### Inquiry-Based Concept Model Development Stages and Purpose

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| **Elicitation**      | • Answers questions such as “What did you observe?” “What do I already know about this topic?” “How or why does this act or behave this way?” Shows interest in topic.  
  • Identifies what information they know and do not know about the phenomena or model.  
  • Identifies or begins to identify a phenomenon, concept, or problem to be explained. | • Creates interest and generates curiosity through a phenomenon related to the model.  
  • Asks eliciting questions to uncover what the students know or think about the concept/topic.  
  • Helps students identify or begin to identify the phenomenon, concept, or pattern to be explained.  
  • Helps students understand what they do not know in relation to the model which has to be explored or understood to develop the model. |
| **Development**      | • Developing a model based on the elements contained within the model, and appropriate to the level of the students.  
  • Thinks freely, but within the limits of the activity.  
  • Tests ideas and predictions about the phenomenon, concept, or problem to be explained  
  • Forms new ideas, and confronts old ideas using information from experiences during development in order to create a model.  
  • Tries alternatives and discusses them with others in a collaborative and supportive environment.  
  • Collects, records observations and ideas, and uses information to develop a model  
  • Remains open to ideas and information in order to develop a model | • Creates a structured set of activities based on model elements to allow students to collect and analyze information in order to build a model.  
  • Encourages the students to work together collaboratively, ideally without direct instruction from the teacher  
  • Observes and listens to the students as they interact in order to understand student thinking and identify misconceptions which will be addressed by the activities  
  • Asks probing questions to help students internalize and manage conflict from old and new ideas.  
  • Redirects students when necessary to maintain focus on the concept element(s) being developed.  
  • Provides time for students to puzzle through problems and resolve development of the model  
  • Acts as a consultant for students to support the model development. |
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#### Deployment
The purpose of the deployment stage is to provide learners an opportunity to use the model they have developed and apply it a new application to extend the model to a real work application. Learners are provided with opportunities to reflect on what they have learned and to consider how their thinking may have changed and what constraints the model may have in application.

- Tests the model out in a new application or situation.
- Using the model as a frame for reasoning, explains possible solutions or answers to others.
- Listens critically to others’ explanations and poses questions to others around the constraints of the model.
- Uses reasoning from development to apply and extend the model in new situations.
- Refers to previous activities and uses recorded observations or data in explanations to identify constraints or limits of the model.
- Reflects on their own progress, knowledge, and kinds of thinking they engaged in during the whole experience.
- Communicates orally and in writing the application of the model and ability of the model for real world applications.

- Creates activities to allow students to use the model in a real-world situation.
- Encourages the students to explain model concepts and definitions in their own words.
- Asks for justification (evidence) and clarification from students.
- Formally provides definitions, explanations, and new labels.
- Uses students’ previous experiences as a basis for explaining concepts and considering limitations of the model.
- Asks open ended questions such as Why do you think…? What evidence do you have? “How well does this model explain…?”, “How can this model be used to….? How does this model help us answer the question….? “Would this model work when…..?”
- X?
- Allow students to assess their own learning and group processing skills in relation to the model.

#### Refinement
The purpose of the refinement stage is to adapt the model based the deployment of the model in a real-world situation.

- Students look at how well the model performs in a real-world situation, and then refine the model if needed to account for discrepancies with the model they developed and what they experienced in the real-world application.
- Students discuss the constraints of the model and the model limits.
- Students develop a more appropriate model for the content.
- Students reconcile the model they have refined versus their initial understanding of the model.
- Students communicate the model in multiple ways.

- Allows students to work through the model cycle and allow for reflection on “First I thought….., now I think….“.
- Creates activities allowing students to share the refined model in multiple ways of communication (oral, written, video, pictorial).
- Helps students to understand models are representations which can grow and change when new information is presented, or old information is no longer relevant.