

Developing and evaluating student durable skills: Tools and strategies from the ELIPSS Project (Enhancing Learning by Improving Process Skills in STEM)

Jan 15, Greater Newark STEM Ecosystem

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Enhancing Learning by Improving
Process Skills in STEM



This project is supported by NSF IUSE Grants:
0717492, 1524965, 1524936, 1524399, 2235614, 2235606

Foundations of the ELIPSS Project:

Enhancing Learning by Improving Process Skills in STEM



Students need obvious opportunities to **intentionally** develop targeted skills



Students and instructors need a **common language** to describe skills and their observable characteristics

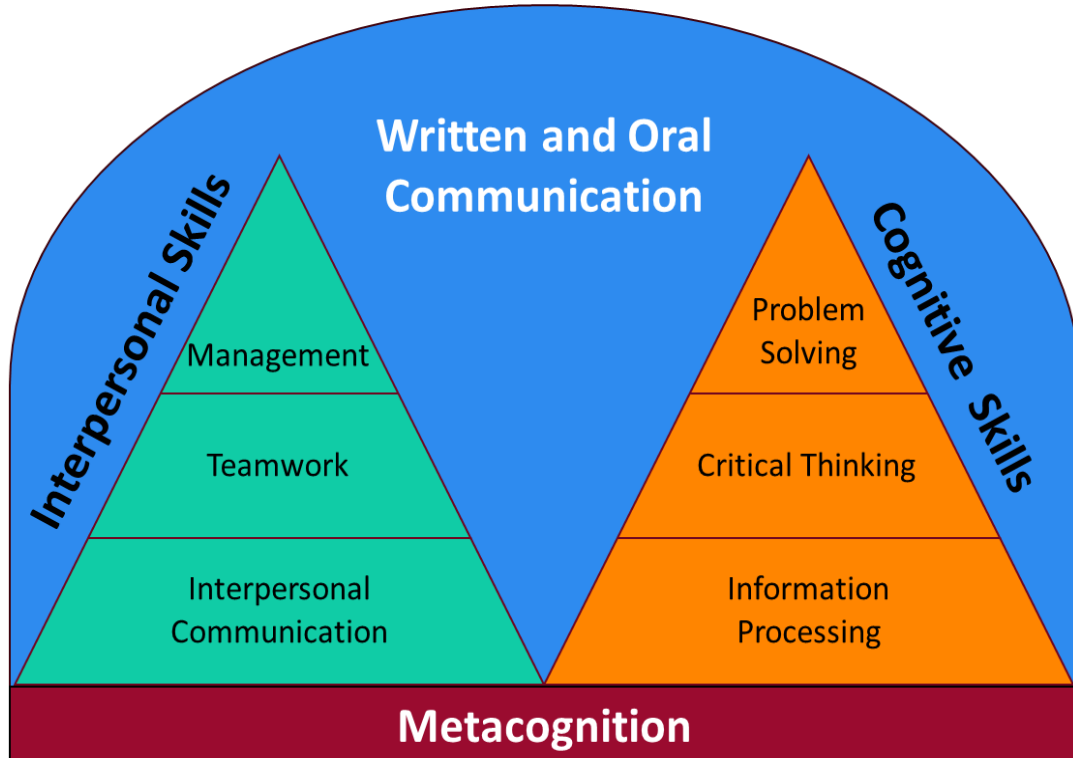


Students need **coaching** on skill development, with feedback on how they did and suggestions for improvement

Skills of the ELIPSS Project

Durable Skills

Skills required to enhance learning and workplace success



Science Practices

Skills required to theorize, investigate, and build models



Investigating

- Asking Questions
- Planning and Carrying Out Investigations
- Using Computational and Mathematical Thinking



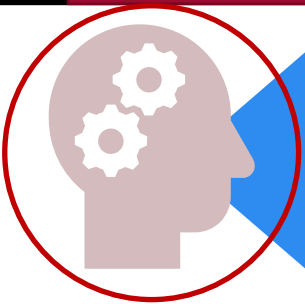
Sensemaking

- Developing and Using Models
- Analyzing and Interpreting Data
- Constructing Explanations



Evaluating and Communicating

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information



Students and instructors need a **common language** to describe skills and their observable characteristics

Teamwork

Teamwork Definition: Interacting with others and building on each other's individual strengths and skills, working toward a common goal.

Teamwork Categories: interacting, contributing, progressing, building community

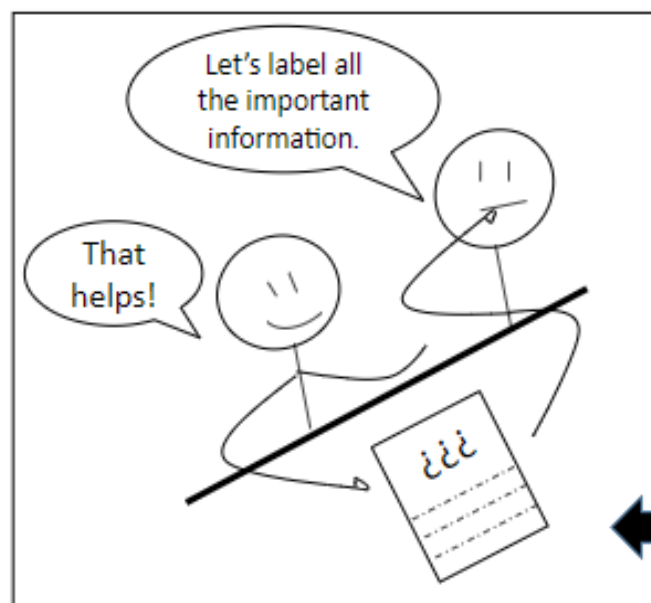
Teamwork CONTRIBUTING: considered the contributions, strengths and skills of all team members.

Observable Characteristics of Contributing:

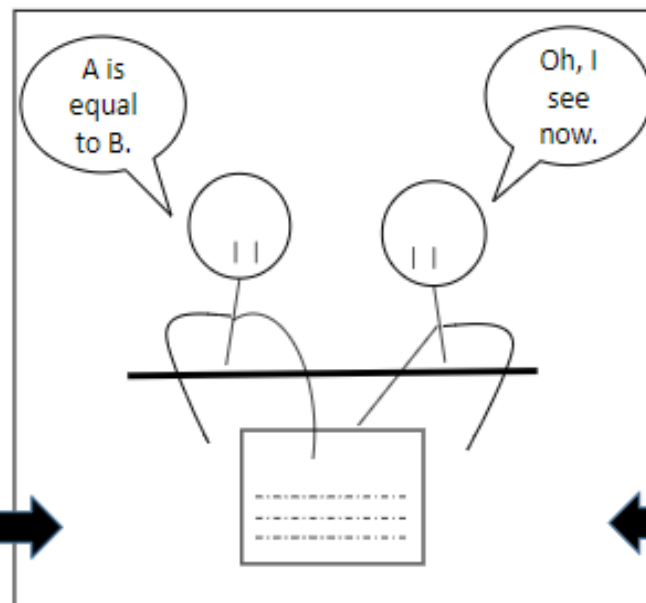
- **Acknowledged the value of the statements of other team members**
- **Invited other team members to participate in the conversation, particularly if they had not contributed in awhile**
- **Expanded on statements of other team members**
- **Asked follow-up questions to clarify team members' thoughts**



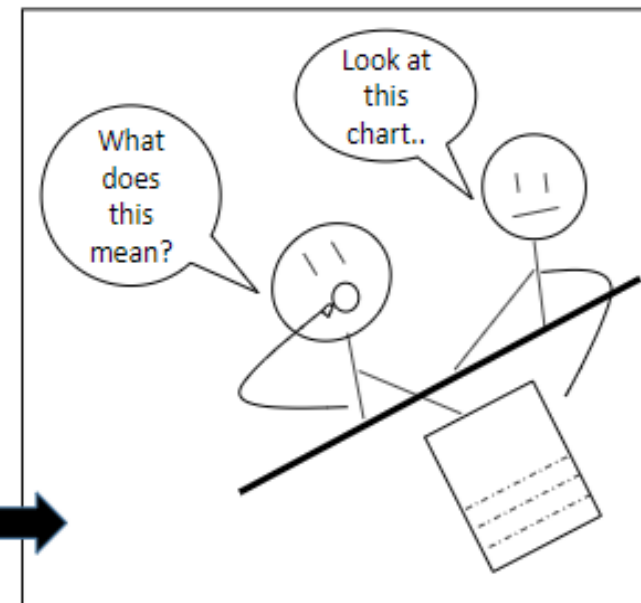
Students need **coaching** on skill development, with feedback on how they did and suggestions for improvement



Information Processing



Teamwork



Critical Thinking

“What does this skill look like? How can I improve?”

Feedback rubrics give explicit feedback on skill development

SKILL: TEAMWORK: Interacting with other and building on each other's individual strengths and skills, working toward a common goal

Rubric category shown: Contributing

Ratings
Considered the contributions, strengths and skills of all team members

No evidence

Rarely

Sometimes

Consistently

Observable Characteristics

- ☐ Acknowledged the value of the statements of other team members
- ☒ Invited other team members to participate in the conversation, particularly if they had not contributed in a while
- ☐ Expanded on statements of other team members
- ☒ Asked follow-up questions to clarify team members' thoughts
- ☐ None

Suggestions For Improvement

- ☐ Acknowledge or point out particularly effective contributions.
- ☐ Initiate discussions of agreement or disagreement with statements made by team members.
- ☒ Contribute your insights and reasoning if you disagree with another member of the team.
- ☒ Regularly ask members of the team to share their ideas or explain their reasoning.
- ☐ Add information or reasoning to contributions from other team members.
- ☐ Ask for clarification or rephrase statements of other team members to ensure understanding.
- ☐ Nothing specific at this time

Comment Box
Comments for improvement...

Definitions describe the category and the measurable objectives

Numerical scale with definition modifiers

Observable characteristics easily identifiable behaviors inform students of behaviors that they engaged in

Suggestions for improvement provide actionable feedback for students

Comments section

Getting started facilitating and assessing skill development

- Go to the www.elipss.com, download the rubrics
- Request Professional Development –
 - Crafting skill-based prompts and activities
 - Customizing rubrics for your course needs
 - implementation strategies
 - Writing Learning Outcomes on student skill development
 - Assessing student work/performance
- Give SkillBuilder (new web interface) a try
 - Training provided, stipends (\$\$\$) for testing available



Enhancing Learning by Improving
Process Skills in STEM



(extra slides)



How do you know these ELIPSS rubrics will work for you?
Our research project showed that the rubrics transcend:

STEM
disciplines

Pedagogy

Tasks

Level

Classroom
constructs

The Primary Collaboration Team was multidisciplinary, experienced and expansive

Discipline	Course Level	Institution Type	Class Size	Pedagogy
Biology/Health Sciences	Introductory, Intermediate, Advanced	RU, CU	M, L, XL	Case Study, Lecture, Lab, Peer Instruction, POGIL, Other
Chemistry	Introductory, Intermediate, Advanced	RU, PUI	S, M, L, XL	Case Study, Lecture, PBL, Peer Instruction, PLTL, POGIL
Computer Science	Introductory	CU	S, M	POGIL
Engineering	Advanced	PUI	M	Case Study, Flipped, Other
Mathematics	Introductory, Advanced	PUI	S, M	Lecture, PBL, POGIL
Statistics	Introductory	PUI	M	Flipped

Each rubric tested for validity, reliability, and utility.

Face Validity

- Do rubric descriptors look appropriate?

Construct Validity

- Do rubrics measure what it is intended to measure?

Reliability

- Can different people use rubrics to get consistent results?

Generalizability

- Can rubrics be used in multiple disciplines, environments, and student populations?

Utility

- Can rubrics be used effectively by instructors and students?



The impact of rubric use for skills is positive

- Students improved their information processing, interpersonal communication, and critical thinking throughout the semester based on the TA scores.
- Student better understood interpersonal skills than cognitive skills.
- Students reported they improved each skill (recognized skill elements and ways to improve..)
- Instructors were better able to monitor student outcomes and improve curricula to address skills