

Alaska Science Consortium

LEARNING CYCLE MODEL (LCM)

GEAR- UP	Mentally engages and motivates students. Excellent time to gain information on student preconceptions. Similar to “anticipatory set” or “engagement”.
EXPLORE	Hands-on, minds-on inquiry activities that provide an opportunity for students to discover a newer explanation for an event or concept.
GENERALIZE	Questioning strategies that help students to verbalize their new discoveries and identify questions to be tested.
EXPERIMENT	Students design and conduct an experiment (fair test).
INTERPRET	Students display and interpret the data that they have collected.
APPLY	Students apply newly learned concept. Activities should help students to recognize the universal nature of the concept (i.e. How does this concept operate in a context different than the one we just explored?)
ASSESSMENT TASK AND RUBRIC	Performance based assessment is an approach to assessing student knowledge by asking students to complete specified tasks and then scoring their performance based on a pre-determined set of criteria that has been precisely defined. This assessment is separate from the instructional sequence of the lesson.

Stages of the ASC Learning Cycle Model (LCM)

GEAR-UP

Mentally engages and motivates students. Excellent time to gain information on student preconceptions. Similar to “anticipatory set” or “engagement”.

Teacher Behaviors

- Presents a stimulating experience that will engage student interest and help focus on this instructional moment
- Assesses student preconceptions (what do students know or think they know about the concept or topic) by asking questions that include what, where, when, and why about the science concept
- Documents student preconceptions and/or knowledge by using a check list, sticky note, whole class chart, etc
- Provides for transitions into explorations

Student Behaviors

- Engages in activities
- Verbalizes or shows evidence of preconceptions
- Accepts others preconceptions as valid

Examples

- Discrepant Event
- Concept map (webbing)
- Puzzles, games
- Current events
- Mysteries
- Poems, stories, movies, readings
- Environmental issues
- Invention/design challenges
- KWL, KWHL, OWL charts

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EXPLORE

Inquiry activities to help students become familiar with materials, test preconceptions, conjecture, and/or “mess around with” cause/effect ideas.

Provides an opportunity for students to discover a newer explanation for an event or concept. It is important for the teacher to value and provide ample time and opportunity for personal explorations by students.

Teacher Behaviors

- Provides activities that starts with current level of student understanding (may involve multiple starting points for a wide range of students)
- Acts as a facilitator in a variety of activities that target skills and the target concept
- Observes and listens to students as they interact
- Encourages varied observations and conjectures
- Asks inquiry oriented questions
- Provides time for students to think and reflect
- Encourages cooperative learning
- Documents successes for assessment

Student Behaviors

- Asks clarifying questions
- Uses a variety of methods to interact
- Works cooperatively with peers and gains insights from their activities
- Makes careful observations, recordings, measurements, and classifications
- Identifies and seeks to expand personal understandings of the concept or phenomena
- Shares conjectures and suspends judgment while discussing tentative alternatives

Examples

- Materials based, open ended manipulations
- Guided discoveries
- Student led investigations
- Simulations, creative drama
- Internet search or other research

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GENERALIZE

Questioning strategies that help students to verbalize their new discoveries and identify questions to be tested.

Teacher Behaviors

- Uses at least two open ended questions (not yes or no answers) to encourage students to explain their observations and findings in their own words
- Provides definitions, new words, and explanations after students develop a need for the technical terms and definitions
- Listens and encourages students to discuss ideas among themselves
- Asks for clarification and justification
- Helps students to compare their new understandings to their original preconceptions
- Documents new understandings of concepts (conceptual growth)
- Determines if additional time should be spent exploring
- If moving to the experiment phase, assists students in refining their testable question

Student Behaviors

- Interact in a positive, supportive manner
- Describe their observations and discoveries
- Listen and question other student ideas
- Distinguish between observations and inferences
- Identify other questions that arise during the questions

Examples

- Revisit concept maps
- Use convergent questions to help student verbalize their newly discovered concepts. Avoid yes or no questions
- Make “our laws” charts or finish KWL or KWHL charts
- Identify testable questions

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EXPERIMENT

Students design and conduct an experiment (fair test). This stage is distinguished from the conjecturing that occurs during the EXPLORE stage by the nature of the testing that occurs. Students are out to develop proof of their hypotheses, so that they can say with conviction “under these circumstances, this will happen”.

Teacher Behaviors

- Assists students as they refine their testable questions
- Helps students design effective data collection and display plans
- Helps students recognize if they need to go back and explore the phenomena (do they need to know more about it so they can better predict the range of responses that will occur)

Student Behaviors

- Refine their testable question until it is fair (all variables except one are controlled; repeated tests occur)
- Accurately record all data
- Accept all data that has been collected with sound techniques; don't reject data if it doesn't match predictions

Examples

- Test one manipulated variable
- Reduce the number of uncontrollable variables
- Conduct repeated tests/experiments
- Collect and record all data
- Have data collection or display charts

Stages of the ASC Learning Cycle Model (LCM)

INTERPRET

Students display and interpret the data they have collected

Teacher Behaviors

- Helps students use the data to answer their original testable question
- Provides models of data display alternatives (appropriate graphing forms, concrete vs. abstract graphs, two or three dimensional, etc), which automatically explain the question and experiment
- Questions students about how the results compare to their predictions; probe for bias
- Documents student mastery of graphic interpretation
- Encourages students to respond to each other's interpretations

Student Behaviors

- Organizes information logically and honestly
- Uses data to determine the answer to the testable question; compares results to predictions
- Modifies views in the face of new evidence
- Reflects upon the successes of mistakes of the new experimental design; shares insights with others
- Designs new testable questions as spin off or for further verification
- Is willing to have others offer different interpretations of data

Examples

- Data Chart/Graph production
- Data analysis
- Conclusions
- Review for bias

Stages of the ASC Learning Cycle Model (LCM)

APPLY

Students apply the newly learned concept. Activities should help students recognize the universal nature of the concept (i.e. .how does this concept operate in a context different than the one we just explored?)

Teacher Behaviors

- Provides opportunities for students to apply new concepts and skills and to extend them to other contexts
- Provides opportunities for students to use new terms and definitions
- Documents student ability to use concept outside of original context; determine if additional explorations and generalizing sessions are needed

Student Behaviors

- Uses previous information to probe, to ask questions, and to make reasonable judgments
- Connects concepts to new applications
- Offers to apply new knowledge to positive benefit to society

Examples

- Inventions
- Models
- Write a story that includes the concept
- Illustrates the concept
- Role play, dramatize the concept
- Venn diagram
- Concept map
- Write a report
- Reflection in science journal
- Power point presentation
- Apply new concept in new context

Assessment Task and Rubric

Performance based assessment is an approach to assessing student knowledge by asking students to complete specified tasks and then scoring their performance based on a pre-determined set of criteria that has been precisely defined. This assessment is separate from the instructional sequence of the lesson.

A rubric or scoring guide is a set of scoring guidelines for judging student work that is based on the performance of a specific task. A graduated set of criteria clearly defines and describes for students and teachers the range of unacceptable to acceptable performances. Both process and content can be evaluated.

The assessment task is the approach the teacher uses to assess the students knowledge and skills in relationship to the learner outcomes identified in the rubric or scoring guide. This method of assessment requires the student to create answers or products that demonstrate his/her knowledge or skills

Teacher Behaviors

Rubric

- Identifies intended concepts and learning objectives
- Develops and quantifies the criteria by which students' performance will be judged
- States the evidence to be produced to demonstrate mastery at each level
- Creates the rubric using a grid format
- Validates that what is scored is what is central to demonstrating mastery
- Shares the rubric with students before they begin the assessment task.
- Evaluates the end product. Scores individual student work with the rubric to determine whether they have mastered the content.

Assessment Task

- Identifies the main concepts and thinking skills targeted in the assessment.
- States the background of the concept or topic to be addressed.
- Identifies the type of product the students are to create.
- If students have options, plainly states what the options are.
- Clearly identifies and quantifies the required criteria.

- Writes the procedures the students will use or the process they must follow. Directions may be very specific or very open depending upon the amount of structure required.

Student Behaviors

- Active participation
- Previews rubric in order to be familiar with scoring expectations
- Demonstrates mastery of all facets of the assessment task
- Applies their knowledge and skills to reality-based situations and scenarios

Examples of Assessment Tasks

- Create an Invention
- Create Models
- Write a story that includes the concept
- Illustrates the concept
- Role play, dramatize the concept
- Compare two scenarios