Measuring the Impact of Training Efforts at NIST

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NIST Training Efforts

• We began tracking NIST-wide training efforts in 2006
  – With support and input from Measurement Services Advisory Group (MSAG) and Conference Facilities in 2007
• Technology Services began having discussions about
  – Training – as related to Technology Transfer efforts
  – Effective measures of impact for training as a part of our Baldrige journey
    • Output (counting) vs Outcome (measuring impact)
Technology Services Course Examples

- Weights and Measures Enforcement
  - Specifications and Tolerances for Commercial Devices (Handbook 44)
    - Scales
    - Vehicle-Tank & Loading-Rack Meters
    - Grain Moisture Meters
    - Railway Track Scales-AREMA (Rick)
    - Small Volume Provers
  - Checking the Net Contents of Packaged Goods (Handbook 133)
  - Price Verification
- Standards in Trade Workshops
  - Middle East, North Africa, and Pakistan on Standards, Codes, and Conformity Assessment for Life Safety and Building Construction
  - Oil and Gas for South America
  - US-China: Intelligent Transportation Systems
  - Support of the Asia Pacific Partnership (APP) on Harmonization of Test Procedures
- Training for US Trade Representatives, Standards Attaches, Foreign Commercial Service Officers

FY: 2007

Measurement Course Examples

- TS Laboratory/Metrology Seminars
  - Basic Metrology - States
  - Basic Mass - Industry
  - Intermediate Metrology
  - Advanced Mass, Advanced Mass Hands-on
  - 6 Regional Measurement Assurance Programs
  - MSC - NIST Seminars: Accreditation (NVLAP), Practical Measurement Assurance
  - NCSLI - Balance & Scale Tutorials
- Summer Institute for Teachers
- Display Metrology
- Laser Measurements
- ARFTG Microwave Measurements
- Microwave Measurements for Emerging Materials
- Near-Field Antenna Measurements and Microwave Holography
- Instrumentation, Metrology, and Standards for Nanomanufacturing
- Gage Blocks
- MSC - NIST Seminars: Pressure and Vacuum, Fluid Flow, Uncertainties
- Mini-Workshop on ITS-90 Fixed Points
- The Role of NIST in Improving the Accuracy of Natural Gas Flow Measurements
- Spectrophotometry
- Time and Frequency Metrology Seminar
- High-Frequency Characterization of Printer-Circuit Board materials
- Optimum CMOS Integrated LNA Design Techniques for Handsets

FY: 2007
Initial Measures

- Initial measures include tracking
  - Number of courses and participants (and trends)
  - Responsible division(s)
  - Location of courses
  - Customer satisfaction measures where available
- 2006: 60 courses and > 1000 participants.
- 2007: > 60 courses and > 1800 participants.

Initial Measures – Internal Assessment

- Technology Services has largest number of courses and participants (64%)
  - Support for weights and measures
    - enforcement officials
    - laboratories
  - Support for standards in trade
- Only about 50% of the courses are tracked by Conference Facilities (they only track fee-based conferences and workshops)
- Management requests for data include tracking participants by organization type and location (e.g., defense in CA, biotech in MN)
- No centralized tracking of data or measures
Evolving Measures

- Part of our TS Baldrige journey
- Beginning to implement formal learning evaluation methods and techniques
- Also tracking requests for training and conducting needs assessments—by group
- New course evaluation forms

Levels include:
- Level 1: REACTION
  - Customer Satisfaction
- Level 2: LEARNING
  - Increased knowledge or skill
- Level 3: BEHAVIOR
  - Application
- Level 4: RESULTS
  - Impact
- Level 5: Return on Investment

1Training Evaluation methods based on formal work by Phillips, Kirkpatrick

Evaluation Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Measurement Focus</th>
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</thead>
<tbody>
<tr>
<td>1. Reaction &amp; Planned Action</td>
<td>Measures participant satisfaction with the program and captures planned actions</td>
</tr>
<tr>
<td>2. Learning</td>
<td>Measures changes in knowledge, skills, and attitudes</td>
</tr>
<tr>
<td>3. Application</td>
<td>Measures changes in on-the-job behavior</td>
</tr>
<tr>
<td>4. Business Impact</td>
<td>Measures changes in business impact variables</td>
</tr>
<tr>
<td>5. Return on Investment</td>
<td>Compares program benefits to the costs</td>
</tr>
</tbody>
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Jack J. Phillips, Ph.D.  FISSEA Conference  March 9, 2004
Characteristics of Evaluation Levels

<table>
<thead>
<tr>
<th>Characteristics of Evaluation Levels</th>
<th>Chain of Impact</th>
<th>Value of Information</th>
<th>Customer Focus</th>
<th>Frequency of Use</th>
<th>Difficulty of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>Lowest</td>
<td>Consumer</td>
<td>Frequent</td>
<td>Easy</td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Highest</td>
<td>Client</td>
<td>Infrequent</td>
<td>Difficult</td>
<td></td>
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<tr>
<td>Impact</td>
<td></td>
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<td></td>
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<tr>
<td>ROI</td>
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</tbody>
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FISSEA Conference  
March 9, 2004

Evolving Measures – Example
Measurement Science Conference – NIST Seminars

- Historically by count and satisfaction:
  - 6 seminars
  - 105 participants
  - People were happy with the experience
- Now multiple levels:
  - Level 1: Satisfaction with
    - Logistics
    - Instruction
  - Data: near 100%
Evolving Measures – Example
Measurement Science Conference – NIST Seminars

• Now: more new measures
  – Level 2: Learning assessments
    • Student perceptions
    • Optional: Testing
    • Optional: hands-on proficiency
  – Level 3: Intent to apply learning
    • MSC: 60% intended to apply something they learned

Evolving Measures – Example
Measurement Science Conference – NIST Seminars

• Follow up to determine impact of student application at 45 days (Level 4)
  – Self-reporting in follow up surveys (32% response rate)
  – Two key questions
    – Begin identifying impact OR begin to identify system barriers
  • Include “needs assessments” for additional training

• If you have applied something, what did you apply and has there been an impact? Please describe.
• If you have not applied anything, but intended to do so, what were/are the barriers that have prevented your implementation? Please explain.
Evolving Measures – Example
Measurement Science Conference – NIST Seminars

• What did you apply? Impact?
  – …achieved A2LA accreditation....
  – …revising our quality manual...
  – …helped locate some problem areas in the lab.
  – …used to throw away glass thermometers …
  – …Make my assessment more presentable to my leadership ....
  – …New control charts are easier to understand and record data on....

• Barriers that prevented implementation?
  – #1 response: TIME
  – …don't allow sufficient time....
  – Identified large steps we have to make [for accreditation] before we begin...

Evolving Measures – Example
State Laboratory Program – NIST Seminars

• Follow up to determine Impact of student application (Level 4)
  – Assessment of interlaboratory comparison results over time
    • Reporting Improvement Actions
    • Targeted needs for improvement
    • Demonstrate improved measurement results
  – Correlation with training?
    • NIST: Publish procedures, focused training.
    • Laboratory: improvement action initiative; what gets measured gets done

- 2007 PT/ILC Follow Up Actions (Corrective, Preventive, Improvement)
- PT/ILC Success Rates

Percent Success

- 2006: 4,864 points 91% 95% 100.00%
- 2007: 3,628 points 92% 97% 100.00%
References for Measuring Training Results

- Measuring ROI in the Public Sector, In Action
  - Jack J. Phillips, Patricia Pulliam Phillips
  - Donald L. Kirkpatrick and James D. Kirkpatrick
- Infoline Guide to Training Evaluation
  - ASTD Infoline Collection
- All available from the American Society for Training & Development

Conclusions

- Using standardized methods for course evaluations helps us evolve from tracking Output to tracking Outcome, thus measuring impact to the measurement system
- A coordinated effort at tracking training efforts can provide opportunity to share impact (and identify opportunities for internal improvements)
- Focus on Outcomes allows us to assess course objectives and focus on participant application and Impact
- Still need to find creative ways to measure Return on Investments