Learning to Be a Research Scientist: Capturing the Transformation

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Learning to be a Research Scientist: Capturing the Transformation through Reflection and Self-Assessment

Dr. Bonnie Mullinix & Dr. Brannon Andersen, Furman University
SOTL Commons Conference Session 3.7
November 1-2, 2007
Session Goal

To engage participants in considering the multiple benefits of self-assessment mechanisms and to identify mechanisms for capturing transformative learning that moves student participants towards recognizing themselves as researchers and scientists.
Session Objectives

By the end of the session, participants will:

1. Explore the SoTL challenge in the context of an extended undergraduate research learning experience (RBRI).
2. Review self assessment approaches and sample instruments and consider their multiple uses and review data analysis showing significant self-assessed learning.
3. Consider the challenges of transforming anecdotal stories into systematic assessment acceptable to various national and foundation funding sources (e.g. NSF, Teagle).
4. Worked in groups to either:
   a. Construct/graphically represent their understanding of the extended research design.
   b. Work with narrative reflections on learning to identify themes and transformational moments.
5. Propose additional mechanisms and key questions to fully explore and capture student’s learning transformations.
River Basins Research Initiative

- Started 1996
- 1999 REU NSF Site
- 175 students
- 7-11 faculty
- 21 student researchers on average

Integrated, Interdisciplinary Watershed Research
This SoTL initiative included:

1. Learner self-assessments of ability, skills, and confidence in conducting scientific research;

2. Reflections on development and growth as scientific researchers, and recounting of critical or transformative experiences; and

3. Learner evaluation of program support and logistics.
Why Self Assessment?

What can self-assessment instruments do?

Participants’ brainstormed responses included:

- Tell you where you are heading towards
- Identify expertise
- Document progressive change
- Foreshadow what the program will do
- Provide accountability
- Help learners see what they know and where they are starting from (- and going KWL: Know-Want to know-Learn)
- Shares fears
- Self-realization/awareness of learner
Why Self Assessment?

What we think our pre & post self-assessment instruments do. They:

- **Serve as advanced organizers** - foreshadowing summer research experience,

- **Serve as pre-tests and needs assessments** - to guide facilitators in team and group formation

- **Set/clarify learner challenges** – help learners/facilitators identify key areas needed for growth.
Self Assessment Instruments

**Pre & Post** Self-Assessment

Four Categories with Sub Categories

- Laboratory and Field Skills
- Project Planning & Interdisciplinary Teamwork
- Knowledge Base & Scholarly Research Practice
- Sharing Research
## Significant Change in Self-Assessed Learning

Paired-samples t tests for the four areas from pre to post-assessments indicated that participants reported significant growth (far less than .05) in all four areas in both 2006 t(14) and 2007 t(8):

<table>
<thead>
<tr>
<th>Area</th>
<th>2006 t(14)</th>
<th>2007 t(8):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory and Field Skills</td>
<td>-11.69, p &lt; .001</td>
<td>-6.01, p&lt; .001</td>
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<tr>
<td>Project Planning &amp; Interdisciplinary Teamwork</td>
<td>-6.98, p &lt; .001</td>
<td>-4.79, p&lt; .05</td>
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<tr>
<td>Knowledge Base &amp; Scholarly Research Practice</td>
<td>-5.33, p &lt; .001</td>
<td>-3.19, p&lt; .05</td>
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<tr>
<td>Sharing Research</td>
<td>-6.35, p &lt; .001</td>
<td>-6.70, p&lt; .001</td>
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Growth by Area in 2006

<table>
<thead>
<tr>
<th>Area</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory and Field Skills</td>
<td>1.22</td>
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<tr>
<td>Project Planning and Interdisciplinary Teamwork</td>
<td>1.09</td>
</tr>
<tr>
<td>Knowledge Base and Scholarly Research Practices</td>
<td>0.68</td>
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<tr>
<td>Sharing Research</td>
<td>0.91</td>
</tr>
</tbody>
</table>
Mean Scores by Area in 2007

- Lab and Field Skills
- Project Planning & Teamwork
- Knowledge Base & Scholarly Research
- Sharing Research

Growth

Mean Scores by Area

- pre
- mid
- post
Small Group Explorations (10-15 min)

- **Methodological Design** – explore core design and phased approach of this SoTL initiative and construct/graphically represent the multi-modal research design
  
  or

- **Qualitative Data on Transformational Learning** – review narrative reflections on learning to identify themes and transformational learning moments.
Rich array of methods – continue to look at ways to maximize productivity of each data collection strategy. Pick the right questions to ask in the right places.

Encourage a notebook/journal that students keep and post their research questions (note: already done under the science support side).
Group Reports – Emergent Themes

Some themes seen from the post assessment responses:

- Improved skills
- Increased self confidence
- Personal & social skills
- Confirming abilities
- Identified areas of improvement
- Pride
- Meaningful work
- Trust own knowledge

See big picture
Some Favorite Quotes…

… I felt like a real scientist...science has become real to me this summer--the good and the bad. It is no longer some abstract concept sitting up on a pedestal that I am striving towards--it is all around me.

…I’ve always said that I want to be a scientist, I want to go on to grad school and do this for the rest of my life, but I always wondered if I could do it or not. And through the course of this summer, I realized I CAN do this, and it doesn’t matter what kind of project I work on, I can figure it out, and I know what to do.

…we’ve been reading papers all summer and seeing people that are professional scientists and are published and have been researching for 20 years and can see that our work is comparable to the work they’re doing, so that makes me think yeah, I’m a professional scientist…. the thing that separates us from a PhD is experience; it’s not necessarily ability or skill or desire, it’s just the years, you know? So, I can now sort of see myself eventually in their position.
Some Favorite Quotes...

…it’s like I can feel my skills progressing as time progresses…

…I feel like I didn't understand myself as a scientist at the onset of the summer. I think I've learned about myself as a researcher, and found some important weaknesses (impatience, my temper, recording methods) that I can really focus on when I work with others in the future…

…This summer has been great, I feel like I’ve been growing the whole time, just learning how to do things on my own. Because at the very beginning of the summer, I didn’t know how to do anything… but all of us have progressed to the point where we can do things ourselves, and our questions are more like “well, I was looking at this data, where do you think this is coming from?” It’s less of “am I doing this right” and more “what do you think of this, let’s sit down and discuss it…”
Future Strategies & Closing Thoughts

What are the next steps in this SoTL project?
How should we identify transformational learning and significant growth as scientists?
What questions should we ask?
How should we gather the data?
Thanks!

We welcome your ideas, comments, questions and suggestions

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