

Alaska Science Consortium LEARNING CYCLE MODEL

GEAR- UP	Mentally engages and motivates students. Excellent time to gain information on students preconceptions. Similar to “anticipatory set” or “engagement”.
EXPLORE	Hands-on, minds-on activities that provide an opportunity for the students to discover a newer explanation for an event or concept.
GENERALIZE	Questioning strategies help students to verbalized 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 the 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?)

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 the students interest and help them to refocus on this instructional moment
- Assesses and documents students preconceptions (“taps into” what the students know or think they know about the concept or topic)
- Affirms students current understandings
- 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 charts

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EXPLORE

Activities to help the students become familiar with the materials, Test out their preconceptions, conjecture, “mess around with” cause/effect ideas. There provide an opportunity for the students to discover a newer explanation for an event or concept. It is important for the teacher to value and protect ample time and opportunity for personal explorations by the students.

Teacher Behaviors

- Provide activities that start with the students current level of understanding (may involve multiple starting points for your 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 authentic assessment

Student Behaviors

- Asks clarifying questions
- Uses a variety of methods to interact with the subject
- 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
- Simulations, creative drama
- I-Search or other research

Stages of the ASC Learning Cycle Model (LCM)

GENERALIZE

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

Teacher Behaviors

- Uses questions 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 students' ideas
- Distinguish between observations and inferences
- Identify other questions that arose 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 have been collected with sound techniques; don't reject data if it doesn't match their predictions

Examples

- Test one manipulated variable
- Reduce the number of uncontrollable variables
- Conducted repeated tests/experiments
- Collect and record all data
- If possible, 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
- Document students' mastery of graphic interpretation for portfolios
- 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 the 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?)

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 students 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

Name _____

Lesson Title _____

Self-Assessment of LCM Lessons
Score of 1-4

	Rubric Score	Comments
Standards and GLES		
Scoring Guide/Rubric		
Assessment Task		
Cultural Relevance		
Gear Up		
Explore		
Generalize		
Experiment		
Interpret		
Apply		

Name _____ Lesson Title _____

Assessed by _____

Instructor Assessment of LCM Lessons
Score of 1-4

	Rubric Score	Comments
Standards and GLEs		
Scoring Guide/Rubric		
Assessment Task		
Cultural Relevance		
Gear Up		
Explore		
Generalize		
Experiment		
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Apply		

LCM Scoring Guide

Descriptor	Level 1	Level 2	Level 3	Level 4
<p>Standards Based Lesson identifies the appropriate AK science content standards and GLEs for the science concept written. At least one-math or language arts content standard and GLE also included.</p>	<p>Content standards and GLEs and science concept not identified.</p>	<p>Science content standards and GLEs identified, but too numerous to be helpful. Science concept is not identified or is not developmentally appropriate.</p>	<p>Science content standards and GLEs identified. Math or language arts GLE only vaguely connected to the lesson. Science concept identified.</p>	<p>Math or language arts and science content standards and GLEs identified and specifically related to lesson. Science concept is clearly identified and related to lesson.</p>
<p>Scoring Guide/Rubric Assessment is done using a scoring guide/rubric with descriptors identified; minimum proficiency related to GLE's.</p>	<p>No scoring guide/rubric evident</p>	<p>Vague or imprecise descriptors listed. Assessment of science concept and GLEs are missing or does not reflect GLE.</p>	<p>Descriptors identified. GLE criteria measures science concept being taught and minimal skill development.</p>	<p>Descriptors clearly identified for all GLEs listed. All GLE criteria measures scientific concept and skill development.</p>
<p>Assess Assessment activity can be scored by the scoring guide and indicates level of proficiency.</p>	<p>No assessment task</p>	<p>Assessment task does not align with scoring guide, or only targets some of the GLE's.</p>	<p>Assessment task aligns with scoring guide and provides opportunity to meet minimum proficiency as stated in the GLE's.</p>	<p>Assessment task aligns with scoring guide and provides opportunity to exceed minimum proficiency as stated in targeted GLE's.</p>
<p>Cultural Relevance Lesson examines topics of local significance, involves local expert(s), and addresses cultural standard.</p>	<p>No cultural standards listed</p>	<p>Cultural standard identified. Little local significance or local expert(s) involved in lesson.</p>	<p>Cultural standard identified. Local significance identified and use of local expert(s) is shown but not clearly tied to or accomplished by lesson.</p>	<p>Cultural standard identified. Local significance, use of local expert(s), and local knowledge development clearly identified and accomplished by lesson.</p>

Descriptor	Level 1	Level 2	Level 3	Level 4
Gear-up Engages and motivates students while assessing knowledge and preconceptions.	Students not engaged or motivated. Knowledge and preconceptions not addressed.	Attempts to motivate and engage students, but knowledge and preconceptions not assessed.	Attempts to motivate and engage students, but students not fully engaged; attempts to assess student's knowledge and preconceptions.	Students are engaged and motivated. Knowledge and preconceptions have been assessed.
Explore Hands-on, minds-on activity that provides discovery of a newer explanation of an event or concept.	No manipulation of materials evident. Investigation of flow of knowledge not evident.	Partial manipulation of materials that lacks the investigation of the student's flow of knowledge. Teacher maintains full responsibility for student learning.	Adequate manipulation of materials with an investigation of student's flow of knowledge attempted with some shared teacher/student responsibility.	Adequate manipulation of materials with an investigation of flow from student's current knowledge. Responsibility for learning is shared fully between teacher/student.
Generalize Questioning strategies help students to verbalize new explorations and have at least two open-ended questions. Questions are asked that could be tested later.	Questioning strategies not evident and no open-ended questions asked; uses lecture to explain science concept.	Questioning strategies used and one open-ended question asked.	Questioning strategies attempt to elicit concept. Two open-ended questions asked that could be tested later.	Uses productive questioning strategies that elicit concept from students. Two or more open-ended questions asked that could be tested later.
Experiment Student's design and conduct an experiment (fair test).	Testable questions lacking. Experimental designs not evident in lesson or unrelated to informal loop.	Vague testable questions. Experimental designs not evident, activity may be connected to informal loop.	Testable questions supported by experimental designs, but have minimal connection to the informal loop explorations.	Clear testable questions supported by experimental design that is related to the informal loop and helps students refine testable questions.

Descriptor	Level 1	Level 2	Level 3	Level 4
<p>Interpret Students display and interpret the data that they have collected.</p>	Models of data display the experiment not present. Questions that compare results to their predictions and responses to other's interpretations not evident.	Provides models of data display. Questions that compare results to their predictions and responses to other's interpretations not evident.	Provides models of data display that explains a question in the experiment. Elicits questions that compare results to their predictions, but does not respond to other's interpretations.	Provides models of data display that explains the questions in the experiment. Elicits questions that compare results to their predictions and responds to other's interpretations.
<p>Apply Students apply the newly learned science concept. Activities should help recognize universal nature of concept.</p>	No application to real life is made.	Some application is made, but not student centered.	Student application of science concept to real life is evident.	Challenges student to apply the science concept in a different context to real life.

Revised C Cooper and D McBee 2007

Original done by Sidney Stephens

LCM Informal Loop

Name
Grade Level

Title

Standards

- Science Content Standard
- Science Process Standard
- Math or LA

GLEs

- Science Content GLE
- Science Process GLE
- Math or LA

Science Concept

Scoring Guide

Assessment Task

Materials

Vocabulary

Gear Up Process Skills
•Activity

Explore Process Skills
•Activity

Generalize Process Skills
•Questions

Apply Process Skills
•Activity

LCM Formal Loop

Name
Grade Level

Title

Standards

- Science Content Standard
- Science Process Standard
- Math or LA

GLEs

- Science Content GLE
- Science Process GLE
- Math or LA GLE

Science Concept

Scoring Guide

Assessment Task

Materials

Vocabulary

Gear Up Process Skills
•Activity

Explore Process Skills
•Activity

Generalize Process Skills
•Questions

Experiment Process Skills
•Activity

Interpret Process Skills
•Questions/activity

Apply Process Skills
•Activity