

SEISMO-LAB

**Template for the Development of a Technology-
Enhanced Educational Scenario Template**

**The Learning Cycle
(Supporting Conceptual Change)**

Table of Contents

1	Development of an Educational Scenario Template	- 3 -
1.1	Description of the Educational Scenario Template in Narrative Format -	3 -
1.2	Graphical Representation of the Flow of Learning Activities	7 -
1.3	Description of the Educational Scenario Template in Common Terms-	8 -
1.3.1	Concept Exploration	8 -
1.3.2	Concept Introduction	9 -
1.3.3	Concept Application	9 -
2	References	- 10 -
3	Annex	- 11 -

List of Figures

Figure 1: Flow of Learning Activities for The Learning Cycle	7 -
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List of Tables

Table 1: Description of the Educational Scenario Template	6 -
Table 2: Concept Exploration	8 -
Table 3: Concept Introduction.....	9 -
Table 4: Concept Application	9 -
Table 5: Learning Activities Description	12 -

1 Development of an Educational Scenario Template

1.1 Description of the Educational Scenario Template in Narrative Format

Describing an Educational Scenario Template	
1. Title of the Educational Scenario Template	The Learning Cycle
2. Educational Problem	<p>Main problems:</p> <ul style="list-style-type: none"> a) theoretical and abstract teaching b) textbook based instruction c) no demonstration infrastructure available d) students misconceptions
3. Educational Scenario Template Objectives	<p>Knowledge The learners should know and understand specific concepts and the analogies between them.</p> <p>Skills The students should be able to:</p> <ul style="list-style-type: none"> • Explore the research procedures themselves • Perform research efforts that are taking place as a structured discovery within the frame of organised teaching • Generalize or transfer ideas to other examples used as illustrations of the central concept • Apply previous knowledge <p>Attitudes The learners should be able to:</p> <ul style="list-style-type: none"> • Acquire an appreciation for basic Science Education matters through the exposure in similar topics • Develop interests, and initiate and maintain a curiosity toward the materials.
4. Characteristics and Needs of Learners	<p>Cognitive The students have less than average knowledge level to mathematics and geometry. Limited knowledge of science subjects.</p> <p>Psychosocial Based on statistics less than 50% of the students have a significant interest in science (both boys and girls). A small number of them (about 15%) will follow careers in science</p>

Describing an Educational Scenario Template	
	<p>(Sjøberg & Schreiner 2005; PISA, 2006).</p> <p>Physiological The average age of students is 15 years.</p> <p>Needs Learners need more participatory schemes of instruction. Learners have to be involved in the process and act as members of a team.</p>
<p>5. Educational Approach of the Educational Scenario Template</p> <p>(a) Description of the Educational Approach rationale (b) Parameters that guarantee the implementation of the Educational Approach</p>	<p>(a) The learning cycle originated in the 1960s with the work of Robert Karplus and his colleagues. Originally, the learning cycle was based on the theoretical insights of Piaget, but it is also consistent with other theories of learning, such as those developed by Ausubel (Karplus, 1980).</p> <p>Anton Lawson (1988) has made important connections between research on student misconceptions and use of the learning cycle. Lawson suggests that use of the learning cycle provides opportunities for students to reveal prior knowledge (particularly, their misconceptions) and opportunities to argue and debate their ideas. This process can result in cognitive disequilibrium and the possibility of developing higher levels of reasoning.</p> <p>Originally there were three phases to the learning cycle: Exploration, Invention, and Discovery. Later, these terms were modified to Exploration, Concept Introduction, and Concept Application. Although other terms have been used for the three original phases, the goals and pedagogy of the phases have remained similar.</p> <p>During the first, or Exploration, phase of the learning cycle, students learn through their involvement and actions. New materials, ideas, and relationships are introduced with minimal teacher guidance. The goal is to allow students to apply previous knowledge, develop interests, and initiate and maintain a curiosity toward the materials. During the exploration, teachers can also assess students' understanding and background relative to the lesson's objectives.</p> <p>Concept Introduction is the next phase. Various teaching strategies can be used to introduce the concept. For example, a demonstration, DVD, CD-ROM, textbook, or lecture can be used. This phase should relate directly to the initial exploration and clarify concepts central to the</p>

Describing an Educational Scenario Template

	<p>lesson. Although the exploration was minimally teacher directed, this phase tends to be more teacher guided.</p> <p>In the next phase, Concept Application, students apply the newly learned concepts to other examples. The teaching goal is to have students generalize or transfer ideas to other examples used as illustrations of the central concept. For some students, self-regulation, equilibration, and mental reorganization of concepts may take time. An excellent introduction to and science teaching examples of the learning cycle have been developed by Howard Birnie (1982) and Karplus and colleagues (1977).</p> <p>(b) The materials that will be used should be carefully structured so involvement with them cannot help but engage concepts and ideas fundamental to the lesson's objectives. Having several activities where a concept is applied can provide the valuable time needed for learning.</p>
6. Learning Activities:	
Phase 1: Concept Exploration	<p>Observation Students observe objects, events, or situations. Student experiences can occur in the classroom, laboratory, or field.</p> <p>Exploration Students explore the objects, events, or situations. During this experience, students may establish relationships, observe patterns, identify variables, and question events. Moreover students may have questions or experiences that motivate them to study what they have observed.</p>
Phase 2: Concept Introduction	<p>Concept Introduction The teacher directs student attention to specific aspects of the exploration experience. Initially, the lesson should be clearly based on student explorations. In this phase, the teacher presents to students the concepts in a simple, clear, and direct manner.</p>
Phase 3: Concept Application	<p>Generalization of the concept Students extend the concepts in new and different situations. Several different activities will facilitate generalization of the concept by the students. Teacher encourages students to identify patterns, discover relationships among variables, and reason through new problems.</p>

Describing an Educational Scenario Template	
7. Participating Roles:	<p>Students</p> <ul style="list-style-type: none"> • Perform scientific prediction • Recording observations • Perform prediction compared to results • Develop experimental models • Use or evaluate a technique • Use science to explain <p>Teacher</p> <ul style="list-style-type: none"> • Presents ideas and evidence in science • Asks questions • Identifies misconceptions • Applies scientific methods • Develops experimental models • Provides historical and contemporary examples
8. Tools, Services and Resources	<p>Tools:</p> <p>Hardware</p> <ul style="list-style-type: none"> • Computer • Projector <p>Software</p> <ul style="list-style-type: none"> • Text, image, audio or video viewer • Database • VLE <p>Resources: Figure, graph, slide, problem statement, simulation, experiment, table, self assessment, exercise, questionnaire, exam.</p>

Table 1: Description of the Educational Scenario Template

1.2 Graphical Representation of the Flow of Learning Activities

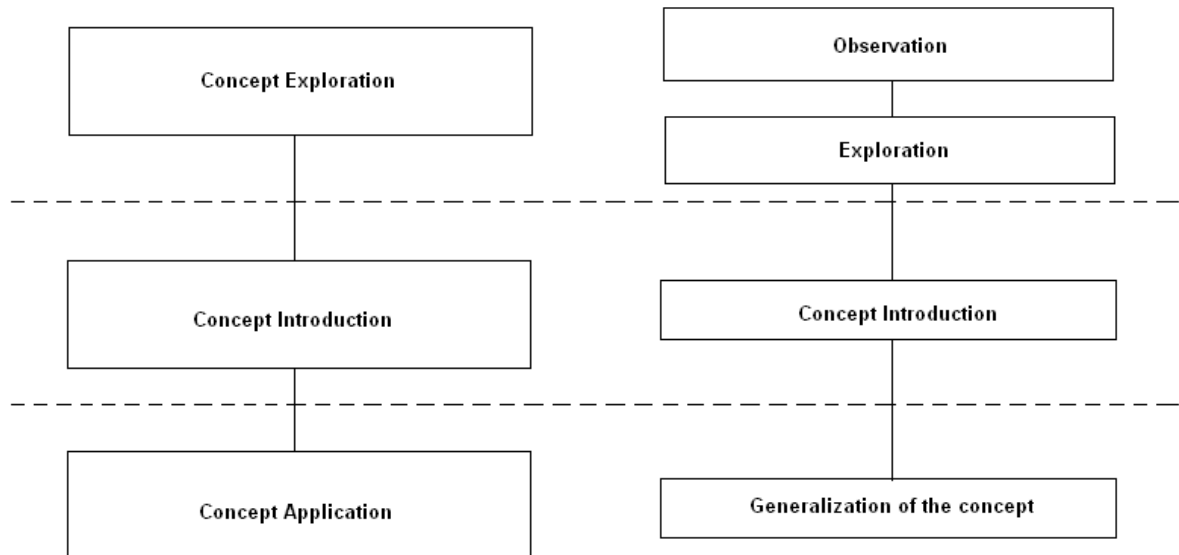


Figure 1: Flow of Learning Activities for The Learning Cycle

1.3 Description of the Educational Scenario Template in Common Terms

1.3.1 Concept Exploration

Phase 1 Concept Exploration	Type	Technique	Interaction	Roles	Tools/Services	Resources
Observations	Experiential Experiencing	Experiential Experiment	Who Class Based Medium Face to Face Timing Synchronous	Facilitator, Individual Learner	Hardware Computer, Projector Software Text, image, audio or video viewer, VLE	Other
Exploration	Experiential Exploring	Experiential Case Study	Who Class Based Medium Face to Face Timing Synchronous	Facilitator, Individual Learner	Hardware Computer, Projector Software Text, image, audio or video viewer, VLE	Other

Table 2: Concept Exploration

1.3.2 Concept Introduction

Phase 2	Type	Technique	Interaction	Roles	Tools/Services	Resources
Concept Introduction	Communicative Presenting	Communicative Articulate reasoning	Who Class Based Medium Face to Face Timing Synchronous	Presenter, Individual Learner	Hardware Computer, Projector Software Text, image, audio or video viewer	Other

Table 3: Concept Introduction

1.3.3 Concept Application

Phase 3	Type	Technique	Interaction	Roles	Tools/Services	Resources
Concept Application	Experiential Applying	Experiential Case Study	Who Class Based Medium Face to Face Timing Synchronous	Facilitator, Individual Learner	Hardware Computer, Projector Software Text, image, audio or video viewer, Database	Other

Table 4: Concept Application

2 References

Birnie H., (1982). An introduction of the learning cycle. Saskatoon, Canada: University of Kastachewan Press.

Karplus, R., et al (1977). Teaching and the development of reasoning. Berkeley: University of California Press.

Karplus R., et al (1980). Teaching for the development of reasoning. In Association for the Education of Teachers of Science Yearbook, A.E. Lawson (Ed.), The Psychology of Teaching for Thinking and Creativity. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Lawson A., (1988). A better way to teach biology. *American Biology Teacher*, 50(5):266-278

PISA (2006). Science Competencies for Tomorrow's World, Volume 1: Analysis, ISBN: 9789264040007

Sjøberg, S. & Schreiner, C. (2005). How do learners in different cultures relate to science and technology? Results and perspectives from the project ROSE. *Asia Pacific Forum on Science Learning and Teaching*, 6, 1-16.

3 Annex

The vocabulary used for the Learning Activities description in common terms, is explained in the following table:

Annex		
Dimension	Type and Value	Description
<i>Type</i>	Experiential: Experiencing	Performing experiments and observations
	Experiential: Exploring	Students give priority to evidence, which allows them to develop explanations that address scientifically oriented questions.
	Communicative: Presenting	Presentation of a specific subject/issue/concept
	Experiential: Applying	Applying the knowledge in different situations
<i>Technique</i>	Experiential: Experiment	Designing, setting up and performing experiments
	Experiential: Case Study	Setting up Case Studies based on experiments
	Communicative: Articulate reasoning	Students explain their reasoning via speaking
<i>Interaction</i>	Who: Class based	In the context of the classroom
	Medium: Face to Face	Face to face interaction of the participating role with others or content
	Timing: Synchronous	Synchronous interaction of the participating role with content
<i>Roles</i>	Individual Learner	The individual learner
	Facilitator	The teacher in a role of facilitator of the learning process
	Presenter	The teachers presents the outcomes of the discussion/debate
<i>Tools/ Services</i>	Hardware: Computer	An electronic, digital device that stores and processes information
	Hardware: Projector	A hardware device that enables an image to be projected onto a flat surface
	Software: Text, image, audio or video viewer	A software tool for displaying text, images, audio or video
	Software: Database	Educational Digital Library (e.g. DSPACE Library)
	Software: VLE	Virtual environment which engage users in learning activities (e.g. COSMOS portal)
<i>Resources</i>	Problem Statement	Document for defining a problem

Annex		
	Slide	Hypermedia document
	Figure	A figure is any graphic, text, table or other representation that is unaligned from the main flow of text
	Graph	Pictorial representation of information
	Exercise	Document for practicing a skill or understanding
	Simulation	An application that imitates a physical process or object by causing a computer to respond mathematically to data and changing conditions as though it were the process or object itself
	Experiment	An action or operation undertaken in order to discover something unknown, to test a hypothesis, or establish or illustrate some known truth
	Table	An arrangement of information in columns and lines
	Self assessment	An assessment or evaluation of oneself, one's actions or attitudes by oneself
	Questionnaire	A list of questions by which information is sought from a selected group
	Exam	Document for testing, the knowledge or ability of students
	Other	It can be any of the following resources: Figure, graph, slide, simulation, experiment, table, self assessment, exercise, questionnaire, exam

Table 5: Learning Activities Description