Assessing Skills in a Two-year Lab Science Program Using Internal and External Expertise

Presented by:

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Outline

1. Introduction
2. Curriculum Development
3. Common Rubrics for Assessment
4. Conclusion – current status
Choosing the Program to Develop

• **Interest from Students**

• **Needs of Employers**

• **Similar programs at other institutions.**
Interest from Students

survey for students

Why only pursuing careers in the health related sciences?
Needs from Employers

Survey for industry

100 regional companies completed an online survey.

Questions related to:

• Hiring trends
• Level of education
• **Skills/competencies**
• Externships opportunities
• Advisory board
Met with coordinators of Biotechnology programs from regional community colleges.

Questions related to:

• Budget
• Enrollment
• Curriculum development
• Graduates
OUR New Program Should...

- prepare students to join the workforce.
- focus on basic laboratory techniques.
- be transferable to four-year schools.
## Curriculum Development

### Courses

#### Year I, Fall Semester
- ENG101
- SCI103
- SCI105
- CIS 110 or higher

#### Year I, Spring Semester
- CHM121
- MAT120
- SCI104
- SCI106

#### Course Name
- English Composition I
- Success in Science Seminar
- Integrated Science I
- Computer Science Elective
- Humanities Elective

### Year II, Fall Semester
- CHM201
- CHM203
- MAT125

#### Course Name
- Introduction to Organic & Biochemistry
- Instrumental Analysis
- Statistics
- Humanities Elective
- Free Elective

### Year II, Spring Semester
- CHM280
- OR
- BIO280
- OR
- ERS280
- SCI281
- SCI291 or SCI292

#### Course Name
- Research Seminar in Analytical Chemistry
- Research Seminar in Biotechnology
- Research Seminar in Environmental Science
- Research Experience in Laboratory Science
- Externship in Laboratory Science
- Science
- Math Elective
What specific type of training and/or education would make a candidate for an entry-level technician position stand out for you?

If you could design a program designed to train entry-level technicians, what would be your priorities?
## Survey Results - Industry

### Skills Rank Ordered by Level of Importance

<table>
<thead>
<tr>
<th>Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard lab skills</td>
</tr>
<tr>
<td>Basic arithmetic</td>
</tr>
<tr>
<td>Able to learn new skills</td>
</tr>
<tr>
<td>Basic reading/writing</td>
</tr>
<tr>
<td>Problem-solving</td>
</tr>
<tr>
<td>Ethical</td>
</tr>
<tr>
<td>Self-initiative/perseverance</td>
</tr>
<tr>
<td>Accurately follows SOPs</td>
</tr>
<tr>
<td>Lab safety awareness</td>
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<tr>
<td>Attention to detail</td>
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<tr>
<td>Communication</td>
</tr>
<tr>
<td>Works well in a team</td>
</tr>
<tr>
<td>Listening/following directions</td>
</tr>
<tr>
<td>Understand/interpret graphs/charts</td>
</tr>
<tr>
<td>GLP/GMP</td>
</tr>
<tr>
<td>Basic computer literacy</td>
</tr>
<tr>
<td>Attitude toward supervision</td>
</tr>
<tr>
<td>Uses time, materials, and staff wisely</td>
</tr>
</tbody>
</table>
Choosing the TOP Skills/Competencies

Initially 10 skills were chosen...

- Standard lab skills
- Basic arithmetic
- Able to learn new skills
- Basic reading/writing
- Problem-solving
- Self-initiative/perseverance
- Accurately follows SOPs
- Attention to detail
- Communication
- Uses time, materials, and staff wisely
Choosing the TOP Skills/Competencies

Top Six Main skills:

- Maintaining lab notebooks
- Following SOPs
- Preparing solutions
- Teamwork
- Communication skills
- Analytical reasoning
Integrating Skills into Curriculum

Hard skills

Soft skills

Academic work

Northern Essex Community College
Developing Outcome Assessment

Define skill
Determine outcome
Create Rubric

Skill Outcome Assessment
Defining the Skill...

**Communication**

Speak and write clearly and concisely and use those skills to describe a situation, observation, or provide instructions (describe results/problems, maintain lab notebook, prepare reports and/or presentations).

Put together and deliver a clear, well organized presentation (lab meeting, literature review, or poster).

Develop receptive listening skills (hear, interpret, analyze and synthesize information) to increase ability to comprehend data and concepts, ask clarifying questions and complete verbal or written directions.

Develop nonverbal listening skills (comprehending the meaning of tone of voice, facial expressions, gestures, and other nonverbal cues).
Skill Rubric - Example

Soft Skills Rubrics: Communication

Rubric: Place a 0, 1, 2, or 3 next to the skills being assessed in the exercise
Grading Scale:
Score of 3- Consistently does skill being assessed exceptionally well throughout exercise (Good)
Score of 2- Consistently does skill being assessed throughout exercise (Proficient)
Score of 1- Establishes skill and demonstrates it fairly but not consistently (Fair)
Score of 0- Student does not demonstrate skill (Inadequate)

<table>
<thead>
<tr>
<th>score</th>
<th>Select Communication Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ORAL Skills:</strong></td>
</tr>
<tr>
<td></td>
<td>O1. Speaks clearly and consistently throughout conversation or presentation</td>
</tr>
<tr>
<td></td>
<td>O2. Describes a situation to the extent that listener can visualize experience clearly without questions</td>
</tr>
<tr>
<td></td>
<td><strong>LISTENING Skills:</strong></td>
</tr>
<tr>
<td></td>
<td>L1. Demonstrates receptive listening skills (this includes: hearing, interpreting, analyzing and synthesizing information)</td>
</tr>
<tr>
<td></td>
<td><strong>WRITING Skills:</strong></td>
</tr>
<tr>
<td></td>
<td>W3. Clearly write about results and problems that occurred over the course of research or experimentation</td>
</tr>
</tbody>
</table>
Linking Skills to Courses: Ideal Plan

**Teamwork**
- General Chemistry
- Research Experience

**Communication skills**
- Topics in Lab Sciences
- Instrumental Analysis

**Analytical Reasoning**
- Integ. Science II
- Intro Org Chem & Biochem.
Linking Skills to Courses: 1\textsuperscript{st} Cohort

**Teamwork**
- General Chemistry

**Communication skills**
- Topics in Lab Sciences

**Analytical Reasoning**
- Integ. Science II

Externship
External assessment: Externship

All Lab Science students are required to complete an externship course in order to graduate from the program.

The immediate supervisors were asked to complete a mid-term and end-term survey which included assessment of the SIX skills.
## Results: Communication

<table>
<thead>
<tr>
<th>Select Communication Skills</th>
<th>Year 1 Internal Assessment Externship Students Only</th>
<th>Year 2 External Assessment from Externship Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ORAL Skills:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O1. Speaks clearly and consistently throughout conversation or presentation</td>
<td>2.44 (n = 9)</td>
<td>2.50 (n = 9)</td>
</tr>
<tr>
<td>O2. Describes a situation to the extent that listener can visualize experience clearly without questions</td>
<td>2.78 (n = 9)</td>
<td>2.44 (n = 9)</td>
</tr>
<tr>
<td><strong>LISTENING Skills:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1. Demonstrates receptive listening skills (this includes: hearing, interpreting, analyzing and synthesizing information)</td>
<td>2.56 (n = 9)</td>
<td>2.28 (n = 9)</td>
</tr>
<tr>
<td><strong>WRITING Skills:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W3. Clearly write about results and problems that occurred over the course of research or experimentation</td>
<td>2.56 (n = 9)</td>
<td>2.57 (n = 9)</td>
</tr>
</tbody>
</table>
## Results: Analytical Reasoning

<table>
<thead>
<tr>
<th>Select Analytical Reasoning Skills</th>
<th>Year 1 Internal Assessment Externship Students Only</th>
<th>Year 2 External Assessment from Externship Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR3. Student gathers information from a variety of reputable sources and presents multiple viewpoints; information cited is presented in student’s own words.</td>
<td>2.56 (n = 9)</td>
<td>2.21 (n = 7)</td>
</tr>
<tr>
<td>AR6. Student thoughtfully analyzes results and data; identifies errors that may have occurred during experimentation and the effects on results</td>
<td>2.44 (n = 9)</td>
<td>2.50 (n = 7)</td>
</tr>
<tr>
<td>AR7. Student uses appropriate quantitative methods in analysis</td>
<td>2.67 (n = 9)</td>
<td>2.71 (n = 7)</td>
</tr>
</tbody>
</table>
## Results: Teamwork

<table>
<thead>
<tr>
<th>Select Teamwork Skills</th>
<th>Year 1 Internal Assessment Externship Students Only</th>
<th>Year 2 External Assessment from Externship Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>T3. The student demonstrated appropriate and respectful communication and interactions with peers, faculty, and/or supervisor</td>
<td>3.00 ((n = 8))</td>
<td>2.61 ((n = 9))</td>
</tr>
<tr>
<td>T4. The student demonstrated a positive and cooperative attitude towards the group work by making multiple useful suggestions and contributions towards the final product</td>
<td>2.89 ((n = 8))</td>
<td>2.78 ((n = 9))</td>
</tr>
</tbody>
</table>
Data Driven Changes

Communication
- Presentation assignments now in every course
- Working with a faculty ‘communication coach’
- Gradually increasing spoken lab directions in upper level courses

Analytical Reasoning
- More case studies as part of curriculum
- Research Experience course prior to Externship
- New Basic Lab Calculations course

Teamwork
- New Externship ‘Boot Camp’
The Continuing Outcome Assessment Cycle

1. Identify Learning Outcome
2. Develop assessment plan
3. Implement internal assessment
4. Analyze data to improve learning outcome
5. Implement external assessment
6. Continue collecting internal and external assessment data for future classes
7. Include hard skills assessments
8. Continue revising curriculum in response to assessment data

Northern Essex Community College
Thank you!

Lab Science Core Team
NECC Staff and Administrators
Lab Science Advisory Board