Investigative Cases: A flexible tool for teaching

National Institute of Education
Singapore
August 3, 2011

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Case Methods provide learners with an opportunity to:

- Engage with characters and circumstances.
- Investigate to understand facts, values, contexts, and decisions.
- Connect the meaning of the story to their own lives.
What is Case Method Teaching?

- Decision Cases: Business or Law School
- Problem Based Learning: Medical Schools
- Investigative Case Based Learning:
  - A variant of PBL, specifically for science
Some Core Features of PBL / ICBL

- Problems are real and meaningful contexts for learners.
- PBL cases are complex and multidisciplinary.
- The problem comes first.
- Learners collaborate and identify what they need to learn.
- Learners identify and use resources.
- Problems require decision making, use of concepts and skills.
Variations on a Structuring PBL/ICBL

- Length and format of problem/case
- Amount of direction provided
- How the problem is introduced
- Where discussion occurs
- Where collaboration occurs
- If, How investigations are integrated with the problem
Meet Diverse Objectives by varying PBL implementation:

- To assess knowledge and skills
- To initiate investigations
- To introduce new technologies
- To initiate writing assignments
- To develop global and multicultural perspectives
- To see value of interdisciplinarity
Using PBL: Pre-Assessment

The Rumor

"I read on the Internet that you can get Mad Cow Disease from breath mints."
Using PBL:  Assessment

The following take home exam was based on a mini case in which a 14 week-old puppy that “chews on everything” was found ill in the back yard.

Resources for each student:
- prepared slide of suspect plant material
- list of back yard plants by gardener
Submit a memo reporting your findings as a forensics specialist:

Provide an identification of the plant material with evidence to support choices:

- root, stem, or leaf
- dicot or monocot
- herbaceous or woody
Using PBL: Assessment

Write a short letter to the pet owner advising the family to remove the poisonous plant from their back yard:

Provide a description of the plant as it would look during flowering and be sure to include:

- common and scientific name
- habitat preference
- danger to humans
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The Radioactive Accident of 1987  
(Translated from Portuguese)

- Two junk dealers, wander thru downtown Goiânia gathering material to sell to old iron shops. At the place known as “The Hole of Holly House” they penetrate into the ruins of what once was the Institute of Radiotherapy and find what seems to be a valuable thing.

- An object all covered in lead, which they take away, break and disassemble. They are marveled at what resembles some sort of stone having the size of an egg, of 3 cm and 90 g, kept inside of a lead capsule. That thing has a strange light never seen before, would it be a precious gem?

- A mixture of curiosity, greed, gestures of politeness and disinformation causes the object to pass from hand to hand. So beautiful that a girl does not resist and licks it. So rare, that a man takes off a piece to give his wife. Another one hides a small piece in the pocket. It can be worth a lot, he thinks about selling it.

- Hours after handling that luminous object, the people start to feel giddiness, vomits, diarrheas that do not cease with homemade remedies. Without improvements, some look for hospitals and are treated as carriers of infectious-contagious diseases. Also without improvements.

- A doctor suspects that the presented symptoms are radioactive syndrome. When consulted, the physicist Walter Mendes Ferreira confirms and gives the alarm. The object covered of lead was a cesium-137 bomb.
Ben called his old friend Lynn after hearing the latest count of people sick with West Nile Virus.

"Hey Lynn, you work in environmental health, . What can you tell me about this West Nile Virus? We have a real epidemic going on here in Texas and everyone is saying it came from your state."

Lynn groaned "I am so sick of New York being blamed! West Nile Virus has been around a lot longer, and it is called West Nile for a reason,” she huffed. “It is true that the first U.S. virus was detected in 1999 in a dead flamingo and a sick horse in New York City. But now it's all over the US. "

"It sure is - but, wait - a bird and a horse? I don't get it."
Approximate global distribution of West Nile virus

“It’s called West Nile for a reason...”

>South_Africa-99
CCAACCACCTGTGGATTCGCATGGTAACTACCCCACACAGATTGGGGCCACTCAGGCAG G
GAGATTTCAGCATCATCCTTGCAGCGCCTTCATACACACATTTAACTTTGGGAGAGTATGGA G
AGGTGACGGGTGGACTGTGAATCGGATTGACACCAATGCATACTACGTGAT G
ACTGTCGGAAACAAAGACGTCTCTTGGTCCATCGTGAGTGGTTATGGACCT

>Israel-52
CCAACCACCTGTGGAGTCGCATGGAAACTACCCCACACAGATTGGGGCCACTCAGGCAG G
GAGATTTCAGCATCATCCTTGCAGCGCCTTCATACACACATTTAACTTTGGGAGAGTATGGA G
AGGTGACGGGTGGACTGTGAATCGGATTGACACCAATGCATACTACGTGAT G
ACTGTCGGAAACAAAGACGTCTCTTGGTCCATCGTGAGTGGTTATGGACCT

>NY-99flamingo
CCAACCTCTGTGGAGTCGCACGGAAACTACCCACACAGATTGGGGCCACTCAGGCAG G
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>NY-99equine
CCAACCTCTGTGGAGTCGCACGGAAACTACCCACACAGATTGGGGCCACTCAGGCAG G
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AGGTGACGGGTGGACTGTGAATCGGATTGACACCAATGCATACTACGTGAT G
ACTGTCGGAAACAAAGACGTCTCTTGGTCCATCGTGAGTGGTTATGGACCT
The **Biology WorkBench** is a web-based resource for analyzing and visualizing molecular data developed at NCSA (the National Center for Supercomputing Applications). Database searching is integrated with access to a wide variety of analysis and modeling tools.
## Aligned Sequences of WNV E Gene

<table>
<thead>
<tr>
<th>Region</th>
<th>Sequence</th>
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<tbody>
<tr>
<td>Azerbaijan-67</td>
<td>CCAAACACTGTGGAAGTCGCATGGAACATGAACGCCACAGATTGGGCAGCTCAGGCAGGG</td>
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<tr>
<td>Russia-63</td>
<td>CCAAACACTGTGGAAGTCGCATGGAACATAACCCACACAGATTGGGCACCTCAGGCAGGG</td>
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<tr>
<td>South_Africa-99</td>
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<td>Egypt-51</td>
<td>CCAAACACTGTGGAAGTCGCATGGAACATAACCTCACACCAGATTGGGCACCTCAGGCAGGG</td>
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<tr>
<td>NY-99equine</td>
<td>CCAAACACTGTGGAAGTCGCACGGAAACATACACCAACAGTTGGGACACCTCAGGCAGGG</td>
</tr>
<tr>
<td>NY-99flamingo</td>
<td>CCAAACACTGTGGAAGTCGCACGGAAACATACACCAACAGTTGGGACACCTCAGGCAGGG</td>
</tr>
<tr>
<td>Israel-98</td>
<td>CCAAACACTGTGGAAGTCGCACGGAAACATACACCAACAGTTGGGACACCTCAGGCAGGG</td>
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<td>Italy-98</td>
<td>CCAAACACTGTGGAAGTCGCACGGAAACATACACCAACAGTTGGGACACCTCAGGCAGGG</td>
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<td>Kunjin-1994</td>
<td>CCAAACACTGTGGAATCGCATGGGAACATACACCCACACAGTTGGGACACCTCAGGCAGGG</td>
</tr>
<tr>
<td>Kenya-?</td>
<td>CGACGACTGTGCCATCCATGGAATTAACACAAGTAGGAGGCACACCAACGCAGGCAGGG</td>
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<tr>
<td>Uganda-59</td>
<td>CCAAACGACGTTGAAATCCTATGGCAGTTAATTCAGCACAGATAGGGGCACACCCAGGCTGGA</td>
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</tbody>
</table>

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Stork migration map

The migration of the White Stork has 2 paths:

- an Eastern route via Turkey, the Middle East, the Nile Valley to reach East Africa and even South Africa
- a Western route via Gibraltar to reach the North of Africa.

White Storks from Switzerland migrate with the western stork populations via Gibraltar.

Family Trees
Carlos Silva sipped his morning coffee in the shade of the orange and grapefruit trees in his yard. He had planted one at the birth of each of his children.

As he began to read the paper, Carlos was startled by the article accompanying the full-color map on the front page. His eyes moved quickly to the center of the map where he found his own home to be outside a yellow zone north of US 41 and east of NW 87th Ave.

- Yellow areas are 1900 ft canker zones.
- If your citrus tree is located in one of the yellow map areas it will likely be cut down by the state citrus-canker fighters.

Ref: Miami Herald, July 26, 2001
PBL to Introduce New Technology

Visualization software to transform the data grid to a three dimensional image.

http://education.ncsa.uiuc.edu/products/dvs.html
PBL to Introduce New Technology

http://bioquest.org/summer2006/projectfiles/cceasyvisposter.ppt
FILTHY LUCRE:
A Case Study Involving the Chemical Detection of Cocaine-Contaminated Currency

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Tom Brown [was daydreaming while standing in the security line at the airport.] He was in a particularly good mood because Grandma Brown had given him $200 in cash as a Christmas present ... Tom had tucked the cash into his carry-on.

"Sir?" repeated a loud voice. “We have detected evidence of illegal drugs and will need to search your carry-on.”
Using Cases: Lab Technology

Tom’s cash ($200 in ones) will be treated with methanol to extract any cocaine present in the money. The extract will then be injected into the gas chromatograph / mass spectrometer (GC/MS), which will determine if any cocaine is present.
• Roll the bill and place it into a clean vial.
• Add 2 mL of methanol to the vial.
• Cap the vial and shake for 1 minute.
• Using a glass Pasteur pipette, transfer enough methanol to an autosampler vial to fill the vial about three-quarters full.
• Remove the bill from the vial when you are finished using a forceps.
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As she was handing her sister-in-law a mug of coffee on a warm morning in July, Tisha realized she couldn't move her left arm very far in front of her."
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In the 1840’s, Late Blight devastated the potato crop which resulted in mass starvation and forced migration of the human population.
Using PBL: Simulating Late Blight

By comparing the late summer rainfall shown by the blue area under the curve and the escalation in new infections highlighted in yellow over the rainfall, an argument could be made to link the two. An increase in new infections seems to be triggered by recent rain.
Simulation Results: IRELAND 1840’s

Cool, wet conditions, no pest management

Sporangia from cull pile

Infections from volunteers

Crop defoliated and entirely lost well before harvest
Modern Management: Blight Cast

Using 1840 conditions. Result of spraying every 5 days = $278 profit, no tuber loss, 3% foliage loss.
AGENDA

- Introduction to Using Cases
- Are cases ICBL? PBL? ???
- How can cases be used?
  - Lots of examples for different objectives
- The idea of a problem space
  - A couple of examples
- Finding Cases
- What’s Next?
Back to the Bay

Liam and Solana looked forward to their family reunion every year. They were finally going to Maryland's Chesapeake Bay, where two generations ago several members of their family had been oystermen and crabbers. After hearing many stories from their great-uncle about this "cradle of the sea," they were anxious to experience the area for themselves, although they knew this section of the Bay no longer supports commercial shell fishing.

While waiting in line to purchase tickets for a boat tour of the bay, Liam and Solana heard a series of screeches. They scanned the docks for the source of the mayhem. A large gull that had settled on a covered boat hurriedly flew away midway through the screeches. After several more seconds, the noise stopped.

"What was that?" Solana asked. "It sounds like birds are being attacked, but I don't see anything." Liam just shrugged and pointed out a mallard still floating a few feet from the dock and a tern still sitting on the nearby pilings despite the noise. "Can't they hear? They'd have to be deaf to ignore that," Solana said.

The woman working at the nearby snack stand looked up and offered an explanation. "Well, it's a tape the marina owner is using to scare the gulls away. Seems like there's more every year. The folks who rent slips here were upset by the damage the gulls caused. Gull droppings cause holes in the boat covers if they aren't cleaned quickly. We've tried everything to keep the gulls away."

"The marina owner found an ad for this tape on the Internet. He says there are six different gull distress calls, which are all supposed to sound just like the real thing. The tape plays every couple of hours during the day. It worked great last summer, but lately some of the gulls seem to ignore it."

"Do you think the gulls just get used to it?"

Solana asked.

"Well, the owner of the next marina over keeps a few dead gulls out on the dock. He claims it keeps the tapes working, but I . . . "

"Look at that," Liam interrupted. "Someone used duct tape to block the speaker at this end of the dock."

Squinting her eyes to get a better look at the speaker, the woman nodded. "I bet the guy in the 22-foot Sea Ray did it," she offered. "He claims that it's the new landfill causing the gull problem in the first place, and we should get rid of that rather than disturb his peace."

"Well, at least the tape still seems to be working on him," observed Liam, laughing.

Figure 8.1 Gull populations often become a nuisance to people in areas such as marinas.
### Table 8.3 Increase in Number of Gull Mating Pairs in Selected Locations

<table>
<thead>
<tr>
<th>Locations</th>
<th>Initial Observation Mating Pairs/Year</th>
<th>Final Observation Mating Pairs/Year</th>
<th>Gull Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leslie Spit, Toronto, Canada</td>
<td>20 pairs/1973</td>
<td>80,000 pairs/1982</td>
<td>Ring-Billed Gull</td>
</tr>
<tr>
<td>Five Islands, Wollongong, New South Wales, Australia</td>
<td>3 pairs (est.)1949</td>
<td>51,500 pairs/1978</td>
<td>Silver Gull</td>
</tr>
<tr>
<td>Mud Islands, Port Phillips Bay, Victoria, Australia</td>
<td>5 pairs/1959</td>
<td>70,000 pairs/1988</td>
<td>Silver Gull</td>
</tr>
</tbody>
</table>
Investigative Case Based Learning (ICBL)

http://bioquest.org/icbl