# Science Learning Activity Types[1, 2]

Of the 38 science activity types that have been identified to date, 27 are focused upon helping students build their knowledge of science concepts and procedures. Seventeen of the knowledge-building activity types emphasize *conceptual* learning and 10 of these involve *procedural knowledge* employed in science learning. Eleven of the activity types describe activities that facilitate students' knowledge expression. The three categories 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 Topic/Conduct background research | Students gather information/conduct background research using print-based and digital sources | Web search engines |

[1] Blanchard, M. R., Harris, J., & Hofer, M. (2009, March). *Operationalizing TPACK for educators: The activity types approach to technology integration*. Part of a symposium presented at the Society for Information Technology and Teacher Education (SITE) annual conference, Charleston, SC.

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|---|---|---|
| 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 |

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|---|---|---|
| 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 11 *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 |

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| 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.