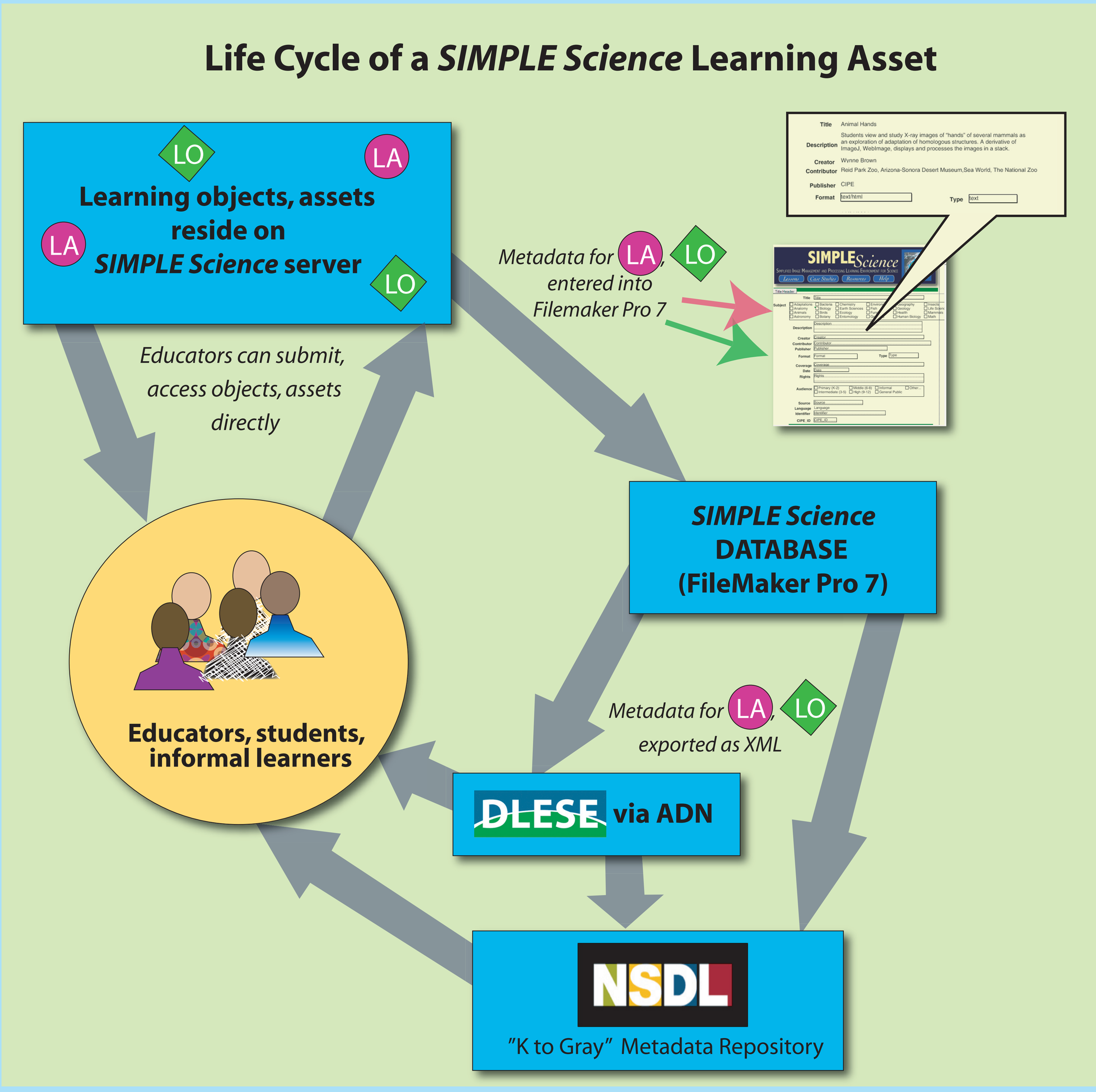
Life Cycle of a *SIMPLE Science* Learning Asset



Accessibility and usability

Web site accessibility refers to the ability of people with disabilities to use the Internet. CIPE staff will run ***SIMPLE Science*** pages through Watchfire's Bobby, which tests Web pages using the guidelines established by the World Wide Web Consortium's (W3C) Web Access Initiative (WAI), as well as Section 508 guidelines from the Architectural and Transportation Barriers Compliance Board (Access Board) of the U.S. Federal Government.

Just because a Web site is accessible does not necessarily mean that it is also usable. ***SIMPLE Science*** pages will be intuitive, attractive, and will meet the needs of educators, students, informal learners, and the general public.

Standards-based lessons

All the ***SIMPLE Science*** learning objects will be searchable, cross-referenced, and correlated to the National Science Education Standards. Standards addressed will include, among others:

Science as Inquiry

Abilities Necessary to do Scientific Inquiry: Students will identify questions and concepts that guide scientific investigations; design and conduct scientific investigations; use technology and mathematics to improve investigations and communications; formulate and revise scientific explanations and models using logic and evidence; recognize and analyze alternative explanations and models; communicate and defend a scientific argument.

Science Content

Life Science: Interdependence of organisms.

Earth and Space Science: Energy in the earth system; Science and Technology: Understandings about science and technology.

Science in Personal and Social Perspectives: Understanding natural resources, environmental quality, natural and human-induced hazards, and science and technology in local, national, and global challenges.

Evaluation

WestEd will evaluate the ***SIMPLE Science*** project. Two lessons will be tested on groups of 450 students on the following grounds:

- Are the ***SIMPLE Science*** lessons of sound instructional quality and in an easily usable form?
- Do the ***SIMPLE Science*** lessons enhance students' knowledge of science content and practice as well or better than traditional forms of classroom instruction?

Pre- and post-lesson surveys will be administered to students to assess their knowledge and skills before and after each lesson. WestEd will compare changes in student learning between treatment (those participating in the ***SIMPLE Science*** lesson) and comparison (those who are taught the same content but not through the ***SIMPLE Science*** lesson) groups of students to measure the effect of the lessons.

An initial pilot test evaluation group will be students at Vail High School in Tucson.

The field test experimental group will include students from

- LAUSD,
- Oregon Episcopal School,
- Roosevelt High School,
- Latin School of Chicago,
- Northview High School, and
- Neshaminy School District.

Visit www.simplescience.org

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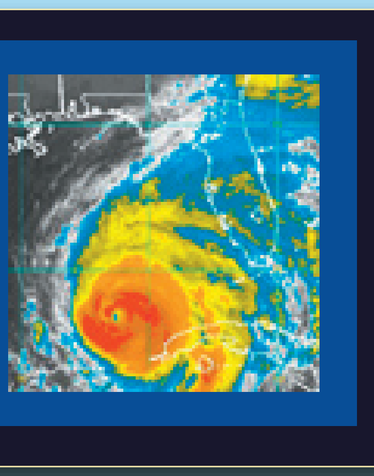
SIMPLE Science

SIMPLIFIED IMAGE MANAGEMENT AND PROCESSING LEARNING ENVIRONMENT FOR SCIENCE

Lessons | Case Studies | Resources | Help



A New Tool for Learning, Teaching, and Collaboration

Abstract

Since 1992 the Center for Image Processing in Education (CIPE) has successfully introduced digital image processing and analysis (IPA) to thousands of K-12 educators. However, mainstream use of the technology is still hampered by barriers such as the complexity of image analysis programs and the scarcity of readily usable data.

The goal of the ***Simplified Image Management and Processing Learning Environment for Science*** (SIMPLE Science) is to help overcome those barriers by

(a) making IPA accessible to mainstream educators and the public as an easy-to-use learning tool,

(b) providing educator access to extensive and updateable archives of imaging data, and

(c) designing a pedagogical structure that helps educators use imaging data in a manner that supports attainment of specific middle-school national education standards.

In this poster presentation, we describe the project, outline its essential elements, and report on our progress to date. Included in the presentation will be a working demonstration of a ***SIMPLE Science*** lesson and a listing of our metadata structure. (NSF Award No. 333723, Principal Investigator: Steven Moore)

Project staff

- ***Steven Moore, Ph.D., Principal Investigator, Center for Image Processing in Education (CIPE)***
- ***Wynne Brown, Project Director, CIPE***
- ***Hedley Bond, Technical Support Specialist, CIPE***
- ***Yuhong Liu, Programmer, CIPE***
- ***Kris Rees, Project Administrator, CIPE***
- ***Sandy Stoll, Administrative Assistant, CIPE***
- ***Don Haviland, Ph.D., Project Evaluator, WestEd***

Advisors

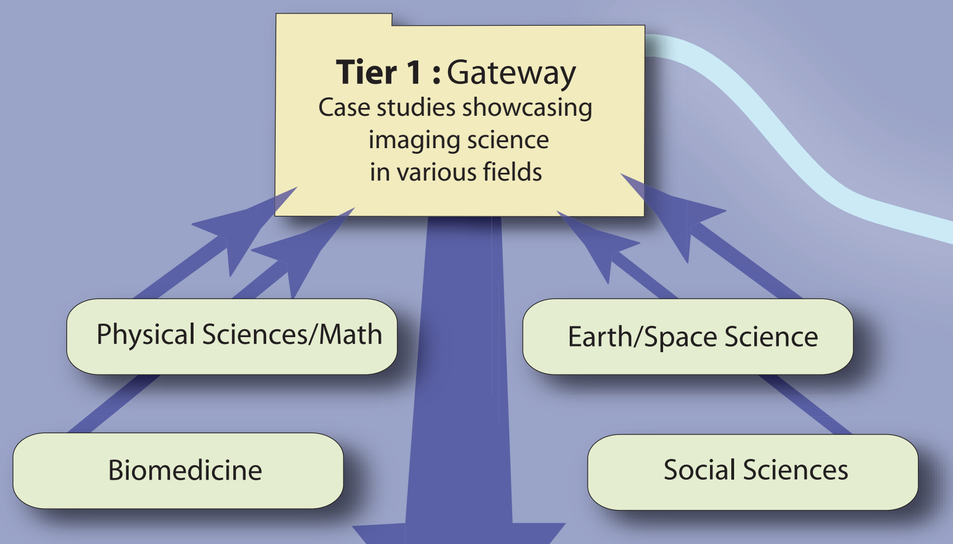
- ***Robert Kolvoord, Ph.D., Professor, College of Integrated Science and Technology, James Madison University***
- ***Mike Charles, Ph.D., University of the Pacific***
- ***Chuck Untulis, Scientist, Hewlett-Packard Laboratories***

Collaborating organizations

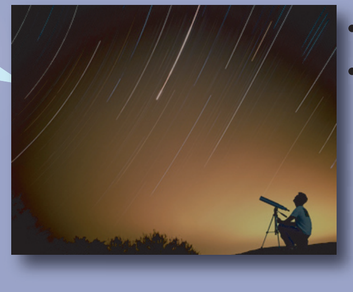
- the National Science Digital Library
- National Science Foundation
- James Madison University
- University of the Pacific
- Hewlett Packard Company
- Los Angeles Unified School District, California
- Oregon Episcopal School, Oregon
- Roosevelt High School, Missouri
- Northview High School, Indiana
- Neshaminy School District, Pennsylvania
- Vail High School, Arizona
- Latin School of Chicago, Illinois

Structure of *SIMPLE Science*

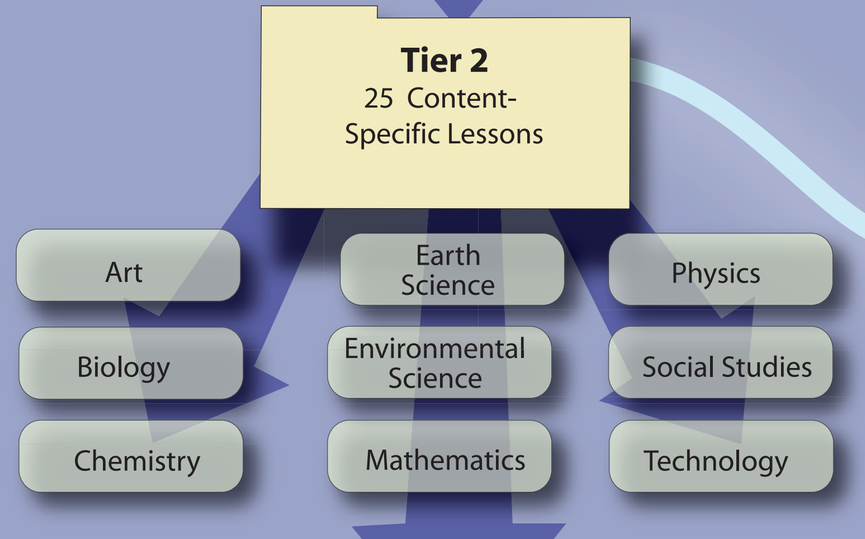
The three-tiered structure scaffolds a learner's use of IPA from basic explorations of how imaging is used in various areas of science to original research on data available from the ***SIMPLE Science*** archive.



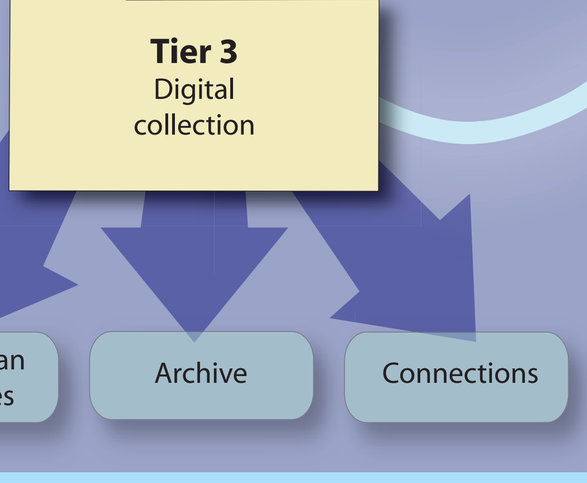
Target Audience



- Mainstream teachers
- Informal learners
  - *General public*
  - *Patrons of science education centers and museums*



- Experienced users of Tier 1
- Experienced, IPA-based teachers



- Experienced users of Tier 1, Tier 2
- Experienced, IPA-based educators

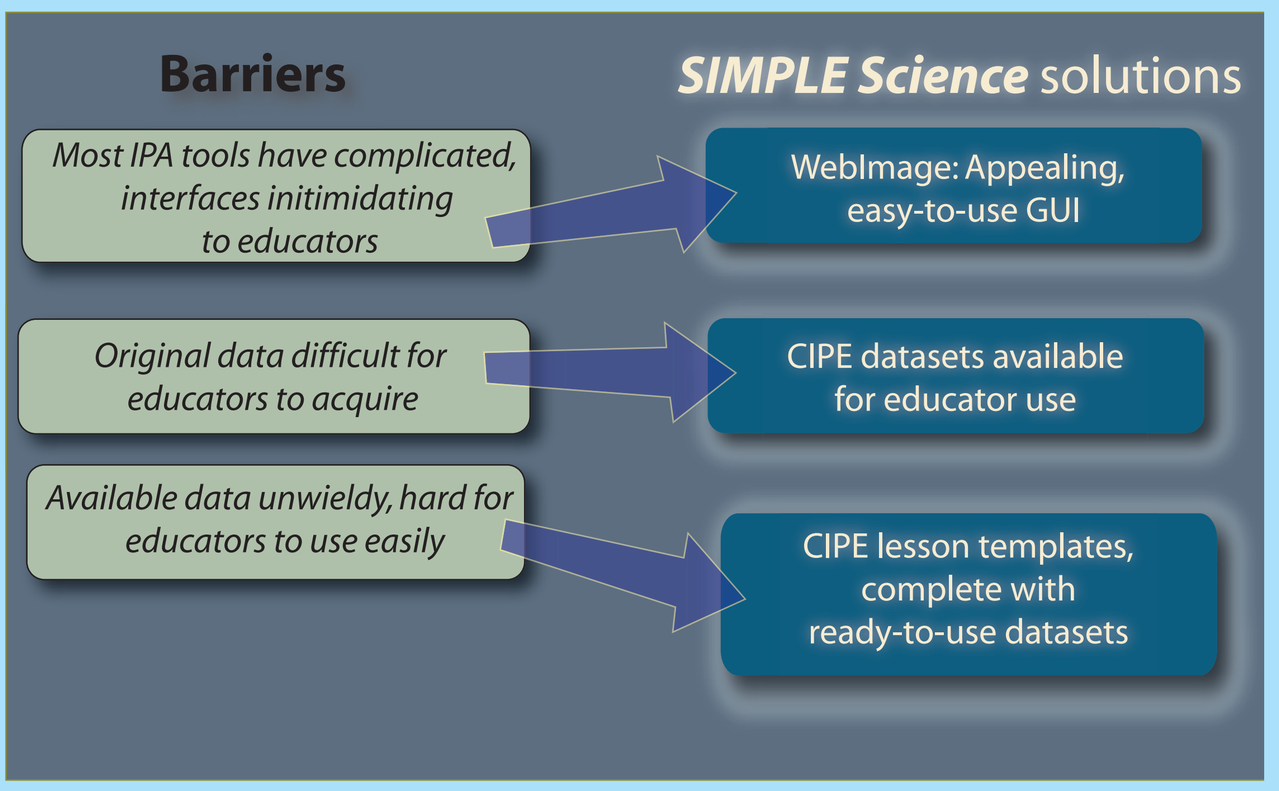
Project design

During a 24-month period, collaborators will implement the ***SIMPLE Science*** project objectives:

(1) Establish and maintain close interaction with other NSDL projects and the Core Integration effort,
(2) Adapt the software interface from CIPE's Visualizing Addiction and Guiding Light for ***SIMPLE Science***,
(3) Develop plugins for ImageJ to enhance its usefulness,
(4) Adapt lessons from CIPE's existing materials, create new lessons, and construct the image archive to be integrated into ***SIMPLE Science***,
(5) Develop an updateable database structure for ***SIMPLE Science's*** image and learning object archive,
(6) Assemble the software interface, lessons, and database for ***SIMPLE Science*** and test the system in schools nationally,
(7) Develop and implement a plan for national self-sustaining dissemination of ***SIMPLE Science***,
(8) Evaluate accomplishment of the project objectives, the usability of ***SIMPLE Science***, and its effectiveness in helping students achieve specific educational standards.

Statement of need

Despite 12 years of success in introducing IPA to the K-14 community, CIPE believes that much more can be done to overcome the barriers to using image-based learning as an instructional tool.



Target audience

SIMPLE Science targets teachers and schools throughout the nation who need the help most and have the potential and enthusiasm to implement the project goals in a way that supports the spirit and goals of the NSDL program:

- Teachers from schools that have large numbers of poor students and students from ethnic groups underrepresented in information technology fields,
- Teachers with good technical and scientific training but limited exposure to IPA,
- Schools that have computing resources but lack more effective ways to use those resources to promote inquiry-based learning in science, technology, engineering, and mathematics (STEM) courses.
- Middle school students,
- Informal learners.

Introducing WebImage . . .

For 12 years, CIPE has relied on three IPA programs for materials and workshops: NIH Image, Scion Image, and, most recently, ImageJ. ImageJ is an open source, public domain image processing program developed at NIH by Wayne Rasband.

Its advantages:

- freely available, platform-independent imaging software,
- wide array of available tools and functions,
- frequent updates,
- large user base of support provided by an active global community of scientists who contribute additional plugins and macros.

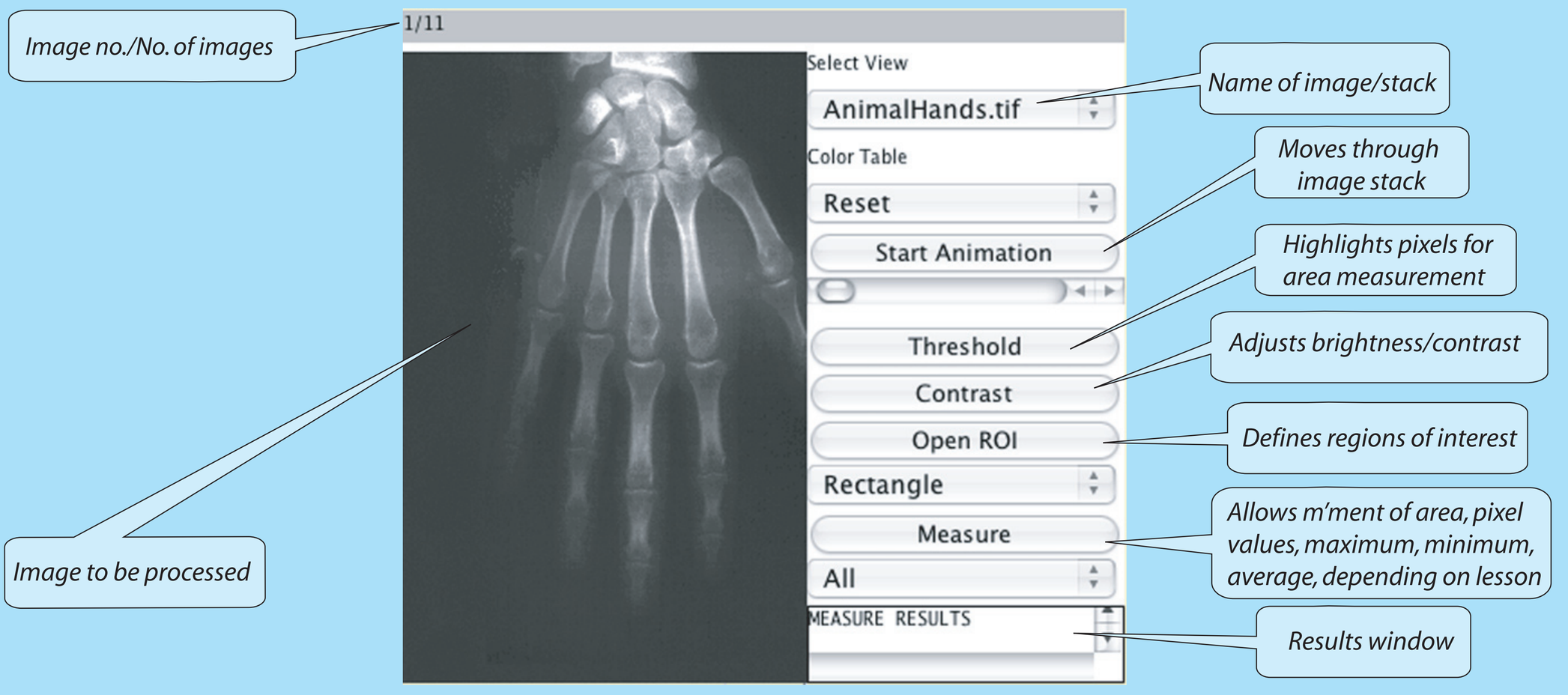
Disadvantages:

- Mainstream educators find ImageJ's many choices intimidating,
- Teachers and students need lengthy step-by-step guidance.

WebImage, CIPE's ImageJ derivative, makes imaging more accessible by:

- running as an applet within a Web page,
- providing only those functions needed for a specific lesson,
- presenting a simpler and more intuitive graphical user interface,
- threading many basic functions, such as image display, and processing of regions of interest, making the program extremely responsive.

WebImage provides an excellent springboard for students and teachers preparing to tackle the complexity of professional image analysis software.



Pedagogical structure

The lessons in ***SIMPLE Science*** rely on the 5E educational model, which is applied below to one lesson, "Animal Hands."

The 5E Model and a Lesson on "Animal Hands"

Engage — Students are shown photographs of various animals walking, flying, swimming, or grasping food, along with text about the animals' way of life. They are then asked: How do the animal "hands" vary according to their function?

Explore — Using *WebImage*, students enhance and examine X-ray images of zoo animals' hands, comparing number of individual fingers (if any), claws, relative length and thickness of bones, and shape of the flesh covering the bones.

Explain — Using CourseBuilder's fill-in-the-blank quiz format, students try to predict which hands go with which animals, based on the animal's lifestyle. When they answer the question correctly, further explanation is provided.

Elaborate — Students can use WebImage to examine the second stack of images for further exploration of other animal hands.

Evaluate — Students take a self-administered multiple-choice quiz to see if they can identify the animal hands correctly.