Learning Cycles – Curricula Based on Research
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Research Tutorial
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Introduction

The curriculum development movement of the 1950s and 1960s brought Bob and Betty Karplus into science education research and development.(Karplus & Karplus, 1970) As director of the Science Curriculum Improvement Study (SCIS) Bob led a project that built an elementary school science curriculum. Learning activities in SCIS were based on research about how children learn and how they develop reasoning skills.

Following a visit to the research institute of Jean Piaget, a Swiss psychologist who studied intellectual development and reasoning, Bob began developing an approach to teaching that stressed student observation. He and J. Myron Atkin published a paper on this "guided discovery" approach in 1962 (Atkin & Karplus, 1962). By 1967 the concepts of the Learning Cycle were well established within the SCIS program and described in a book by Karplus and Thier. (Karplus & Thier, 1967)

Until the early 1970s the Learning Cycle was used primarily in elementary school teaching. Following the conclusions of Piaget most curriculum developers assumed that secondary school and college students were mature enough intellectually for abstract or formal reasoning. However, McKinnon and Renner (McKinnon & Renner, 1971) focused attention on the lack of formal reasoning skills among college physics students. This study, which was repeated by many other investigators with the same results, showed clearly that students were not developing their intellectual skills at the rate that Piaget had stated. Thus, college faculty became interested in the Learning Cycle approach because it was based on research that investigated intellectual development.

Under Bob Karplus' direction AAPT received a grant to create and disseminate information on the intellectual development model of Piaget and on the Learning Cycle. The result was the *Workshop on Physics Teaching and the Development of Reasoning.* (Karplus, Renner, Fuller, Collea, & Paldy, 1975) This workshop used the Learning Cycle to teach about the Learning Cycle and was distributed by AAPT for about 10 years. Later versions were created for all of the secondary science curricula and for many other topics in the university curriculum.

Many other models of learning and teaching have been developed in recent years. Most of the ones which emphasize the development of student reasoning skills have activities and phases similar to the Learning Cycle. For example, *Workshop Physics* is based on a different model of teaching but the steps in the learning-teaching process are very similar.(Laws, 1991) A good review of a variety of learning models has been published by Driver and her colleagues. (Scott, Asoko, & Driver, 1991)

In the 1980s the Learning Cycle was adapted to many university situations including a full curriculum for first-year college students (Fuller & al., 1977), graduate teacher training and large enrollment classes (Zollman, 1990). In addition, because the basic Learning Cycle has been adapted to a wide variety of situations, many variations have been created. The most recent in the physics teaching/learning literature is the "Modeling Cycle." (Hestenes, 1987; Wells, Hestenes, & Swackhamer, 1995)

Research on the effectiveness of the Learning Cycle has been extensive. This research has gone beyond just looking at whether this approach teaches "better" than more traditional teaching. Some studies have looked at individual phases of the cycle, the order of the phases and the relation between teaching content and the process of science. The most complete summaries of this work are published in Lawson, Abraham and Renner and in Lawson.(Lawson, 1995; Lawson, Abraham & Renner, 1989)

In keeping with the learning Cycle approach we will not tell you what it is. Instead, we will let you experience a learning cycle on an aspect of physics. In this way you can see how a research-based curriculum can be used in modern day teaching. Our version today is quite close to the Modeling Cycle.

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