Science Learning Activity Types[1, 2]

Of the thirty-eight science activity types that have been identified to date, twenty-seven are focused upon helping students build their knowledge of science concepts and procedures. Seventeen of the knowledge-building activity types emphasize *conceptual* learning and ten of these involve *procedural knowledge* employed in science learning. Eleven of the activity types describe activities that facilitate students' knowledge expression. The three sets of activity types (conceptual knowledge building, procedural knowledge building, and knowledge expression) are presented in the tables that follow, including compatible technologies that may be used to support each type of learning activity.

Conceptual Knowledge Building Activity Types

As the table of activity types below shows, teachers have a variety of options available to assist students in building science conceptual knowledge.

Table 1: Conceptual Knowledge Building Activity Types

Activity Type	Brief Description	Possible Technologies
Read Text	Students extract information from textbooks, laboratories, etc.; both print-based and digital formats	Web sites, electronic books, online databases
View Presentation/ Demonstration	Students gain information from teachers, guest speakers, and peers; synchronous/asynchronous, oral or multimedia	Presentation software, document camera, video
Take Notes	Students record information from lecture, presentation, group work	Word processor, handheld computer, wiki
View Images/Objects	Students examine both still and moving (video, animations) images/objects; print-based or digital format	Video, document camera, digital microscope, digital camera, Web sites
Discuss	Students engage in dialogue with one or more peers or the entire class; synchronous/asynchronous	Discussion board, email, chat, videoconferencing, interactive white board
Do a Simulation	Students interact with live or digital simulations that demonstrate science content	Curriculum software, Web-based simulations, personal/student response systems
Explore a	Students gather information/conduct	Web search engines

[1] Suggested citation (APA format, 6th ed.):
Blanchard, M. R., Harris, J., & Hofer, M. (2009, February). *Science learning activity types*. Retrieved from College of William and Mary, School of Education, Learning Activity Types Wiki: http://activitytypes.wmwikis.net/file/view/ScienceLearningATs-Feb09.pdf

Topic/Conduct background research	background research using print-based and digital sources	
Study	Students study terminology, classifications, test review, etc.	Web sites, quiz software/Web sites, wikis
Have an Evocative Experience	Students observe phenomena that raises scientific questions from physical objects, organisms, or digital media	Video, digital microscope, document camera, software
Distinguish Observations from Inferences	Students distinguish directly observed sensory input from inferences requiring background knowledge	SmartBoard, document camera, video, audio recording
Develop Predictions, Hypotheses, Questions, Variables	Students develop, think about predictions, & select pertinent hypotheses, testable questions, and variables	Word processor, SmartBoard, Inspiration, wiki
Select Procedures	Students choose relevant instruments and methods to test questions	Probeware, digital stirrer, video, audio recorder, digital camera, digital timer, graphing calculator
Sequence Procedures	Students sequence the order of procedures to collect relevant data	Simulation, curriculum software, word processor
Organize/Classify Data	Students create a structure to organize data collected	Database, spreadsheet, Inspiration
Analyze Data	Students describe relationships, understand cause-and-effect, prioritize evidence, determine possible sources of error/discrepancies, etc.	Spreadsheet, TinkerPlots, Inspire Data, graphing calculator, statistical software
Compare Findings with Predictions/ Hypotheses	Students evaluate their findings in light of their hypotheses	Spreadsheets, TinkerPlots, InspireData
Make Connections between Findings & Science Concepts/Knowledge	Students link their findings to concepts in the text/research publications	Web search engines

Procedural Knowledge Building Activity Types

In science classrooms, building conceptual knowledge frequently requires that students use materials and "process" skills (Millar & Driver, 1987) as they develop scientific knowledge. The essential features of classroom inquiry promoted by the National Science Education Standards often engage students in procedures and the use of scientific equipment (NRC, 2000). We term this kind of understanding *procedural knowledge*, as detailed in the table below.

Table 2: Procedural Knowledge Building Activity Types

Activity Type	Brief Description	Possible Technologies
Learn Procedures	Students learn how to safely and appropriately handle equipment	Video, document camera
Practice	Students practice using equipment, software, measuring, testing what they have designed, etc.	Web-based software or software tutorials, probeware, document

		camera
Prepare/Clean Up	Students organize equipment or information for writing	Document camera, projector
Generate Data	Students generate data (e.g. heart rate, cooling water temperatures) by manipulating equipment or animations	Software, graphing calculators, probeware, digital balance
Collect Data	Students collect data with physical objects or simulations	Graphing calculators, video, audio, digital cameras, digital microscopes, web-based data sheets
Compute	Students calculate results from data	Scientific calculator, spreadsheet
Observe	Students make observations from physical or digital experiences	Document camera, WebCams, digital/video cameras, digital microscopes
Collect Samples	Students obtain samples/items to study (soil, bird songs, video footage)	Digital cameras, videos, audio recorder
Do Procedures	Students run trials or otherwise carry out steps to investigations (e.g. use electronic balance)	Simulation, curriculum software
Record Data	Students record observational and recorded data in tables, graphs, images, lab notes	Spreadsheet, word processor, database, handheld computer, tablet computers

Knowledge Expression Activity Types

While in many cases teachers may want their students to express similar understandings of course content, at other times they will want to encourage students to develop and express their own understandings of a given topic. The following eleven *knowledge expression activity types* afford students opportunities to share and further develop current understandings of concepts, procedures, and relationships.

Table 3: Knowledge Expression Activity Types

Activity Type	Brief Description	Possible Technologies
Answer questions	Students respond to teacher, peer, written, or digitally posed questions	Curriculum software, word processor, quiz software, Web sites, discussion boards
Write a Report	Students write a laboratory or research report	Word processor, presentation software, video, wiki, podcast
Do a Presentation or Demonstration	Students present or demonstrate laboratory or research findings, or other course learning (e.g. a system of the human body)	Presentation software, video, document camera, podcast, video, moviemaking software
Take a Quiz or Test	Students respond to questions on a test or quiz	Curriculum software, word processor, quiz software, Web sites, student response

		systems
Debate	Students discuss opposing viewpoints embedded in science content knowledge, linked to ethics, nature of science, personal preferences, politics, etc.	Videoconferencing, discussion board, personal/student response system
Develop or Build a Model	Students physically or digitally create models to demonstrate content knowledge, conduct experiments, etc. (e.g. cell model, rubber band car)	Modeling software, drawing tools, Inspiration
Draw/Create Images	Students physically or digitally draw or create images (from labs, observations, etc.)	Drawing software, digital camera, image editing software
Concept Mapping	Students participate in or develop graphic organizers, semantic maps, etc.	Inspiration/Kidspiration, interactive whiteboards, drawing software
Play a Game	Students participate in games; group or individual; digital or physical; original or pre-made.	Curriculum software, personal/student response systems, web-based games
Develop a Game	Students develop a physical or digital interactive game	Word processor, web authorizing tool, videogame development software (e.g. MIT Media Lab)
Create/Perform	Students create and/or perform a script, rap, song, poem, collection, invention, exhibit, etc.	Video, audiorecorder, digital camera, YouTube, document camera, word processor, moviemaking software, wiki, web authorizing software, presentation software

References:

Millar, R. & Driver, R. (1987). Beyond Processes. *Studies in Science Education, 14,* 33-62.

National Research Council. (2000). *Inquiry and the national science education standards.* Washington, DC: National Academy Press.