Digital Pathology - Implementation Challenges in Developing Countries

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Why mobile phones?

- More than 5 billion connections *
  (UN goal in 2000 - 50% by 2015)
- In 2006, 80% live within MP range

*GSMA Press release February 2010
Why Mobiles?

- 64% of US physicians use smart phones
- 89% say Internet is essential to practice (88% Korea, 87% Australia, 81% Europe)
- More than 88% use PDAs at least 4x per day, 15% more than 25x per day
- 50% use Wikipedia for information

*Manhattan Research, “Taking the Pulse v9.0”*
Digital Divide?

- “…the answer to that question turns out to be remarkably clear: promoting the spread of mobile phones.”
- “mobile phones raise long-term growth rates”
- “impact is twice as big in developing nations as in developed ones”
- “an extra 10 phones/100 people in a developing country increases GDP growth by 0.6 percentage points.”

– Economist, 3/10/05
Challenges

• Cost and maintenance of optical microscopes is greater
• Students have to share microscopes in the teaching laboratory; no access after class hours
• Glass slide breakage
• Faculty-to-student ratio is higher
Challenges

• Cost of equipment is substantial (computers, whole slide scanners)
• Access to workstations is limited especially after class hours.
• Internet access in academic networks is often slow and expensive
• Subject to frequent power outages and adverse weather events
Internet bandwidth - biggest challenge

• Dialup connection does not work
• Local network mirror server
  – Images – Aperio T3 Scanscope, Digital Slide Studio (.svs to .jpg), Zoomify
  – Web server - Apache, MySQL, PHP
• Web archive can be viewed on any browser with Flash Player
University of the Philippines
College of Medicine

- 50 medical students (MSIII, 6%; MSIV, 94%)
- Non-randomized, convenience sample
- One iPad, viewed at-random 2 Web sites optimized for iOS devices (no Flash)
  - NLM images.nlm.nih.gov/pathlab9
  - UPCM (mirror) zell.telehealth.ph/pathlab
- Evaluation – paper questionnaire, 5-point Likert scale, immediately after session
## Results

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Local server (Philippines)</th>
<th>NLM server</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The site is easy to access using an iPad</td>
<td>4.62</td>
<td>4.04</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>The site is easy to navigate using an iPad</td>
<td>4.5</td>
<td>3.82</td>
<td>0.0001</td>
</tr>
<tr>
<td>The site loads fast enough to display a clear image.</td>
<td>4.52</td>
<td>3.86</td>
<td>0.0003</td>
</tr>
<tr>
<td>I see myself using this site to address my academic needs.</td>
<td>4.42</td>
<td>3.98</td>
<td>0.0005</td>
</tr>
</tbody>
</table>
Lessons learned

• Access to both servers was satisfactory but the local server was faster and preferred
• Virtual slides, accessible through a local network may enhance student learning in developing countries
• Digital Pathology may be a cost-saving option for developing countries
• Partnership with academic institutions in developed countries is encouraged
## Digital Pathology - Implementation Challenges in Developing Countries

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Solutions</th>
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<td>Cost and maintenance of optical microscopes is greater</td>
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<td>Glass slide breakage</td>
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<th><strong>CHALLENGES</strong></th>
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<td>High cost of whole slide scanners and computers</td>
<td>Partnering with universities in developed countries</td>
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<td>Access to workstations is limited especially after class hours</td>
<td>Web archive accessible anywhere in the local network</td>
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<tr>
<td>Internet on academic networks is often slow and expensive</td>
<td>Web archive accessible anywhere in the local network?</td>
</tr>
<tr>
<td>Frequent power outages and adverse weather events</td>
<td>Backup power sources</td>
</tr>
</tbody>
</table>
Challenges

Upper left photo courtesy of Dr. Kirk Patrick Uy; lower right from Dr. Siegfried Perez, published in “Development of a Virtual Slide Library in a Developing Country”. Encinas MA, Ducut E, Liu F, Avila JM, Diwa M, Fontelo P. AMIA Annu Symp Proc; 2009; 836

Solutions


• The One Laptop per Child (OLPC) Computer for Health Clinics in Developing Countries. Fontelo P, Liu F, Zhang K, Ackerman M, Herman T. AMIA Annu Symp Proc; 2008; 192-6 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2656055

Avez-vous des questions?

Digital pathology, virtual slides, developing countries, etc, etc...blah...blah...blah....