDWARE:</b> Computers Digital microscopes</p> <p><b>SOFTWARE:</b> Digital microscope software, Word-processing, spreadsheet, graphing</p> <p><b>OTHER:</b> FBI Kid's and Youth Educational Page: <a href="http://www.fbi.gov/kids/k5th/whatwedo2.htm">www.fbi.gov/kids/k5th/whatwedo2.htm</a> Search engines such as HotBot (<a href="http://www.hotbot.com">www.hotbot.com</a>) to generate general lists of fingerprint sites</p>	<p>At first, one of our biggest concerns was the fingerprint scenario. We worried that students could become labeled or have their feelings hurt by being identified by a group as a "culprit." To solve this problem, we asked for student volunteers to place their names in a box if they were willing to be the subject of a hunt. This made the exercise fun for the students who chose to volunteer.</p> <p>This lesson sequence can easily be adapted for use with different subject matter, e.g. coins, footprints.</p>

## Assessment

Criteria	Level 4	Level 3	Level 2	Level 1	Score
Collaboration	Student works cooperatively with group to complete the activity, emerging as an effective collaborator who supports the ideas and suggestions of his/her peers.	Student is able to work cooperatively with group to complete the activity, but may not be receptive to partners' ideas.	Student simply follows directions of group and makes little effort to actively contribute.	Student is unable to work cooperatively with group to complete the activity. Requires continual intervention by teacher.	
Procedure	Student correctly follows every aspect of the procedure and supplements procedure with effective and inventive additions.	Student follows critical aspects of procedure, but has difficulty responding effectively to problems.	Student correctly follows some aspects of procedure, but makes crucial mistakes or skips some important steps.	Student does not correctly follow many aspects of the procedure.	
Data and Observations	Data and observations are complete and correct, with all relevant fingerprint information included. Student provides a level of detail and organization that goes above and beyond requirements.	Data and observations are complete and correct.	Data and observations are incomplete or do not include sufficient details. Relevant information may be missing.	Data and observations are incorrect or missing entirely. Relevant information is missing.	
Conclusions and Explanations	Conclusions and explanations are complete and supported by student's data. Student provides a level of detail and depth that goes above and beyond requirements.	Conclusions and explanations are complete and supported by student's data. Relevant data and observations and referenced where appropriate.	Conclusions and explanations are incomplete not supported by sufficient details. Relevant data and observations are not referenced.	Conclusions and explanations are missing or do not make sense given student's data and observations.	

This rubric was put together with the “Rubric Wizard” tool at [www.taskstream.com](http://www.taskstream.com)

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## Credits and contact information

This lesson sequence was adapted from a previously published piece *Who's Who in Fingerprinting* (2000) written by Jane Gorder Jefferson Elementary School, Spokane, Washington ([janeg@sd81.k12.wa.us](mailto:janeg@sd81.k12.wa.us))

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