

Online Communication Between Mentors and Students: Analysis of a Model

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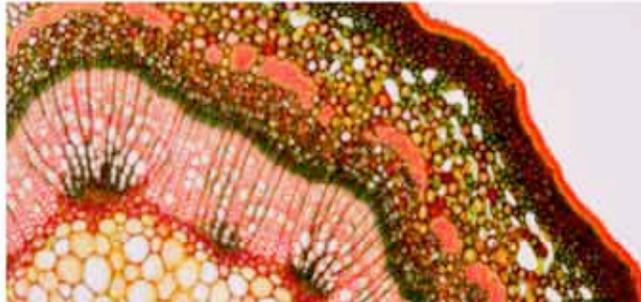
**1st International Teacher-Scientist Partnership Conference
February 13-14, 2013 – Boston, MA**

The Online Community of Planting Science



<http://plantingscience.org>

[Student](#) [Teacher](#) [Scientist](#) [Research Gallery](#) [Plant Themes](#)



Spring Session Underway

Welcome students, teachers, and mentors! The spring session of PlantingScience will run from February 4 - March 29.

New PlantingScience Website in the Works

We're working hard to bring you a new, improved PlantingScience website. This spring we will be hosting a small session as we continue work on the new website. We're not currently accepting new teacher or mentor applications, but we'll open registration back up on the new website in early fall. Thanks for your patience as we make improvements.

How can your class participate?

Teachers, please consider joining a future session. Here's ["how to participate."](#)

How it Works

PlantingScience is a learning and research resource, bringing together students, plant scientists, and teachers from across the nation. Students engage in hands-on plant investigations, working with peers and scientist mentors to build collaborations and to improve their understanding of science. [Learn more](#)

Supporting Science Literacy

If your organization seeks to improve science literacy as a means of growing a sustainable tomorrow, we ask that you consider joining the **PlantingScience** movement. [Learn more](#)

What teachers are saying

It is so much better that they get to do science instead of a teacher doing it for them. That makes volume for what will be helping us do.

Viewing Research Projects

Please browse and enjoy some of the projects from the last session.



[Team Awesome](#)

High Technology High School
Lincroft, [New Jersey](#)

Will there will be a significant difference in the germination rates of the Brassica rape seeds when the soil is heated to a higher temperature using heating mats?



[Team ACE](#)

Springfield Central High School
Springfield, [Massachusetts](#)

Will the amount of fertilization affect the time of germination?



[Plant Peas](#)

Seoul American High School
Seoul, [South Korea](#)

How does the temperature affect the growth of the radish plant?



[The Green Issue](#)

Springfield Central High School
Springfield, [Massachusetts](#)

How will the fertilizer make the radish seed grow in the size, height, color, and in the number of leaves and length of the plants?

Login

User name

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New Student? Sign Up!

Online

36 anonymous users and 1 registered user online.

You are an unregistered user or have not logged in.

Research Questions

- (1) How do scientists contribute to students' development and use of scientific proficiencies to employ knowledge, engage in practices, understand the nature of science, and communicate scientifically? (*Scientific proficiencies framework*)

- (2) How do scientists contribute as socially connected and accepted members participating in the student inquiry group? (*Sociocultural, participation framework*)

- (3) How do scientists contribute to the motivation of students? (*Motivation framework*)

Details of the Research

- Seventeen student inquiry projects were analyzed
- Inquiry projects were posted as “STAR” projects on the *PlantingScience* website
- Coding schemes were chosen and/or developed for each perspective
- Rater agreement was reached in the coding of scientists’ comments
- Percentages of occurrences of types of codes were calculated from each of three perspectives

An Examination of One Scientist-Student Inquiry Group Dialogue

- Scan the text at your tables
- Find examples from the text of scientists' impacts on students

Contributions from Perspective of Scientific Proficiency

- In 2007, National Research Council released Taking Science To School (TSTS) Report, which was based on extensive research in learning sciences and science education (see Duschl et al., 2007).
- “The four strands of scientific proficiency reflect an important change in focus for science education, one that embraces a shift from teaching about *what* to teaching about *how* and *why*.” (Duschl, 2008, p. 270).
- TSTS highlights the cultural basis of science and blends it with learning goals of science with an emphasis on four strands of proficiencies for all students (Duschl, 2008).

Contributions from Perspective of Scientific Proficiency

How do scientists enhance students' proficiencies in science through their online mentoring of independent student inquiry projects?

- By assisting students in UNDERSTANDING SCIENTIFIC EXPLANATIONS (*know, use and interpret scientific explanations of the natural world*)
- By assisting students in GENERATING SCIENTIFIC EVIDENCE (*generate and evaluate scientific evidence*)
- By encouraging and assisting students in REFLECTING ON SCIENTIFIC KNOWLEDGE (*understand the nature and development of scientific knowledge*)
- By encouraging and engaging students to PARTICIPATE PRODUCTIVELY IN SCIENCE (*participate productively in scientific practices and discourse*)

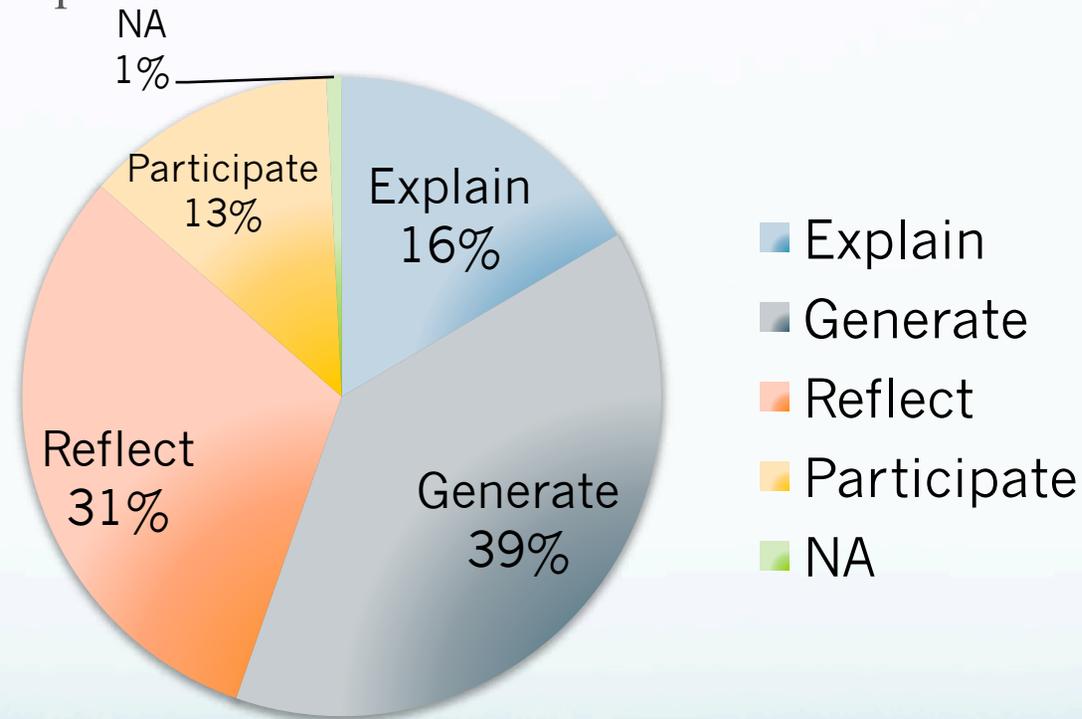
Contributions from Perspective of Scientific Proficiency

Examples
Scientists:

- “That's science, it always leads to more questions and experiments!”
- “As you can now see for your own experience, science is always a challenge (even small experiment). Unexpected results also are very useful, more than the expected one perhaps, because they make you think on the situation more and from other points of view and, at the end, there will be more questions to keep working on”
- “Remember that creating a good research question is really about the toughest part of the 'science game'.”
- “Just remember that science is a team effort.”
- “If you include all these things, then someone else can repeat your experiment and check your results; this is called repeatability and is very important. Your conclusion based on your results should be based on an experiment that can be repeated over and over again.”

Contributions from Perspective of Scientific Proficiency

Frequencies of Four Strands of Science Proficiencies

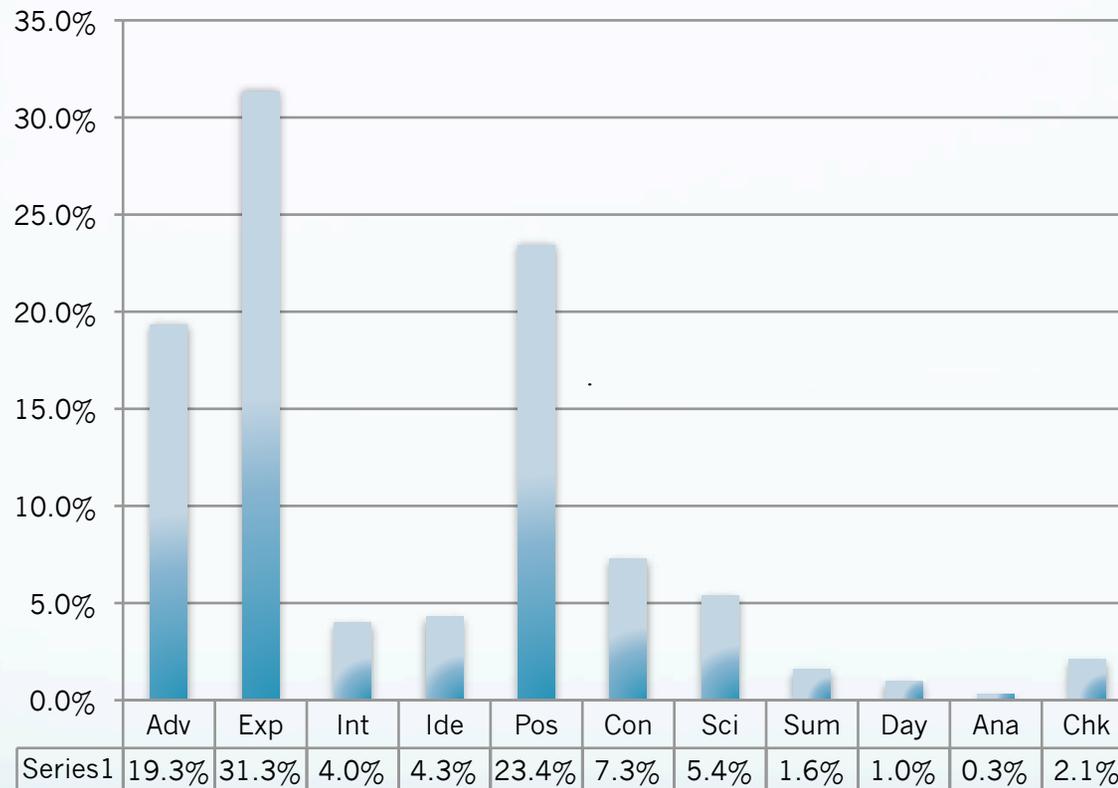


Explain= Understanding Scientific Explanations, Generate= Generating Scientific Evidence, Reflect= Reflecting On Scientific Knowledge, Participate= Participate Productively In Science, NA= Unclear Items.

Socio-cultural, Participation Coding Framework (See Handout for Details)

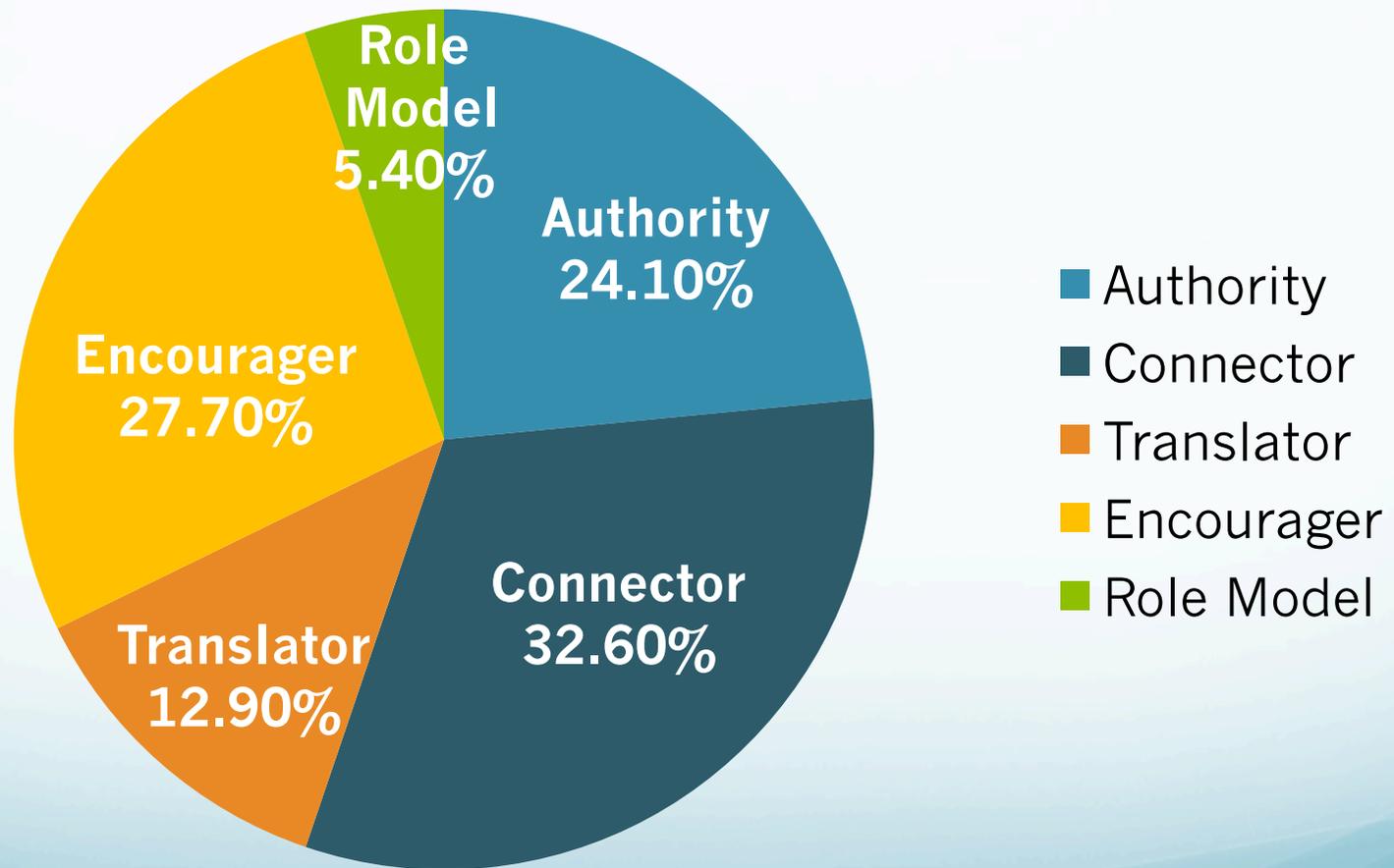
| Example Comment Type | Dialogue Example |
|--|---|
| | Role: Expert Authority |
| Offering advice/ directions | “All I can say is be patient.” |
| | Role: Connector |
| Providing explanation | “As to your question about.... “ |
| Providing daily life examples | “Plant cells (just like human cells) ... “ |
| | Role: Translator |
| Confirming | “I often have to double check my spelling, too!” |
| Summarizing | “Glad you got to look at some pollen!” |
| | Role: Encourager |
| Providing positive remarks | “I am disappointed for you, too.” |
| | Role: Role Model |
| Sharing their own experiences | “I am a plant ecologist, with a big interest in.... “ |

Percentages of Occurrence of Types of Participation (n = 909 Comments)



Adv = Advice/Directions; **Exp** = Explanation; **Int** = Interpretation; **Ide** = Invoking New Ideas; **Pos** = Encouraging, positive remarks; **Con** = Confirming; **Sci** = Sharing experiences as scientist; **Sum** = Summarizing students' ideas; **Day** = Providing daily life examples; **Ana** = Providing analogies; **Chk** = Checking students' knowledge

Participation Roles of Scientists Demonstrated in The Online Dialogue



Contributions from Perspective of Student Motivation

- Self-determination Theory (SDT) (Deci & Ryan, 1985)
 - Three basic psychological needs:
 - Autonomy
 - Competence
 - Relatedness
- Environments supporting these needs promote self-determined behavior
- How do *PlantingScience* scientist-mentors contribute to student motivation?

Contributions to Motivation: Autonomy Support

- Promotes choice over control
- Online interactions are conducive to autonomy support
- Scientists' comments from the dialogues:
 - “What kind of data will you collect to determine which grows better?”
 - “Keep me updated and let me know your progress”
 - “I think you are right...”

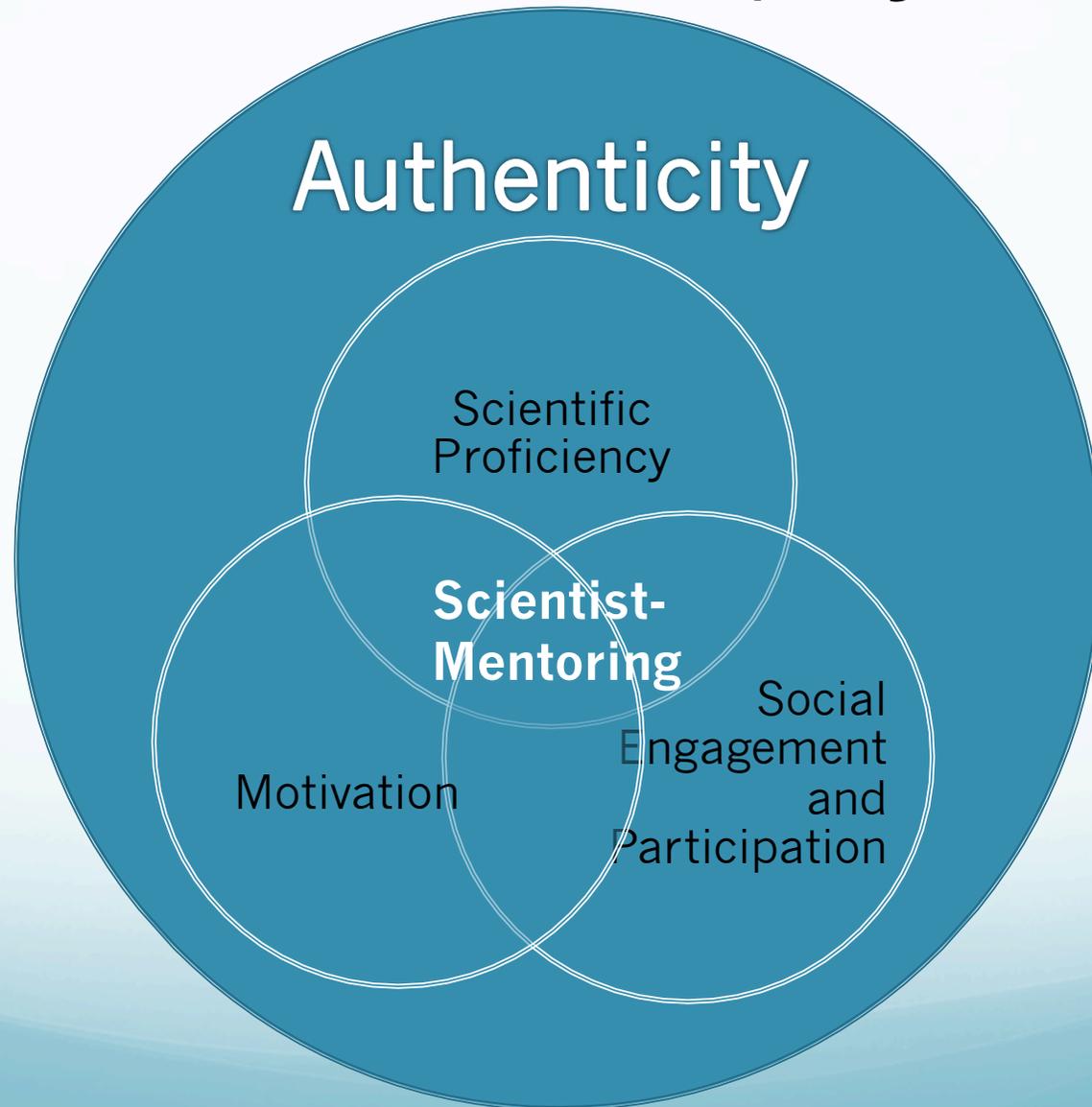
Contributions to Motivation: Competence Support

- Provides feelings of effectiveness
- Competence-supporting comments in the dialogues
 - 23% were encouragement
 - 64% were offering advice, providing explanations, interpreting, confirming, or summarizing
- Scientists' comments from the dialogues:
 - "I'm impressed with your observations and the questions you have developed"
 - "You have done a very nice job stating your research prediction and describing your independent and dependent variables..."

Contributions to Motivation: Relatedness

- Promotes belonging and connectedness
- Scientists as partners in the scientific process
- Scientists' comments from the dialogues:
 - “Together we can determine whether the problem...”
 - “I am looking forward to working with you this semester...”
 - “I am with you until the end of your experiment”

A Model for Authenticity in Student Inquiry



Authenticity

- Possesses different meanings in different contexts, including:
 - “Real-world”
 - Meaningful to and initiated by students
 - Students’ questions
 - Students’ methods for answering them
 - Students conclusions and defenses for them
 - Unknown answers to an inquiry

Support of Authentic Inquiry

- Scientist-mentors support authenticity through:
 - Scientific proficiency development
 - Social participation
 - Supporting student motivation

Thank You

- National Science Foundation
- Botanical Society of America