Science Learning Activity Types[1, 2]

Of the forty science activity types that have been identified to date, twenty-eight are focused upon helping students build their knowledge of science concepts and procedures. Seventeen of the knowledge-building activity types emphasize *conceptual* learning and eleven of these involve *procedural knowledge* employed in science learning. Twelve 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. The technologies listed in the tables are meant to be illustrative. The taxonomy authors do not necessarily endorse the specific software titles and/or Web sites listed.

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, magazines
Attend to Presentation/ Demonstration	Students gain information from teachers, guest speakers, and peers; in person or via video, oral or multimedia	Presentation software, document camera, video
Take Notes	Students record information from lecture, presentation, group work	Word processing software, wiki, concept mapping software
View Images/Objects	Students examine both still and moving (e.g., video, animations) images/objects; print-based or digital format	Document camera, digital microscope, digital camera, video,(e.g., documentaries or debates), Web sites
Discuss	Students engage in dialogue with one or more peers or the entire class; synchronous/asynchronous	Online discussion fora, email, chat, blog, videoconferencing, interactive white board

[1] Suggested citation (APA format, 6th ed.):
Blanchard, M. R., Harris, J., & Hofer, M. (2011, 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-Feb2011.pdf

Participate in a Simulation	Students interact with live or digital simulations that enable students to explore science content	Curriculum software, Web-based simulations, student response systems ("clickers")
Explore a Topic/Conduct background research	Students gather information/conduct background research using print-based and digital sources	Web search engines, digital archives
Study	Students study terminology, classifications, test review, etc.	Web sites, quiz software, online text supplements, wikis
Observe Phenomena	Students observe phenomena that raise scientific questions from physical objects, organisms, or digital media	Video clips, digital microscope, document camera, presentation software
Distinguish Observations from Inferences	Students distinguish directly observed sensory input from inferences requiring background knowledge	Interactive whiteboard, document camera, video clips, audio recording
Develop Predictions, Hypotheses, Questions, Variables	Students develop/think about predictions and select pertinent hypotheses, testable questions, and variables	Word processing software, interactive whiteboard, concept mapping software, wiki
Select Procedures	Students select procedures and accompanying instruments to test hypotheses and/or answer 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 processing software
Organize/Classify Data	Students create a structure to organize data collected	Database, spreadsheet, concept mapping software
Analyze Data	Students recognize patterns, describe relationships, understand cause-and-effect, prioritize evidence, determine possible sources of error/discrepancies, etc.	Spreadsheet, TinkerPlots, graphing calculator, statistical software
Compare Findings with Predictions/ Hypotheses	Students evaluate their findings in relation to 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 and Practice Safety Procedures	Students learn how to safely and appropriately handle equipment	Video clips, document camera
Measure	Students learn how to make measurements appropriately with specific tools (e.g., graduated cylinder, motion sensor)	Probeware, content-specific interactive tools (e.g., ExploreScience)
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 the laboratory	Document camera, projector
Carry Out Procedures	Students run trials or otherwise carry out steps to investigations (e.g. use an electronic balance)	Simulation, curriculum software
Observe	Students make observations from physical or digital experiences	Document camera, WebCams, digital/video cameras, digital microscopes
Record Data	Students record observational and previously recorded data in tables, graphs, images, lab notes	Spreadsheet, word processing software, database, handheld computer, tablet computers
Generate Data	Students generate data (e.g. heart rate, cooling water temperatures) by manipulating equipment or animations	Curriculum 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 sets
Collect Samples	Students obtain samples/items to study (e.g., soil, bird songs, video footage)	Digital cameras, videos, audio recorder
Compute	Students calculate results from data	Scientific calculator, spreadsheet

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 twelve *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
Respond to questions	Students respond to teacher-supplied, peer-written, published, or digitally posed questions (e.g., that require short answers, explanations, or elaborations)	Curriculum software, word processing software, quiz software, Web sites, online discussion fora
Write a Report	Students write a laboratory or research report	Word processing software, presentation software, video creation software, wiki, podcast
Create an Image	Students create an image to demonstrate their knowledge of a science concept and/or process	Drawing software, digital camera, comic creation software,
Present or Demonstrate	Students present or demonstrate laboratory or research findings, or other course learning (e.g. a system of the human body)	Presentation software, video creation software, document camera, podcast, Glogster
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, concept mapping software
Draw/Create Images	Students physically or digitally draw or create images (from labs, observations, etc.)	Drawing software, digital camera, image editing software
Develop a Concept Map	Students participate in or develop graphic organizers, semantic maps, etc.	Concept mapping software, 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 processing software, web authorizing software, videogame development software (e.g. MIT Media Lab)
Create/Perform	Students create and/or perform a script, rap, song, poem, collection, poster, invention, exhibit, etc.	Video, audiorecorder, digital camera, document camera, word processing software, Glogster, video creation software, wiki, Web authoring 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.