

LifeLines OnLine: Investigative Case Based Learning for 21st Century Learners

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SUMMARY

Demographic profiles around the world are rapidly changing with resulting impact on the types of students that come into college classrooms. This paper describes investigative case based learning (ICBL) strategies suitable for addressing the preferences and needs of adult college students – the most rapidly increasing group of college students in the United States. ICBL strategies are designed to promote life long learning skills while having students use scientific problem solving approaches. ICBL as presented in the electronic newspaper “LifeLines OnLine” begins with a realistically complex case presented initially as a news story. Students collaboratively analyze the story. After identifying issues and questions, students consult further resources and devise methods for investigating their questions. Investigations followed by presentations of their findings in a variety of formats brings the process to a close. Evaluation of student work needs to include assessment of content learned as well as of how the students worked on their problem (process). While ICBL strategies are consistent with learning strategies known to characterize adult learning, these strategies also can be used with traditional college age learners.

KEY WORDS: investigative case-based learning, problem solving, scientific approaches, realistic problems, lifelong learning

RESUME

LifeLines OnLine : des stratégies pour apprendre de la recherche investigatrice des cas par les étudiants du 21st siècle

Dans le 21st siècle, les étudiants qui arrivent à nos universités sont changer en toute la globe. Dans les États Unis, adultes comprennent une groupe la plus grande. Ici, nous décrivons des stratégies qui utilisent réalistes problèmes, pour apprendre par la recherche investigatrice des cas (ICBL). Stratégies pour ICBL utilisent méthodes scientifiques et aussi aident les étudiants dans le développement des stratégies pour longue étude de la vie. ICBL stratégies commencent avec un cas présenté initialement comme une article sur un électronique journal s'appelle “LifeLines OnLine.” Dans petits groupes, les étudiants notent des problèmes et des questions principaux qui se présentent. Ils trouvent des références supplémentaires ou des autres ressources pour les aider à répondre aux questions. Ils dessinent et faites des recherches scientifiques qui sont liées à la question, et finalement, les étudiants produisent quelque sorte d'objet montent leur compréhension des recherches. Il faut considérer toutes les choses que vous voulez que les étudiants apprennent : le savoir et la compréhension conceptuelle et aussi la capacité à identifier des questions et trouver des ressources, la capacité à dessiner et faire des recherches, et la capacité à penser d'un façon critique. : Des Stratégies de la Recherche Investigatrice des Cas (ICBL) est dessine pour les adultes, mais les étudiants d'université des ages traditionnels les utilisent aussi.

MOTS-CLES: ICBL, Des Stratégies de la Recherche Investigatrice des Cas, scientifiques méthodes, réalistes problèmes

Around the world, demographic profiles of many nations are changing in ways that will affect education and educational strategies. In the United States the population is aging.

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According to American Association of Community College projections¹ the typical undergraduate taking biology in the U.S. within 5 years will be over the age of 25, working, and enrolled in a two year college. This represents a significant change for US colleges and requires reconsideration of strategies traditionally used for teaching biology. Adults generally prefer to learn by actively applying their knowledge, skills and experiences to solving problems that have meaning for their lives. Adult students assign value to and put their effort into tasks that they see as relevant to situations they are likely to face in their own lives.² Even young adults (18 years old) have these preferences.

At BioED 2000 a major theme was the need for new teaching strategies that will engage students in doing science and in using scientific methods and knowledge of biology throughout their lives. New instructional strategies need to incorporate methods suitable for achieving these goals with adult learners: strategies that present biology in meaningful contexts, develop problem-solving skills, and are pedagogically consistent with adult learning preferences. A first step towards developing resources that engage undergraduates is to make more use of pedagogical strategies that recognize and build upon the prior experience, knowledge, and practical learning strengths of adult students.

A second step toward addressing the needs of both the 21st century biology curriculum and 21st century learners is to introduce investigative biology methodologies for everyday problem exploration and resolution. These methodologies need to be fully integrated with the biology content so that students see the seamless connections between processes of science and scientific knowledge. If students see that these investigative experiences also extend their ability to make sense of the science-related problems they face each and every day, then they are more likely to value and use investigative skills throughout their lives.

This paper describes biology teaching strategies called Investigative Case Based Learning (ICBL). ICBL strategies engage college students in collaboratively investigating realistic problems, managing information resources, conducting relevant scientific investigations and presenting the findings for review. We have developed a web-based delivery system for curriculum materials designed around ICBL strategies called LifeLines OnLine³. LifeLines OnLine is an electronic newspaper that serves as the initial interface. Students read news items in the paper and click on links that bring them to further details of the story, resources, or learning activities.

The teaching strategies for LifeLines OnLine encourage students to work collaboratively to identify issues, to frame questions of interest to them, and then to identify additional information in answer to their questions. ICBL strategies further encourage students to plan and conduct extended investigations. Students work to develop reasonable investigative approaches, gather data and information testing their hypotheses, and then work to persuade others of their findings.

¹ American Association of Community Colleges. "National Community College Snapshot" Accessed March 2000 online at <http://www.aacc.nche.edu/allaboutcc.snapshot.html>

² Knowles, Malcolm. *Andragogy in Action*. San Francisco: Jossey-Bass, 1984; Ertmer, P.A. and D.R. Dillon. "Shooting in the dark versus breaking it down: Understanding students' approaches to case-based instruction." *Qualitative Studies in Education*, 11(4): 1998, 605-622.

³ See the LifeLines website at <http://bioquest.org/lsummer00> and <http://bioquest.org/lifelines.html>

Students use a variety of resources, including traditional laboratory and field techniques, software simulations and models, data sets, internet-based tools and information retrieval methods. They thus learn to manage information and to develop problem solving strategies for lifelong learning in the context of investigating biological problems that they find meaningful¹.

One way to illustrate differences between more traditional lecture/text based teaching strategies and ICBL or other problem-based strategies is to consider how students and instructor work with scientific knowledge. Traditional methods have the effect of gradually limiting the encyclopedic knowledge of the discipline as the instructor makes choices about specific chapters and specific topics within a text. The students are usually examined about specific facts. Learning is individual, not collaborative, and real world applications may or may not be elucidated in text and lecture, most frequently being left for the student to determine. The traditional methods are effective for meeting certain kinds of learning goals and for helping students navigate a discipline, and should be used with care.

ICBL begins with a specific biological scenario which is then connected more broadly. Instructors choose the specific cases, thus directing the general areas to be examined. Students begin with a small problem, and as they work collaboratively, they begin to see the many ways the problem relates their lives and to multiple aspects of biology. As students locate resources and develop investigations, they develop an even broader understanding of the topic. ICBL methods emphasize student collaboration and student directed learning. Rather than narrowing a broad field, ICBL methods help students use a specific instance to develop the broader understanding. Like any instructional strategies, ICBL methods are useful for specific types of learning goals.

Six strategies characterize sequential phases of ICBL approaches:²

1. Recognize Potential Issues: In groups of 3-10,³ students read the case, presented as a news article, and make notes about words or phrases that seem to be important to understanding what the case is about. This step may take five minutes.
2. Brainstorm for Connections. Students engage in discussion about the terms and phrases they thought were important. They are answering the question: What is this case about? In this phase, which may take up to 20 minutes, students are identifying key issues as they share what they already know about the topic. They are also preparing a list of questions that arise from their discussion that they wish to pursue further.
3. Obtain Additional References and Resources. No matter what types of questions learners pose, they will likely need more information. Resources may

¹ Stanley, Ethel and Margaret Waterman. "LifeLines OnLine: Curriculum and Teaching Strategies for Adult Learners." *Journal of College Science Teaching* March/April 2000, 306-310.

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³ Student groups can be formed within larger classes, so that a class of 40 students might break up into 5 groups of eight, or a class of 140 might temporarily work within near neighbor groups of 3-4 while they discuss shorter cases.

include texts, internet resources, scientific papers, interviews with experts, data sets, and a wide variety of other sources. Instructors may provide certain key resources in the classroom, computer lab or library, or they may choose to let the students find all resources on their own. (We recommend with students new to ICBL that the instructor provide as least some “starting” resources.) This information gathering phase may take place during class time or as homework.

4. Design and Conduct Scientific Investigations. In this phase of ICBL students design lab, field or computer based scientific investigations of questions they identified from the case. Instructors may engage students in laboratory exercises to teach methods, or they may simply provide materials and have the students design their own investigations. This phase of ICBL will take variable amounts of time depending on the learning goals that the instructor has selected. Investigations might range from a one-lab period experience to a full semester length project.
5. Produce Materials that Support Understanding of Conclusions. In this phase, students provide evidence of their understanding and of the ways they approached solving the problem. This evidence may take the form of individually written papers and lab reports, of group produced posters and presentations, or of myriad other products students could produce to show their learning. Public presentation with peer review mirrors the process used in scientific communities for showing the results of investigations.
6. Assess All the Types of Learning You Want Students to Achieve. Be sure to include assessments throughout the phases of ICBL, so that you look at students’ skills in identifying questions and managing information resources and in developing and using investigative methodologies, as well as their knowledge of science concepts.

As students learn biology that is integrated with their own interests and they are more likely to develop an appreciation for the power of science to solve problems important to their lives. While there are many instructional strategies to accomplish this end, the ICBL strategies described here and used with the curriculum materials in LifeLines OnLine provide real resources for accomplishing these goals.