



System-Wide Evaluation of ICT in Education

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University of Hong Kong

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Outline/Overview



- Why evaluate? But obstacles.
- Systemic or organizational approaches
 - Grappling Model
- Teaching and Learning Focus
 - TLC
 - Paradigms of ICT's Role
- Student Performance Focus
 - Effects of ICT roles on student outcomes
 - What are the priority 21st Century student outcomes?
 - IEA SITES (case students and student assessments)
- Performance Assessment Prototype Project
- What do we go from here?



The Demand for System-Wide Evaluations of ICT in Education

- **Planning (policy) and accountability for:**
 - schools
 - Groups of schools
 - National educational systems
- **International Comparisons**
 - Policy driven: relative system performance
 - Research driven: understanding system differences

5 Major Obstacles to Such Evaluations



1. Multiple, diverse, & changing **goals** with little (curricular) institutionalization, e.g. nothing like “math achievement”
2. Multiple, diverse, & changing types of **ICT** and types of **pedagogies** using ICT
3. Some ICT learning more at **home** than school, but not by all
4. Few relevant **indicators** and measurement quality unknown
5. Little **funding**
 - few researchers
 - few research projects

Given Obstacles, ICT in Ed Evaluation Methodology Should:



1. Use multiple or **mixed methods** & approaches
2. Recognize embedded **interactions** or co-occurrence between type of ICT and type of pedagogy
3. Use ICT for **data collection** whenever possible
4. And

Evaluation Focus Level & Indicators Needed



| ANALYTIC FOCUS | LEVELS FOR WHICH INDICATORS NEEDED |
|-----------------------------------|---|
| Systemic / Organizational | Community/parents Administrative (staff) Teachers Students |
| Teaching and Learning | Teachers |
| Student Performance / Outcomes | Students |



Systemic and Organizational Approaches

The Grappling Model for System Accountability*



- 24 Main indicators measuring all system levels
- The Grappling Tool Kit contains for each indicator:
 - 1 or more survey instruments
 - 1 or more interview schedules
 - Templates for coding forms
 - Rubrics for coding and scoring
 - Report formats

***The Grappling System was developed by Bernajean Porter. Further information can be obtained at her web site: <http://www.bjpconsulting.com>**

The Grappling Model for System Accountability



SYSTEM ADAPATABILITY

- 1. Collective Vision**
- 2. Community Support/Benefits**
- 3. Leadership Capacity**
- 4. Innovators**
- 5. Staff Capacity**
- 6. Pedagogical Readiness**

INSTRUCTIONAL PROG.

- 7. Equitable Learning Experiences**
- 8. Libraries as Information Centers**
- 9. Instructional Practices**
- 10. Learning Uses**
- 11. Student Performance**
- 12. Home/School Connection**

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The Grappling Model for System Accountability



THE ICT PROGRAM

- 13. Technology Planning/Implementation**
- 14. Equitable Deployment**
- 15. Ubiquitous Access**
- 16. Tool Capacity**
- 17. Connectivity**
- 18. Technical Support**

ORGANIZATIONAL CAPACITY

- 19. Budget Support**
- 20. Collaborative Decisions**
- 21. Staff Development Program**
- 22. Policies and Management**
- 23. Communication/Marketing**
- 24. Evaluation/Accountability**

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Teaching and Learning Foci

TLC Study: 1998 National USA Survey of Schools & 4,000 Teachers*



SYSTEMIC & Teaching FACTORS PREDICTING UTILIZATION OF QUALITY ICT APPLICATIONS IN TEACHING

Systemic

- Leadership: decision making, vision and climate of instructional improvement
- Support for instructional and technical ICT implementations
- Professional Community (school climate)
- ICT resources and access for all

Teachers & Teaching

- Teachers' Philosophy of Teaching, especially constructivism
- Professional community (teacher's participation)
- Teacher expertise in ICT
- ICT resources in classrooms

TLC Reports Web Site:

www.crito.usci.edu/tlc/reports/findings.html



Address  <http://www.crito.usci.edu/tlc/html/findings.html>

TLC HOME PAGE

STUDY METHODOLOGY &
SURVEY QUESTIONNAIRES

REPORTS & SNAPSHOTS

FUTURE TOPICS

CONFERENCE PRESENTATIONS

NEWSLETTERS

ORDER REPORTS

DISCUSSION FORUM

TLC RESEARCH STAFF



Teaching, Learning and Computing: 1998

A National Survey of Schools and Teachers

TLC 12 Report Series

NEW!

Report #8

[School Investments in Instructional Technology](#) - 08/07/01

Report #7

[Teacher Professional Engagement and Constructivist-Compatible Computer Use](#)-01/

Report #6

[School Technology Leadership: Incidence and Impact](#) - 01/10/01

Report #5

[Technology Support: Its Depth, Breadth and Impact in America's Schools](#) - 6/22/00

Report #4

[Constructivist Compatible Beliefs and Practices among U.S. Teachers](#) - 7/00

Note: there are 19 more reports available from this web page.

Role of Professional Community As Confirmed by Both TLC Survey and SITES Case Studies



Core elements of professional community

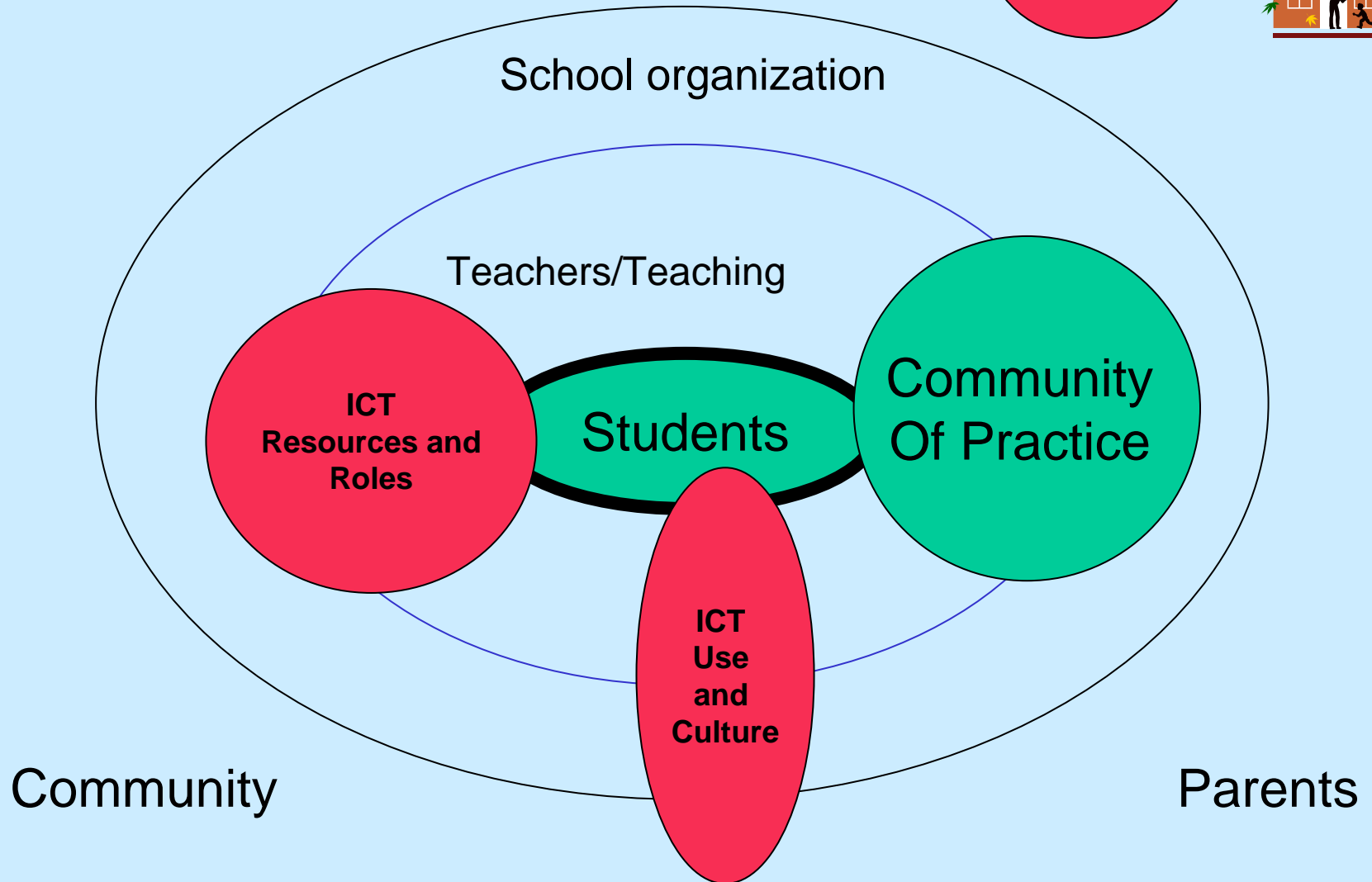
- Collaboration, reflective dialogue
- Deprivatization (“OK to be relatively stupid”)
- Reciprocal and recursive relationships among professional community participants regarding meaningful technology use

Sources:

- TLC: <http://www.crito.uci.edu/TLC/http://sitesm2.org>
- USA SITES M2: <http://www.education.umn.edu/edutech/etips/supports/Research.html>

Universities and other external institutions

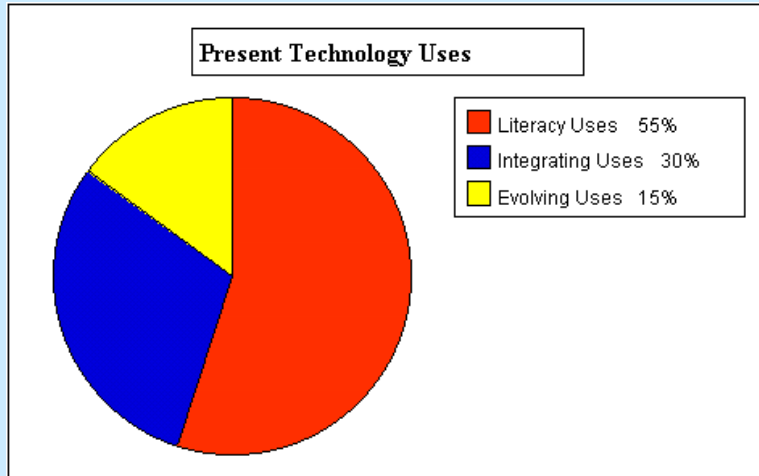
Expectations For ICT



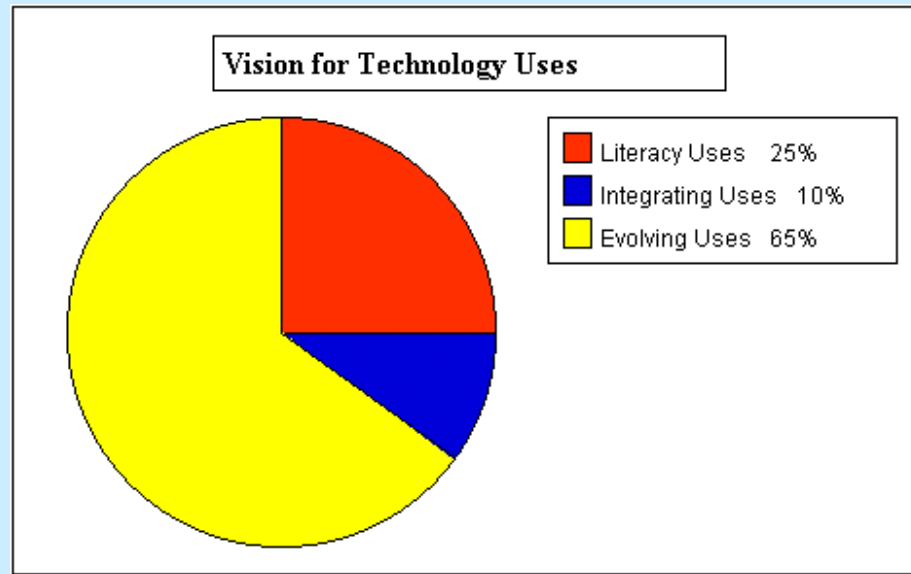
Paradigms on Role of ICT in Teaching and Learning



| <i>Role of ICT</i> | <i>Grappling's Terminology</i> | <i>Core Values</i> | <i>Role in Teaching</i> | <i>Outcomes</i> |
|--|---------------------------------------|--|--|---|
| Programmed Learning | Adaptive | Efficiency | Delivery vehicle | Gains in low level learning |
| Content-Specific Educational Software | Adaptive | Diversion, Tutorial efficiency | Narrow, targeted instruction, remediation | Mixed |
| Learning Programming and ICT Literacy | Literacy | Procedural Control, ICT mastery | Tool, object of instruction | Procedural efficiency and understanding of ICT |
| Information Tools | Adaptive | | | Proficiency in ICT and apps |
| Mind Tools | Transformative | Augmentation of intellect | Learning partner | Deeper understanding, collaboration |



Grappling's Model of ICT's Desired Role





Student Performance Focus

What Indicators of **Student Performance** are Needed in System-Wide Evaluations



Some Alternative Answers

- Electronic portfolios (Authentic Assessment to support authentic learning activities)
- New tests (e.g., as in 21st Century Standards)
- Old (Standardized) tests

A Synthesis of Statements of Desired 21st Century Student Outcomes



- Creativity and knowledge construction
 - Critical thinking: analyze, interpret data, and evaluate evidence
 - Complex problem-solving
 - Work collaboratively, teamwork
 - Effective discourse & presentation
-
- Distillation and utilization of knowledge on best practices (from Knowledge Management community)
 - Understand concepts, principles, and secondary effects of ICT (from the informatics community)

How the Global Knowledge Economy is Shaping Definitions of Required Skills and Learning Strategies

| <i>DEMANDS from SOCIETY</i> | <i>REQUIRED SKILLS</i> | <i>LEARNING STRATEGIES</i> |
|---|---------------------------------|---|
| Rapid <u>change</u> , renewal | Adaptability | Learning to re-learn, on-demand learning |
| <u>Information</u> explosion | Finding, organizing, retrieving | Organizing, browsing exercises |
| Poorly organized <u>information</u> | Information management | Database construction |
| Poorly evaluated <u>information</u> | Critical thinking | Information literacy |
| Information & knowledge as <u>commodity</u> | Knowledge construction | Inquiry, project learning, constructivism |
| Voluminous tacit <u>knowledge</u> | Reflection | Knowledge management exercises |
| <u>Knowledge</u> collective | Teamwork, collaborations | Collaborative activities |

Effects of ICT Implementation by Type of Student Outcome



| | Achievement | ICT Skills | Communication Skills | Knowledge Construction | Engagement & Empowerment |
|----------------------------------|-------------|------------|----------------------|------------------------|--------------------------|
| Programmed Learning | * | + | | | |
| Informatics | | * | | | |
| Information Tools | | * | | | |
| Educational Software, e.g. Games | o | o | o | o | |
| Mind Tools | o | + | + | + | + |

* Statistically established games across many studies.

+ Partial or limited confirmation of effects.

o Mixed effects.

NOTE: these conclusions are based upon hunches, not necessarily meta-analyses.

Coordinated by the **IEA**
(International Association for
Evaluation of Educational
Achievement)



SITES (Second Information Technology in Education Study)

- SITES: 3 Modules:
1. School Survey
 2. Case studies
 3. Expanded Surveys

SITES and its Three Modules



| Module | Time Frame | No. of Countries | Issue | Data |
|--------------|------------|------------------|--|---|
| 1 (SITES-M1) | 1997-1999 | 26 | What are the main trends? | Surveys of principals and of technology coordinators |
| 2 (SITES-M2) | 1999-2003 | 30 | What innovative teaching uses technology and what does it take? | In-depth case studies of innovative teaching in schools |
| 3 (SITES-M3) | 2001-2005 | Not yet known | What are teachers and <i>students</i> able to do with ICT to improve their learning? | Surveys of schools, teachers, and students. Student test and <i>performance assessment.</i> |

SITES M3 Design of Framework for Performance Assessment (with sample performance tasks in cells)



| | Tools to find, organize | Tools to analyze, model | Tools to present, communicate, write |
|---|---|---|--|
| Knowledge construction | <i>Science or math project with choice of tools & data</i> | <i>Science or math project with choice of tools & data</i> | <i>Science or math project with choice of tools & data</i> |
| Critical thinking: analyze, interpret, evaluate evidence | | <i>Interpret results from visualizations using WorldWatcher</i> | |
| Projects and complex problem solving | | <i>Using SimCalc or GenScope compare effects of a variable</i> | |
| Collaboration, teamwork | | | |
| Persuasive communications | | | <i>Using presentation tools or specialized science tools like SenseMaker or KIE, prepare arguments and visuals</i> |
| Searching and restructuring knowledge | <i>Using browser and/or specialized science tools, assemble relevant data</i> | | |

Predator and Prey Performance Assessment



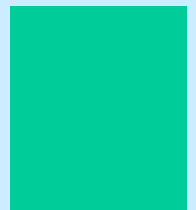
Predator and Prey Performance Assessment



- Please log in.

Name

Identification #



Predator and Prey Performance Assessment



- Please log in.

Name

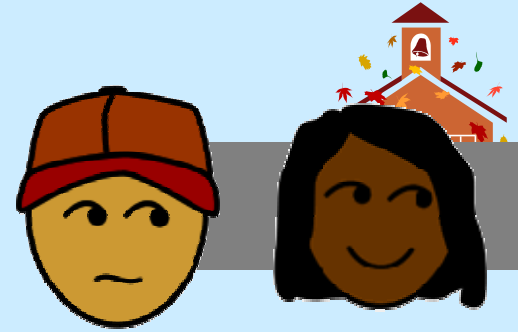
Mirabel

Identification #

29183-030



Too many hares!



- Read the following passage.

Park rangers in Canada's Northwest Territories have noticed a problem in the last few years. They have observed that parks in the area are being overrun by snowshoe hares! The hares are causing problems, eating small plants that other animals depend on for food. Some rangers suggest that the government should bring in more lynx to eat more hares.



The park service hired Dr. Kloss at the Research Institute to investigate. Dr. Kloss is involving teams of students to help. Each team is made up of students from different schools. You'll be working with two other students, Filo from York and Kari from Ottawa. For this project you'll be using technology you've used in class in a variety of ways to solve the problem (research the question, analyze information you find, and make a recommendation): should the government bring in more lynx?



Data from the last 4 years



- Organize data, find patterns and make a prediction.

Park rangers noticed the problem because they've been estimating the number of hares in the area for the last four years. Here's what they found. Last year, 2002, there were about 95,000 hares. The year before that, 2001, there were about 80,000. In 2000, there were 25,000. And in 1999, there were only about 1,000 hares.

Your task is to organize the data to see if there is a trend.

Pick a tool to use:

Word processor

Spreadsheet

Presentation

1

More data



- Represent and transform data to find patterns and make a prediction.



Hi Maribel,

I saw the data that you got from the Canadian park service. I did some research for our team. I looked in the record books, and I found a list of local animal populations that go back 25 years. It was put together by a fur trading company. I guess the rangers didn't know about it. Anyway, it shows how many hares there were, and how many lynx there were. I attached the information in a spreadsheet. I can't understand it. We need to figure out how to make sense of all this. Can you find a better way to analyze and display the data?

Thanks,
Kari



1

Open attachment

2

Finished with task

Planning and accessing information



- Plan topics to research.

You've seen that the hare and lynx populations cycle up and down. But your team needs to do some research to understand why. Are the populations linked? How?

Pick the topics you think would be most relevant for finding more information.

- Canadian parks
- animals
- lynx and hare
- Canadian rangers
- population trends



Create a keyword search



- Create a keyword search to find more information.

You want to find out more about how the hare and lynx populations are related. Type a search below that would help you find more information.

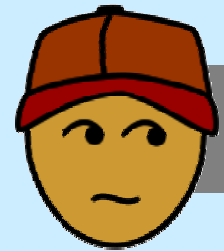


Evaluating an effective search



- Pick the better of Filo's searches.

Here are two searches that Filo was thinking of trying. Pick the one that you think is likely to give you the better results. You'll be using it to do your research.



- Canadian lynx and hare population
- Canadian parks and animals



Evaluating search results



- Decide whether this was an effective search or not, and why.

Results 1 to 5 (out of) 1,700 for “Canadian lynx and hare population”

1. **Canadian Lynx**

... snow shoe **hare** is the primary staple of the **Canadian Lynx** but due to over hunting their food supply is diminished. Hunters only comprise 6% of our **population**, ...
www.wildlifeeasy.com/canadian_lynx.htm

2. **Lynx canadensis (Canadian Lynx): Narrative:**

... increased attention has been focused on the pelts of **Canadian ... Lynx** help control populations of small mammals, such as snowshoe hares ... **Hare population ...**
animaldiversity.ummz.umich.edu/accounts/lynx/l._canadensis.html

3. **Lynx Cats :: Management ... Canadian Lynx**

The **lynx population** cycle is closely linked to the snowshoe **hare population ...**
www.lynx-cats.com/lynx-cat-management.htm - 16k

4.

The LYNX and the HARE part 1

... since 1988, crashed from a high of seven to nine hares per hectare to one **hare** or less per hectare in 1991. The following winter the **Canadian Lynx population ...**,
lynx.uio.no/jon/lynx/cglynx2c.html - 14k

5.

Predator-Prey, Part 1

... pair of interacting populations that come close: the **Canadian lynx ...** first approximation, there was apparently nothing keeping the **hare population ...**
www.math.duke.edu/education/prep02/Word2HTML/HTML%20Sample/pred1.html

Explain whether you think this was an effective search.



Submit

Evaluating results, pt. 2



- Decide whether this was a good search or not, and **why**. Res. to 5 (out of) 250 for “Canadian parks and animals”

1. Eric Praetzel - Vacation Pictures
Recreation > Travel > Image Galleries
Photograph collections from around the world, with a focus on outdoor panoramas and **Canadian** and American...
sca.uwaterloo.ca/~praetzel/vacations.htm
2. Canada's National Parks: Kouchibouguac National Park
Regional > North America > ... > National Parks > Kouchibouguac National Park
Park introduction and show transcript from this Discovery Channel TV show.
exn.ca/Parks/Kouchibouguac.cfm
3. 3,612 Pictures of Mountains, Animals, Nature, Parks, Beaches, etc...
Shopping > Visual Arts > Photography > Exhibits > Realistic > Scenic
Large collection of scenic landscape, sunset, wildlife, and wildflower pictures from most US national...
adventurepix.com/

4. The Burrowing Owl [Speotyto cunicularia] and Links to Owl Pages
Society > Issues > ... > Conservation and Endangered Species > Species Loss > Birds
The Burrowing Owl and other Endangered Animal and Bird Species in Alberta, Canada and North America
raysweb.net/specialplaces/pages/owl.html

5. Alberta's Endangered Species
Society > Issues > ... > Regional > North America > Canada > Alberta
Endangered species in Alberta, North America and elsewhere.
raysweb.net/specialplaces/pages/species.htm

Explain whether you think this was an effective search.



Accessing and retrieving information



- Collect information, take notes, and cite sources.

You'll have three sites to read through. Copy and paste any useful information into the space below. Remember to keep track of what information came from which site. Be sure to include citations. When you're finished collecting information, please save it.

What you want to find out is:

- When does the hare population start to decrease?
- What are reasons that can cause it to decrease?



- » [Canadian lynx](#)
- » [The lynx and hare](#)
- » [Predator-prey cycles](#)

Notes

Retrieving information



- Collect information, take notes and cite sources.

What you want to find out is:

- When does the hare population start to go down?
 - What are reasons that can cause it to go down?
- » [Canadian lynx](#)
- » [The lynx and hare](#)
- » [Predator-prey cycles](#)

Notes

Canadian Lynx
Lynx canadensis

Key Facts

Body Length(mm) - 900-1100

Weight (kg) - 9-18 (male)

Litter Size - 2-4 average

The lynx, in its four species has by far the most restricted range of any of the felids and in as much inhabits either side of the Atlantic Ocean. In the United States the Canadian lynx is found in both Canada and the northern states of the United States. Lynx found in Newfoundland are accredited as a subspecies - that of L. c. canadensis.

As in common with lynx in Europe and Asia

Retrieving information



- Collect information, take notes and cite sources.

What you want to find out is:

- When does the hare population start to go down?
 - What are reasons that can cause it to go down?
- » [Canadian lynx](#)
 - » [The lynx and hare](#)
 - » [Predator-prey cycles](#)

Lynx mostly eat hares. They don't eat much else. If there aren't many hares, they start to get hungry.

<http://dSPACE.dial.pipex.com/agarman/>

The screenshot shows a web browser window with the title "Canadian Lynx". The address bar contains the URL "http://dSPACE.dial.pipex.com/agarman/canlynx.htm". The page features a large photograph of a lynx in a snowy environment. To the right of the photo, the text reads "Canadian Lynx" and "Lynx canadensis". Below the photo, there is a "Key Facts" section with the following information:

| | |
|-----------------|---------------|
| Body Length(mm) | -900-1100 |
| Weight (kg) | - 9-18 (male) |
| Litter Size | - 2-4 average |

Additional text on the page includes: "The lynx, in its four species has by far the most restricted range of any of the felids and in as much inhabits either side of the Atlantic Ocean. In the United States, the Canadian lynx is found in both Canada and the United States as in some of the northern states of the United States. Changes in habitat and over hunting have reduced the extent. Lynx found in Newfoundland are accredited as a subspecies - that of L. c. canadensis." and "As is common with lynx in Europe and Asia..."





Organizing information

- Summarize your notes.

Below are the notes and quotes from the sites you visited. Summarize what you read in an organized way, using a list, outline, or paragraph. Try to answer: When does the hare population start to go down? What are reasons that can cause it to go down?

Notes

Lynx mostly eat hares. They don't eat much else. If there aren't many hares, they start to get hungry.

<http://dSPACE.dial.pipex.com/agarman/canlynx.htm>

Hares are different from rab-

Summary



Citations



Organizing information

- Summarize your notes.

Below are the notes and quotes from the sites you visited. Summarize what you read in an organized way, using a list, outline, or paragraph. Try to answer: When does the hare population start to go down? What are reasons that can cause it to go down?

Notes

Lynx mostly eat hares. They don't eat much else. If there aren't many hares, they start to get hungry.

<http://dspace.dial.pipex.com/agarman/canlynx.htm>

Hares are different from rab-

Summary

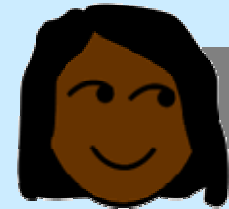
- Lynx eat mostly hares
- Hares get eaten by lots of other animals
- Hares eat grass and small plants, and they grow really

Citations

<http://dspace.dial.pipex.com>



Integrating information



- Incorporate Filo and Kari's information into yours.

Hi Mirabel.

We've done some research into the relationship between snowshoe hares and lynx in the Northwest Territories, and we've found some interesting information. We know you've already done excellent work on this topic. Could you make sure that the report you made also includes all of our points?

Here's what we found:

- Disturbing systems in equilibrium isn't predictable.

Your task is to make sure that your report includes all the new information. Fit it into your summary.

Summary

- Lynx eat mostly hares
- Hares get eaten by lots of other animals
- Hares eat grass and small plants, and they grow really



Analyzing and collecting data using a model



- See what might happen if you introduce more lynx.

After reading some Web pages, and analyzing population data, you know that lynx depend on hares for food, and that introducing more lynx might decrease the hare population more quickly. But how will you know?

Dr. Kloss has an idea. He'd like you to use a modeling program to predict what would happen to the populations if you added more lynx.

Modeling tool

1

Once you've used the modeling tool, record your results below.

If we don't add lynx, the hare population might:

2003

- increase a lot
- increase a little
- decrease a little
- decrease a lot

2008

- increase a lot
- increase a little
- decrease a little
- decrease a lot

If we do add lynx, the hare population might:

2003

- increase a lot
- increase a little
- decrease a little
- decrease a lot

2008

- increase a lot
- increase a little
- decrease a little
- decrease a lot



Planning an argument

- Use the planning form to organize all your information into a clear argument.

Below is a summary of all your information. Use the information to plan your argument.

Summary

- Lynx eat mostly hares
- Hares get eaten by lots of other animals
- Hares eat grass and small plants, and they grow really
- Hare populations go up and down

Problem statement

Recommendation

Evidence and explanations



Create a presentation



- Make a presentation to communicate your recommendation and evidence to the park service.

Now that you've decided what your team's recommendation should be, Dr. Kloss has asked you to prepare a presentation to the park service about what they should do.

Filo's put the planning form into a file. Your task is to use the plan to create a presentation.

Be sure your presentation includes:

- A clear statement of the problem
- Your group's recommendation
- Information, data and explanations to support your recommendation
- Logical organization

Presentation

Word processor

1

2

Finished with task

Critique a presentation



- Critique a colleague's presentation

Hi Mirabel.

Dr. Kloss is almost ready to deliver your presentation to the park service. But we just received this report from another team that is making a recommendation different than ours. Please refer to the checklist at right when making your comments. You'll be sending your comments to the group.

Thanks,
Kari

The presentation should have:

- A clear problem statement
- A clear, supported recommendation
- Supporting evidence and explanations
- A logical organization

1

Open attachment

2

Finished with task

The SRI Performance Assessment Prototype Project



- Five countries partnering: Chile, Finland, Norway, Singapore, USA
 - Participation in design group meetings & pilot testing
- Possible official partnership with IEA
 - Likely January conference to move in that direction
- Schedule
 - Winter, 2003 - Continued development of prototypes
 - Winter, 2003 - Development of scoring, training procedures
 - Spring, 2003 - “pre-pilot” of one school in each country
 - Fall, 2003 - Revised prototypes and other procedures

Some Design Alternatives for Performance Assessments



1. Longer or much longer (days) tasks
2. Relevance to other subjects
3. Variations in balance between pre-coded and open answer formats
4. Structured comparisons of online and offline formats
5. Less independence of tasks
6. Less presumption of prior exposure to tools, subject matter
7. Etc

Where do we go from here?



- Collaboration among countries for a variety of evaluation and assessment projects
 - IEA and OECD ?
 - CISCO Academy & other private organizations ?
 - E.g., Open content organizations
- Case studies of pioneering evaluation and assessment projects

Other ideas?

