Online Communities of Practice for Professional Development: What’s In It for Us?

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We Describe Science Educators’ Experiences In Online Communities Of Practice (CoP)

• Communities of practice are:
  – Informal structures external to a formally structured organization
  – Develop as people within a profession come together due to common interests
    (e.g., Brown & Duguid, 2000; Lave & Wenger, 1991)
  – Need not be physically bounded
Roadmap

• Background, research questions, and methods
• Overview of NSTA Learning Center
• Preliminary Results
  – Who participates?
  – How do participants generate sociotechnical capital?
  – What outcomes do participants report?
  – How do experiences differ for CoP newcomers and oldtimers?
• Summary and Conclusions
Online CoPs May Overcome Limited Opportunities to Interact with Colleagues

- Competing demands leave little time for community building among teachers (Hollins et al., 2004)
- In rural areas, opportunities further constrained by small numbers and high turnover (Lowe, 2006)
- Professional development (PD) opportunities for science teachers often insufficient
  - Lack of local PD (Sherman, Byers & Rapp, 2007)
  - Short-lived, lack continuity, not context-specific (e.g. Corcoran, et al., 1998; Garet et al., 2001; Schlager & Fusco, 2003)
Study Draws on Several Bodies of Literature

- **Sociotechnical Systems Theory**
  - Technological systems ↔ social systems
  - Performance is a function of joint optimization of social and technical factors

- **Sociotechnical capital**

- **Communities of practice**
  - Participation → sociotechnical capital
    - e.g., group relationships, collective identity, trust, commitment to the group
Participants’ Language Helps Build a Sense of Community

• “We-ness" (Fayard & DeSanctis, 2010) is reflected, in language such as
  – Collective pronouns
  – Introducing oneself
  – Recognizing and welcoming newcomers
  – Offering thanks or positive feedback
  – Building a shared history by referencing others’ responses or expertise (see also Kraut et al., 2008)
  – Sharing personal experiences or "stories" (Brown & Duguid, 1991; Gray, 2004)
We Address Several Research Questions About Online CoPs for Science Educators

• What factors predict participation?
• What characterizes participation?
• How does participation affect sociotechnical capital and job outcomes?
We Investigate the Research Questions with Participants in NSTA Learning Center

• Funded by NSF
• Incorporates two communities from the NSTA Learning Center
  – Life sciences (LS)
  – Physical sciences (PS)
• Uses mixed methods and longitudinal design
  – Surveys in 2012 (n = ~700) and 2013 (n = ~500)
  – Content analysis of discussion forums
  – Web analytics
  – Interviews
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• Summary and Conclusions
Offers a Range of Individual and Collaborative Resources

- Self-Directed Access
- 10,700+ resources
- Free tools to help teachers personalize, and document their learning
- Immediate access to online advisors and colleagues through chat and discussion
- Innovative teacher badge recognition system
A Professional Learning Platform

- Teacher indexes PD needs
- Resources, and opportunities suggested
  - Teacher selects based on needs/preferences. Creates PD Plan
  - Join others
    - Discussion group online
    - Content/knowledge assessment
      - Teachers address their individual learning needs, preferences, and consumption modes
      - Analytical Research Database
      - Into Teacher Portfolio

- Self-directed study
  - Live Online Advisor “Help desk” and email Content Mentors

- Takes moderated course
  - Professor for graduate credit online
### Do-It-Yourself Learning

- SciGuides [39]
- Science Objects [94]
- SciPacks [24]
- Archived Seminars/Podcast [1,840+]

### Live Online Seminars & Classes

- Web Seminars [110/year]
- Short Courses [20+/year]

### Books & Articles

- Journal Articles [5,700+]
- NSTA Press Books [294+]
- e-Books [200+]
- e-Chapters [2,093+]

### In Person Experiences

- Symposia [6-10/year]
- PD Institutes [6-10/year]
- NSTA Conf./Forums [5/year]

June 2013: 10,700+ Learning Resources and Opportunities available
Learning Center Has Grown Substantially Since 2010

**121,703 Active Users***
- 22,585 Members (18.6%)
- 99,118 Non-Members (81.4%)

**Active User Growth**

**1,082,398 Resources in Libraries**

RAND
NSTA Strives to Encourage Participation Through Recognition of User Activities and Contributions

• Over 48,000 badges earned since 2011
• Designed to promote a vibrant learning community

Psycho-Emotional Roles
High Quality Content
Social Learning Discourse
Roadmap

- Background, research questions, and methods
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- **Preliminary Results**
  - Who participates?
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- **Summary and Conclusions**
The Majority of Study Participants Are Middle and High School Teachers
Most Teach in Medium-Sized Schools

<table>
<thead>
<tr>
<th>School Size</th>
<th>Life Science</th>
<th>Physical Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>401-1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>more than 1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Most Participants Have Two or More Science Colleagues at Their Schools

![Bar chart showing the percentage of participants with different numbers of science colleagues. The chart compares Life Science and Physical Science categories. Most participants have 5 or more colleagues.](chart.png)
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Most Participation is Individual, Although Teachers Engage in a Variety of Collaborative Activities

- Add resource to personal library
- Participate in online PD
- Review or rate resources
- Share resources
- Post in online forum
- Chat with online advisor

Percentage

No or minimal collaboration
Highly collaborative

Life Science
Physical Science

No or minimal collaboration
Highly collaborative

Add resource to personal library
Participate in online PD
Review or rate resources
Share resources
Post in online forum
Chat with online advisor

Life Science
Physical Science
About Half Engage in One or More Collaborative Activities

Life Science

Physical Science

None 1 2 3 or more

None 1 2 3 or more
How Do Participants Interact?

- We content analyzed approximately 700 posts to online forums for life sciences and physical sciences educators from 2012.
- Posts covered 56 topics (threads).
- Two coders analyzed the posts using categories derived from prior research:
  - Task categories (e.g., requests for information, responses)
  - Social categories (e.g., establishing legitimacy, greetings, positive feedback, personal information)
  - Conversational style
A Sample Thread from PS Discussion Forum

Community Forums

Welcome to the Discussion!
You're free to browse these public discussions. To post your own topics or replies simply log in or complete a free registration.

15 people currently online

POST REPLY

by Amy Casey, Fri Oct 12, 2012 4:45 AM

My family and I went to a fair at a community college. Some of the Science major students did mini demonstrations for the kids. When my kids and I passed by the booth, one of the students had a beaker full of dish soap. He had another container that contained dry ice and water. There was a rubber tube connected to the top of the container. The student dipped the other end of a rubber tube into the dish soap. He told the kids to stick their hands out and he would let the bubble come out and it would form on their hands. The bubble would sink if he just let it form and be released. The kids just loved the mini demonstration.

After watching the demonstration, I thought that I need to make my Science lessons a bit more fun and engaging. In school, what are some ways that you help make Science fun and engaging?

by Betty Paulsell, Tue Oct 16, 2012 10:25 AM

Amy,

There is an interesting book that is free is PDF form from National Academies Press. It is entitled "Ready, Set, Science: Putting Research to Work in K-8 Science Classrooms" by Sarah Michaels. The website to get it is http://www.nap.edu/catalog/11382.html I believe this book may give you some ideas about how to make science even more fun!!
Learning Center Profiles Provide Professional Background of Participants

About Me: I am a retired elementary teacher now working for NSTA as an online advisor. I also teach university science courses online and face to face. Plus I teach workshops for Mad Science. And I do lots of volunteer work in schools.

Affiliation: Independent Science Consultant

Location: Kansas City, MO

Badges Earned:

Recent Posts
Recent Public Collections
Recent Reviews

Recent Donations
- Provide a Day's Worth of Fresh Drinking Water (5 donations made)
- Plant a Seed (3 donations made)
- Give a Bowl of Rice (3 donations made)
Most Threads (75%) Start with Requests for Ideas or Resources

<table>
<thead>
<tr>
<th>Topic</th>
<th>Excerpts</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Life&quot; in movies</td>
<td>I think that the introduction of movies in class can be used as a great anticipatory lesson...Anybody else have experience with using movies within the classroom? Any ideas?</td>
</tr>
<tr>
<td>Chemical Bonding</td>
<td>I was wondering if anyone has an cool activities I can do to help [students] understand ionic and covalent bonding. ...Any advice will be greatly appreciated. Thanks!</td>
</tr>
</tbody>
</table>
### Some Threads (25%) Propose Topics for Discussion

<table>
<thead>
<tr>
<th>Topic</th>
<th>Excerpts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition SciPack</td>
<td>Aloha All, Today I completed the nutrition SciPack and I must say it was much more difficult than I had envisioned. However, it did have some great interactives that I could definitely use with my fourth graders...In all, I was impressed with this SciPack!</td>
</tr>
<tr>
<td>Projects &amp; Upcoming Articles</td>
<td>A couple of weeks ago I held classes for constructing model wind turbines, the kids really enjoyed that. The fact that you can measure performance with an inexpensive voltmeter is a big plus. I am working on a construction article for my website on my design...</td>
</tr>
</tbody>
</table>
Number of Replies Varies Widely

Number of Replies per Thread

Frequency

0 1 2 3 4 5 6 7 8 9 10 11 12 14 18 20 21 22 24 26 27 29 38 47 59

RAND
Many Replies Demonstrate “We-ness” in Both Task and Social Communication

• Thanks for sharing, Helen! That was an ideal way to incorporate movies into the classroom. I used to use the scene from Shrek where he's arguing with Donkey about ogres having layers (like an onion) to introduce the layers of the earth...it was so familiar to students they allowed themselves to be sucked right into the lesson every time. Just for fun, here's the link to the latest [url=http://www.nsta.org/publications... :)Thanks again! Kendra
Teachers Build Sociotechnical Capital Through How-Tos, Stories, URLs, & Creating Shared Histories

- Describe activity, resource, etc.
- Share "stories"
- Provide URL
- Linking, build shared history
- Attach a resource
- Offer personal help
Members’ Language Reflects Strong Community Focus

- Informal style: 240
- Positive feedback, Individuals: 170
- Name of poster: 150
- Greetings: 120
- Personal information - relevant: 80
- Positive feedback, group: 60
- Personal information - not relevant: 40
- Refer to the group: 20
Hi Jessica, Congratulations on your choice of careers and welcome to the discussion forums! You have a lot compacted in your request. Let me address one small part of it. Others will chime in with lots of great ideas for you, I'm sure. There are a few resources I would like to share with you that I think will be great places to investigate for information on what is grade level/developmentally appropriate for middle schoolers learning about Force and Motion. One is http://www.project2061.org/... Another is... What do others think are the most important elements a teacher should consider when preparing to teach a unit on force and motion to middle school students?
Many Posts Demonstrate “We-ness” (3)

• ...There are also some fun songs http://www.youtube.com/... The one below is to Row, Row, Row your boat. I like to have a song leader each day lead the class in singing the song at the beginning and end of the period. This really helps the kids learn the basic structure of DNA. To get them to learn the song I promise them an extra credit point per stanza on a quiz if they can write the song down. The song is goofy but fun...

*http://www.youtube.com/watch?v=gqvYOr78THo&feature=related
And a One, and a Two...

We love DNA
Made of nucleotides
Sugar, phosphate, and a base
Bonded down one side.

Adenine and thymine
Make a lovely pair
Cytosine without guanine
Would feel very bare.
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Participants Report Positive Climate, Strong Collective Identity, but Lower Commitment to CoP

Commitment has strongest association with participation

<table>
<thead>
<tr>
<th></th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td></td>
</tr>
<tr>
<td>Collective Identity</td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td></td>
</tr>
</tbody>
</table>

Life Science  Physical Science
Teachers Report Using Instructor-Facilitated Practices; Somewhat Less for Student-Facilitated

![Bar chart showing average ratings for Instructor-facilitated and Student-facilitated/hands-on practices in Life Science and Physical Science. The chart indicates a higher average rating for Instructor-facilitated practices compared to Student-facilitated/hands-on practices in both Life Science and Physical Science.]
Teachers Report High Self-Efficacy

Average Rating

<table>
<thead>
<tr>
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<th>Physical Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy, instruction</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Self-efficacy, content</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

-life and physical science ratings are equal and high.
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CoP Newcomers Report Lower Sociotechnical Capital Compared to CoP Oldtimers

### Climate*
- Newcomers Y1: 4.5
- Newcomers Y2: 4.3
- Oldtimers Y1: 4.7
- Oldtimers Y2: 4.6

### Collective identity**
- Newcomers Y1: 4.2
- Newcomers Y2: 4.1
- Oldtimers Y1: 4.4
- Oldtimers Y2: 4.3

### Commitment**
- Newcomers Y1: 3.8
- Newcomers Y2: 3.7
- Oldtimers Y1: 4.0
- Oldtimers Y2: 3.9
CoP Newcomers Report Less Favorable Teaching Outcomes Compared to CoP Oldtimers

![Bar chart showing self-efficacy for content and instruction between newcomers and oldtimers for years Y1 and Y2.](chart_image)
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Summary and Early Conclusions

• Overall, participants in LS and PS communities are similar in inputs, participation, and outcomes
• Teachers who may benefit most from participation are least represented in sample
• About 50% of participants engage in one or more collaborative activities
• Contributions to online discussions create a positive climate
• Teachers report relatively high self-efficacy for science instruction but lower use of “best practices”
• Newcomers report lower levels of sociotechnical capital and teaching outcomes; generally don’t “catch up” after one year of participation
Implications for Practice and Research

• Engagement of teachers with few local colleagues
  – Does geographic location/district structure matter?
• Involvement/outcomes for newcomers
• Investigate and address possible gap between self efficacy and practice
  – Facilitate moderated sharing of work samples; videos of instruction, lesson plans, de-identified student products
• Balance between positive climate and constructive feedback
Limitations and Future Directions

• Selection bias in surveys and participation in discussion forums
  – Respondents may not be representative of all Learning Center users or “typical” participants in CoPs

• Self-report measures in surveys
  – May not reflect objective experience

Forthcoming analyses will address some of these issues
Research in Progress will Assess Predictors and Consequences of Participation

- Antecedents of Participation
- Sociotechnical Capital
- Participation in CoP
- Job Outcomes
Questions?

Slides will be available at iste.org and at learningcenter.nsta.org/iste