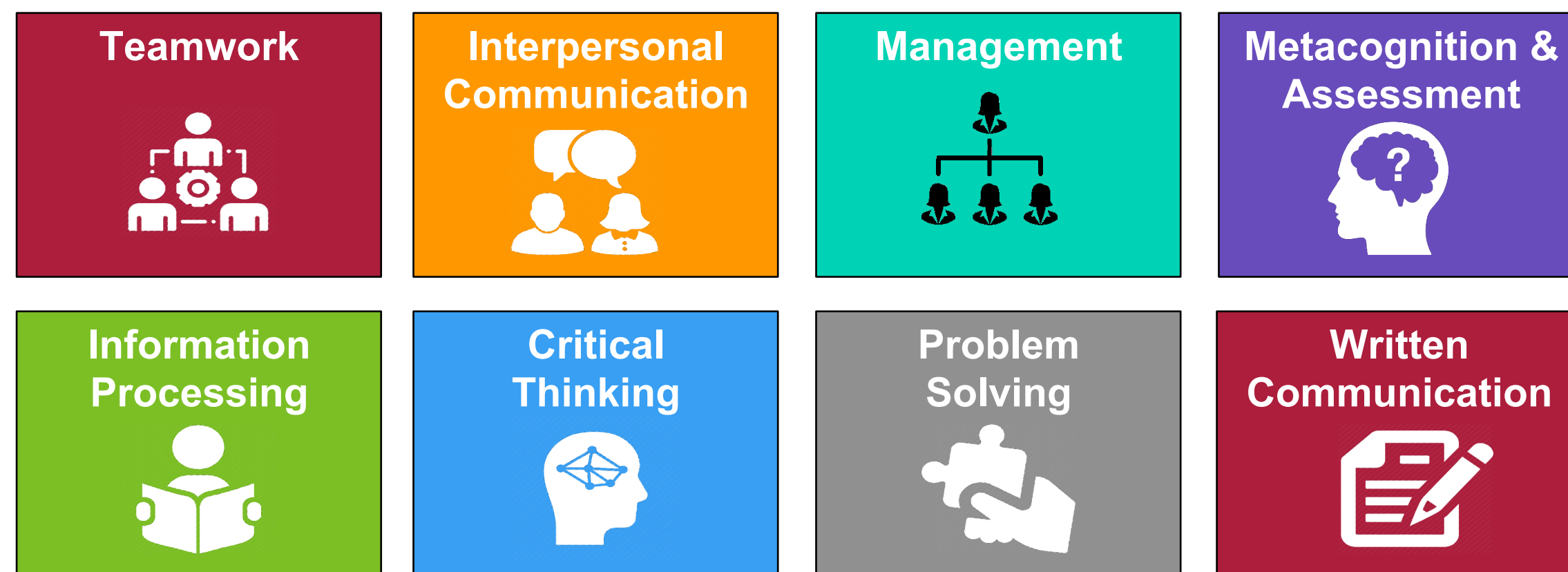




Project Overview

Process skills are important components of the learning environment, especially those utilizing active-learning techniques that require higher order thinking skills and peer interaction during class activities. These are also the skills that employers often cite as desirable in new hires, even valuing them over technical knowledge related to the job. Helping students develop and improve these skills has important implications for learning and preparing students for post-college careers.



The ELIPSS Project has developed a series of rubrics to assess a suite of process skills through student written work and group interactions.^{1,2} Traditional analytic rubrics were created to assess the eight process skills pictured above. These rubrics have been tested in a variety of STEM classrooms and are available on the ELIPSS project website.

Information Processing	Evaluating, interpreting, and manipulating or transforming information.					
Category	0	1	2	3	4	5
(A) Evaluating	A. Minimally determined the significance or relevance of information/data needed for the task.		A. Partially determined the significance or relevance of information/data needed for the task.			A. Completely determined the significance or relevance of information/data needed for the task.
(B) Interpreting	B. Inaccurately provided meaning to data, made inferences and predictions from data, or extracted patterns from data.		B. Provided meaning to data, made inferences and predictions from data, or extracted patterns from data with some errors.			B. Accurately provided meaning to data, made inferences and predictions from data, or extracted patterns from data.
(C) Manipulating or Transforming	C. Ineffectively converted information/data from one form to another.		C. Partially converted information/data from one form to another.			C. Effectively converted information/data from one form to another.

Analytic style rubric for assessing Information Processing

After using the analytic rubrics, users struggled to find strategies that provided students with feedback and encouragement to improve. This led to the development of novel feedback style rubrics, which could provide students with actionable feedback for improving their process skills (see center top image)³.

Feedback is one of the most effective means of improving student achievement. Research demonstrates that students value developmental feedback that helps them identify strategies to improve.⁴ When using rubrics, the inclusion of improvement information in addition to performance evaluation leads to better performance and enables students to more accurately self-assess their own performance.⁵

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Process Skill Feedback Rubrics

Information Processing	Evaluating, interpreting, and manipulating or transforming information.					
Category	Ratings					Observable Characteristics
Evaluating	Determined the significance or relevance of information/data needed for the task.					<input checked="" type="checkbox"/> Identified what information is present in the prompt/model <input checked="" type="checkbox"/> Indicated what information is relevant <input checked="" type="checkbox"/> Indicated what information is NOT relevant <input type="checkbox"/> Indicated why certain information is relevant or not <input type="checkbox"/> Other:
	No evidence: 0, 1, 2, 3, 4, 5					
Interpreting	Provided meaning to data, made inferences and predictions from data, or extracted patterns from data.					<input type="checkbox"/> Assigned correct meaning to/labeled information (text, tables, graphs, diagrams, etc.) <input checked="" type="checkbox"/> Extracted specific details from information <input checked="" type="checkbox"/> Explained information in own words <input type="checkbox"/> Determined patterns in information <input type="checkbox"/> Other:
	No evidence: 0, 1, 2, 3, 4, 5					
Manipulating or Transforming	Converted information/data from one form to another.					<input checked="" type="checkbox"/> Converted relevant information into a different form <input checked="" type="checkbox"/> Converted information into an appropriate form <input checked="" type="checkbox"/> Explained the process behind the transformation <input type="checkbox"/> Other:
	No evidence: 0, 1, 2, 3, 4, 5					

Digital version of the Feedback Rubric for Information Processing, that is used in Google Sheets to evaluate student group activity during class.

Definitions outline the measurable objectives of each category for a particular process skill.

Observable characteristics: provide the rater with easily identifiable behaviors that they can utilize to make an accurate rating, and inform the student of positive behaviors that they engaged in.

Numerical scale with definition modifiers provides performance **rating** in the skill category.

Suggestions for improvement: provide actionable feedback for students and guidance for more detailed, content relevant feedback.

Comments section: allows raters to provide more detailed feedback on the skill in the context of the specific task.

Instructor Comments on Rubric Implementation

"For me, I can see that the process skills are being emphasized and they're foregrounded in the minds of students and instructional assistants, because there's something explicitly being observed and discussed here. And then I think students also appreciated that there are tangible, actionable items to improve, and the instructional assistants reported that the feedback rubrics were really helpful in guiding them toward a productive conversation with students. Jumping in and even just trying one rubric once can be a very powerful experience...even if it is not perfectly implemented the first time, I think it will still be beneficial and it will still be an interesting and useful experience." **Stanley Lo** on using the ELIPSS rubrics in his classes.

"That (written communication) rubric gave students a lot of structure and it made their feedback about written communication a lot more specific. It also allows me to give students specific feedback about their writing as well and to talk about how to improve... Before I started doing this peer review assignment several years ago, I used to be very frustrated about how bad the submitted proposals were, and I was very unmotivated to read them, but now I actually really enjoy reading them, and the writing quality is much better, so I can focus on whether the ideas of what the students would like to do are appropriate for the course." **Chris Mayfield**, on using the written communication rubric as part of a peer review and faculty review process of student written proposals.

"We've had students who go for job interviews or medical school interviews, and they're actually asked about problems solving or critical thinking. And they've come back and told me 'Gosh, I knew exactly what to share because I just did this in Chem 107 when I was filling out my process skills rubric'...and that's obviously a great joy when you see how students see that something is so relevant to their lives." **Rebecca Sansom** on using ELIPSS rubrics in her courses.

Implementation Strategies for Rubric Usage in a Variety of Course Settings



General Chemistry course (180 – 240 students). Students reported their rubric ratings using clickers and results were discussed with the whole class.

Christopher Bauer
Professor
Chemistry
University of New Hampshire



Anatomy & Physiology course (100 – 110 students). A rubric was applied to a video recorded during class teamwork then feedback provided to the whole class.

Patrick Brown
Associate Professor
Health Sciences
East Tennessee State Univ



General Chemistry course and lab (20 – 50 students). Evidence for team development was submitted through an LMS survey; grading rubrics used in lab incorporated segments of ELIPSS rubrics

Teresa Bixby
Associate Professor
Chemistry
Lewis University



Advanced Undergraduate Chemistry course (20 students). Students completed rubrics as part of the reports required for their respective roles.

Caryl Fish
Professor
Interdisciplinary Science
Saint Vincent College



Introductory Calculus course (35 students). Laminated rubrics at each table were completed by the instructor and course assistants during class work.

Jill Guerra
Preceptor
Mathematics
Harvard University



Introductory Biology lab (25 students). Students received feedback from instructional assistants on interpersonal and teamwork skills as they wrote a research proposal.

Stanley Lo
Associate Professor
Cell & Developmental Biology
UC San Diego



Database Systems Computer Science course (25-30 students). Rubrics were used for a peer review process on a semester-long team proposal project, followed by instructor feedback.

Chris Mayfield
Associate Professor
Computer Science
James Madison University



General Chemistry laboratory (120 students). Students were prompted to think about skills. They self-assessed and received feedback through LMS.

Rebecca Sansom
Associate Professor
Chemistry & Biochemistry
Brigham Young Univ

Videos

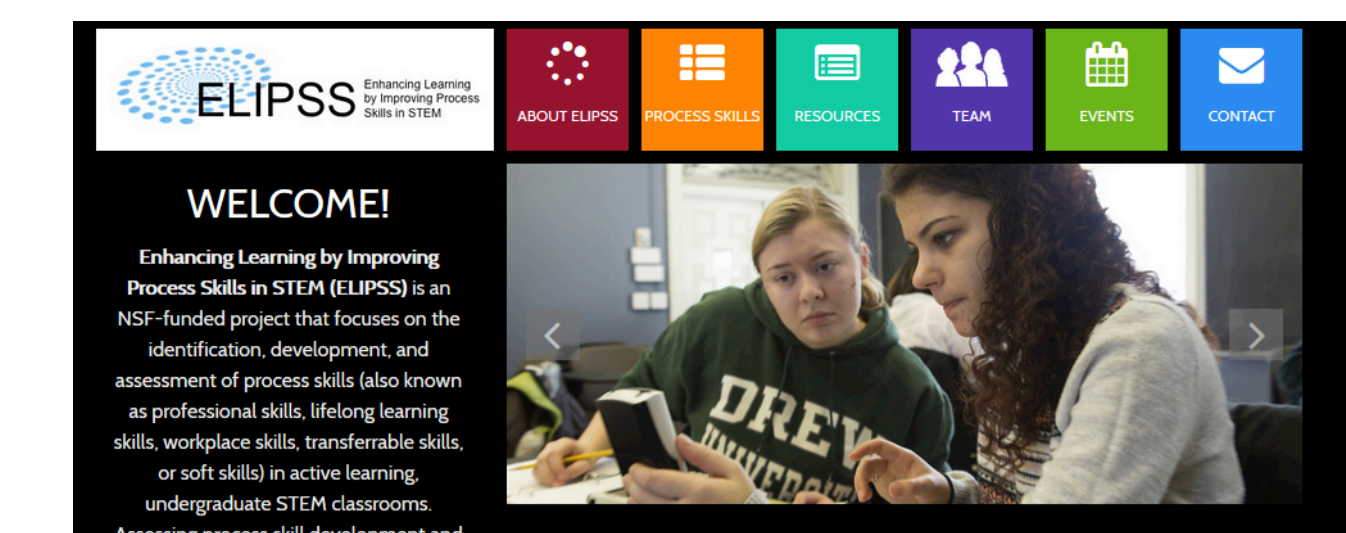
Watch videos of instructors explaining their strategies for using the rubrics in their classes



Acknowledgments

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