TURNING A CLASSROOM INTO A CYBER LABORATORY

How SUNY Delhi transformed cyber learning from lecture to hands-on.

Mathew J. Heath Van Horn, PhD
INTRODUCTION

• Associate Professor – SUNY Delhi
  • PhD Information Technology
  • Teaching since Fall 2017
• 23 Years military experience in Cyber
  • Teaching 18-22 year-olds the norm
  • Designed initial USAF cyber training
• 4 Years Business owner
  • Leveraged Cyber knowledge to grow $430 business into $1M annual sales
DAY 1

Typical Classroom
DEATH BY POWERPOINT
FIRST SEMESTER RESULTS

<table>
<thead>
<tr>
<th>Measures</th>
<th>Fall 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands-On Labs</td>
<td>0</td>
</tr>
<tr>
<td>Number of Slides</td>
<td>4,800+</td>
</tr>
<tr>
<td>Student Feedback</td>
<td>2.1</td>
</tr>
<tr>
<td>Pass Rate</td>
<td>63%</td>
</tr>
</tbody>
</table>

NOTE: Factors consolidated to simplify presentation

I. Student Feedback: A 5-point scale: 1- Poor, 5 - Excellent
II. Pass Rate: All students with minimum course average of 65%
III. Pass Rate: Withdrawals are counted as not passing
OBSTACLES TO CHANGE

• No time – Teaching Load
• No money – New Idea, not budgeted
• No precedence – Classes not considered hands-on material
• No feedback – Student comments did not address lack of equipment or hands-on
• Bureaucracy – No government organization changes quickly
NEW PLAN
~ 5 Years of Work

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate
PHASE 1

PROTOTYPE:
Demonstrate the effectiveness of hands-on learning

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate
PHASE 1 STRUGGLES

Today
Short-term
Long-term
Used simulators in place of equipment
Wrote 4 labs
Leveraged broken equipment for student learning

Managed to divert $350 from pens/pencil purchases for 1 learning kit.
## SECOND SEMESTER RESULTS

<table>
<thead>
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<tbody>
<tr>
<td>Hands-On Labs</td>
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</tr>
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<td>3,600</td>
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<tr>
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**NOTE:** Factors consolidated to simplify presentation

I. Student feedback on a 5-point scale: 1- poor, 5 - Excellent
II. Pass Rate is a student average of 65% or better
III. Pass Rate: Withdrawals are counted as not passing
PHASE 2
Expand program:
Adjust the prototype to include more student learning

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate
SHORT-TERM SOLUTIONS

• Used simulators in conjunction with equipment
• Purchased 9 learning kits
• Wrote 18 labs
• 4-port NICs and used VMs
SHORT-TERM PROBLEMS

• CLUTTER!
  • Desks were not designed for this much equipment
  • Classroom used by non-lab courses
• Not enough learning stations for a full class
• Broken PCs are dying
• No dedicated classroom
  • Shared HVAC
  • Typical Power
LONG-TERM PLANNING

• Need money to build “proof of concept”
  • Started grant paperwork to transform classroom
• Need to get equipment off of desks
• Need to reduce lecture and focus on hands-on learning

• Related issues
  • Get students excited about IT
  • Get parents excited
  • Need some “wow” - Wargames
# THIRD SEMESTER RESULTS

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I. Student feedback on a 5-point scale: 1- poor, 5 - Excellent  
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PHASE 3
Go Full Scale

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate
STRUGGLE TO JUGGLE

Today
Short-term
Long-term

Grants
Labs
Build
Quotes
Design
• 10 Equipment Racks, 19” wide
• 30 PC’s
  • Rack mounted
  • Cheap - $700/ea
  • Host 5 VMs at same time
• Power Strips
• 14 Additional Networking Kits
ACTIONS

• Two Saturdays – My Family
  • Assembled Equipment Racks
  • Installed learning kits

• Introduction to Computer Hardware/Software
  • Students built the PC’s
  • Installed the OS and software

• Introduction to Cyber Security
  • Installed the Virtual Machines
  • Tested the first labs

• Networking Class started 100% hands-on
EVERYTHING ELSE

• Flipped three of the courses
  • Increased reading on own
  • Class time: Answer questions, quiz, hands-on labs
  • First time through, largely self-paced
• Offer Stellar Students Independent Study
  • Create Instructional Videos
  • Write Labs
  • Test labs I wrote
  • Provide feedback on their class
• Wrote labs in step-by-step format
ITS ALWAYS ABOUT MARKETING
THE “WARGAMES” EFFECT
TRICKLE DOWN EFFECTS

Freshmen learn PC hardware, operating systems and virtualization

Cyber students can hack and defend their networks

 Networking students can build small business networks that support 50 users

Able to transform the room to satisfy course needs
# FOURTH SEMESTER RESULTS

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### NOTE: Factors consolidated to simplify presentation

I. Student feedback on a 5-point scale: 1 - poor, 5 - Excellent
II. Pass Rate is a student achieving 65% or better
PHASE 4
Sustainment

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate
PHASE 4 ACTIVITIES

• SUNY Center for Professional Development – Grant writing

• Grant#1
  • Need a sustainment budget of $30k/year
    • $20k in equipment
    • $10k in support
  • Opportunity to learn grant-writing process
PHASE 4 ACTIVITIES CONT.

• Grant#2
  • PC’s are end of life at 4 years
  • Effects of students building PC’s that they will use for their degree program?
    • Increase Learning?
    • Increase Dedication?
    • Reduce Help Desk support?
PHASE 4 ACTIVITIES CONT.

• Grant#3
  • Build a lab designed to support a robust IT infrastructure
    • Equipment
    • Support
    • Dedicated HVAC
    • Dedicated Power
    • Collaborative learning
PHASE 4 ACTIVITIES CONT.

• Proof of Concept
  • Can Raspberry Pi’s be used instead of PC’s?
  • Rack mounted solution
  • Reduce lab station costs from $2,000 to $200 per seat

• Amazon Web Services
  • Can our students conceptualize?
  • Can they translate skills to real network environments?
1. Prototype $350
2. Expand $3,500
3. Full Scale $30,000
4. Sustainment $30,000/yr
5. Dedicate $1M + $30k/yr

Complete by 2020
QUESTIONS

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