Syllabus 2005

An Alternative Paradigm for Online Learning: Using the Science of Learning to Create Dynamic Online Instruction

Kathy J. Schmidt
Director, Faculty Innovation Center, College of Engineering, The University of Texas at Austin

Michael Sullivan
Faculty, College of Education, The University of Texas at Brownsville

1 Introduction

Students who are actively learning are working with ideas. Most educators assume that learning is inherently active; yet research suggests that for students to be actively learning, they need to do more than just listen and instead be dynamically engaged in tasks and in thinking processes. As such, "it is proposed that strategies promoting active learning be defined as instructional activities involving students in doing and thinking about what they are doing." [1] In many institutions of higher education, there is talk of active learning and how to implement it into classrooms. Not only is there a need to promote more active learning in traditional classes, but the need also exists in online learning. Without active learning and student involvement students often lack the ability to apply learning in novel or complex ways. This inability, coined the "inert knowledge" problem, [2] is supported by research that shows how traditional approaches often result in inert knowledge [3]. Given that traditional instruction has limitations, educators have employed instructional innovations such as problem-based [4] or project-centered learning [5] to engage and stimulate student thinking.

Problem-based learning uses real world problems to motivate students to identify and apply research concepts and work collaboratively, but it is a strategy that may have limitations. Students can be motivated, but engagement does not necessarily equate with learning. Furthermore, typical academic problem-solving tends to be situation specific with well-defined problem parameters resulting in a predetermined correct answer. If students need to learn by analyzing and solving representative, authentic problems, it bears to reason that problem-solving to a predetermined solution does not build upon students' ability to solve complex problems in an efficient way.

In order to provide powerful learning environments, we can use new knowledge on the science of learning combined with more advanced instructional technology tools. To be able to use instructional technology effectively requires an understanding of the technology, the learner, and interactions between the two. In this paper we will look at a pedagogically sound framework for online environments to provide a structured inquiry model to challenge students.

2 An Inquiry Model

Advances from the last couple of decades, have greatly increased our understanding of learning and its developmental, cognitive and social aspects. Based on the science of learning described in the National Academy Press book, *How People Learn* [6], an easy to use and pedagogically sound inquiry cycle has been developed. *How People Learn* (HPL) has been used to create a cycle or framework, coined the STAR.Legacy (Software Technology for Action and Reflection) cycle [7]. This framework organizes student learning into typical phases of inquiry and makes learning visible, uses these four overlapping "lenses":

- Learner-centered environments focus on the knowledge, skills, and attitudes that students bring to the learning situation
- Knowledge-centered environments focus on content that is organized around big ideas or core concepts
- Assessment-centered environments help students' thinking to become more visible so that both they and their teachers may assess and revise their understanding
- Community-centered environments capitalize on local expertise to create a sense of collaboration among students

These four lenses influence curriculum development and instructional settings. Teachers create *knowledge-centered* settings by working with students' prior knowledge, skills and cultural resources and they create *assessment-centered* learning by providing for frequent assessments of student progress. Students need opportunities to bring what they know and their beliefs about school subjects in order to have *learner-centered* opportunities and both teachers and students can maximize community resources to build *community-centered* learning that is motivational and collaborative.

2.1 Designing Online Instruction with an Inquiry Model

HPL driven instruction is similar to problem-based learning in that students are given challenges or problems. A key feature of the challenges is that they can be successful in helping students combat an inability to apply learning to relevant situations. Appropriate challenges not only hook students' interest, but help them to extend learning. When developing HPL driven design, these five criteria are needed:

- Students develop their own ideas for solving a complex problem
- Instructors provide explicit outcomes to enhance student self-assessment
- Student work in groups for social mediation of knowledge and solutions
- Students test their own solutions through hands-on activities and computer simulations
- Instructors provide well-defined structure for learning opportunities [8]

When thinking about technology and the current tools available, how can we best incorporate the criteria listed above? Using the Web, students are explorers and have a multitude of resources to develop their emerging ideas on how to solve a problem.

Objectives need to be provided that help guide students thinking so that they are better able to self-assess. Technological assessments, such as online tests, can provide quick feedback. Group work is easily facilitated with technology. Students can post queries to a bulletin board to hear perspectives other than their own. Using more powerful tools from web conferencing systems, students are able to extend their learning community beyond the classroom into one with experts and revisit these sessions due to archival capabilities. Being able to use the computer for hands-on activities rather than solely for accessing course materials helps student with the construction of knowledge. Lastly, the HPL framework works nicely within an online environment to provide a well-defined structure. Students are active and exploring, but boundaries are provided and instructional components, such as feedback and sharing are built into the cycle. Given that this instruction is intended to be adaptive and flexible, HPL driven design is a good one for online learning.

3 An Online Inquiry Model

The STAR.Legacy model works well in a computer environment. Instructors can easily modify materials so that students can be part of the larger community by leaving a legacy of their insights for future learners. Pictured is a visual that outlines its steps.

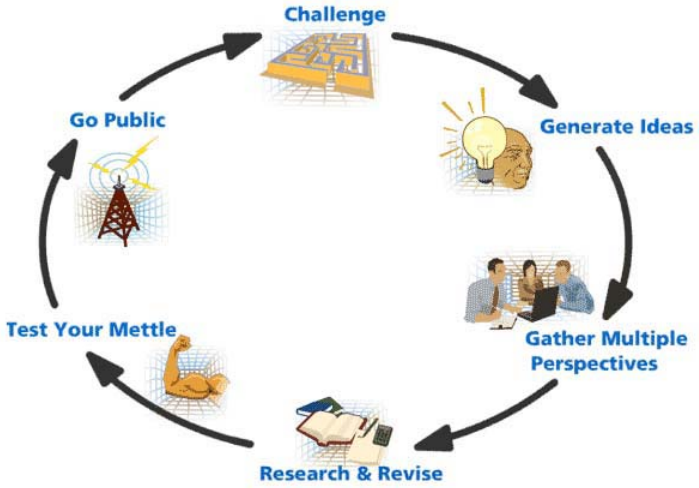

Figure 1: STAR.Legacy Model

This model is intended for structuring problem-based learning. Inherent in this model is the notion that “learning is enhanced when teachers and learners can ‘see where they are’ in a complex sequence of inquiry” [7]. The intent is for students to complete progressively complex challenges as they go through the cycle.

3.1 Challenge

It is possible to provide several challenges that build upon student understanding. The challenges can be written as text and may include multimedia resources. After they have seen the challenge, students can then complete the remainder of the cycle.

3.2 Generate Ideas

The next step, Generate Ideas, is where they generate issues related to and possible answers to the challenge. Whether students generate ideas individually or in groups, it is important that these ideas are shared. When students are required to make their thinking explicit, it helps them with what they already know and what they need to learn. If they are given opportunities to contrast their initial thoughts with subsequent ones, they get time to analyze what is new and to think deeper.

3.3 Multiple Perspectives

After generating ideas, students go next to multiple perspectives to learn from experts. During this process, it is important for students to play close attention to the contrasts between their thoughts and those of the experts. Often the students will realize how these experts have insights far beyond what they have ever considered. Additionally, the experts do not provide solutions but they provide guidance in what students should look for and where they should look.

3.4 Research and Revise

Once students have looked at multiple perspectives, they are ready to do the research and revise process. It is here that students have many options from collaborating, reviewing more information, conducting simulations, to working with resources left by previous students... Often students will not need all the resources provided but because students may look at issues and solutions differently, a wide range of resources is needed.

3.5 Test Your Mettle

In the Test Your Mettle phases, a number of different possibilities exist. Students might, for example, take a multiple choice test or they might submit a plan for how they want to go public with their results. Whatever form this assessment takes, it is meant to be formative and to send students back to Research and Revise if needed.

3.6 Go Public

The final step is for student to Go Public with their thinking in order to show to others their best solutions to the challenges. This step not only motivates students because their work is seen by others, but it also gives them the opportunity to see what their peers are thinking and to learn from them. During this process, students can be asked additional questions about their learning so that they transfer their understanding to other issues and settings.

4 Conclusions

Given the current information in learning science and today's technological tools, it is now possible to focus more on the science of teaching and. The STAR.Legacy cycle

described in this paper is one way to effectively use instructional technology to actively engage students in problem or challenge-based learning activities. While the technology makes it possible for students to work independently as well as collaboratively, future advances should help to make collaborations more facile and more realistic. Our current tools and models for online instruction have been effective. We need, however, to seriously consider the benefits of using a new model delivered with contemporary tools in order to meet the needs of our students and better prepare them for the challenges of the 21st century.

References

[1] Bonwell, C. & Eison, J. (1991). Active Learning: Creating Excitement in the Classroom. *ERIC Digest*, 1991091.

[2] Whitehead, A.N. (1929). *The aims of education*. New York: MacMillian.

[3] Gick, M.L. & Holyoak, K.J. (1983). Schema induction and analogical transfer. Cognitive Psychology, 15, 1-38.

[4] Barrows, H.S. (1984). A Specific, problem-based, self-directed learning method designed to teach medical problem-solving skills, self-learning skills and enhance knowledge retention and recall. In: H.G. Schmidt and M.L. de Volder, Editors, *Tutorials in problem-based learning. A new direction in teaching the health profession*, Van Gorcum.

[5] Wolk, S. Project-based Learning: Pursuits with a Purpose. *Educational Leadership*, 52(3), pp. 42-45.

[6] Bransford, J.D., Brown, A. L., & Cocking, R. (2000). *How People Learn.* National Academy Press, Washington, D.C.

[7] Schwartz, D.L., Brophy, S., Xiaodong, L., & Bransford, J.D. (1999). Software for Managing Complex Learning: Examples from an Educational Psychology Course. Educational Technology Research and Development, 47(2), 39-59.

[8] VaNTH, www.vanth.org