ESSENTIAL SKILLS IN CHEMICAL SCIENCE & ENGINEERING

Presentation for 4TU.CEE, CELT and lecturers UT
6 March 2024

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WHAT ARE "ESSENTIAL SKILLS"?

- Essential skills are skills that are essential in a future career (of an engineer): intellectual, practical, personal, …
- Other – less fitting, less complete – names:

  Academic skills, or Professional skills

- We teach many skills in the courses (sometimes implicitly)
- We also teach and assess skills explicitly

  Connected to the content of the module (most often to the project)

WHY WOULD WE TEACH ESSENTIAL SKILLS?

- We see:
  - ✓ challenges in (project) group work
  - ✓ cultural / diversity challenges in the international classroom
  - ✓ lingering communicative skills (written and oral)
  - ✓ a lack of critical thinking (and quantitative literacy, inquiry and analysis, …)
- We intend:
  - ✓ to promote the quality of our education
  - ✓ to demonstrate the value of discovery, innovation, and (critical) reflection
  - ✓ to improve the embedding of essential (academic and professional) skills

ESSENTIAL SKILLS IN THE BSc-CSE

1. Inquiry and analysis
2. Critical thinking (incl. Listening)
3. Creative thinking
4. Written communication
5. Oral communication
6. Reading
7. Quantitative literacy
8. Information literacy
9. Teamwork
10. Problem solving (incl. Design & Modelling)
11. Civic engagement – local and global (incl. Sustainability awareness)
12. Intercultural knowledge and competence
13. Ethical reasoning
14. Integrative learning

- CSE skills education developed since 2019 for the BSc CSE by Leonie Krab and Linlin Pei
- Taught by Leonie, Linlin, and since 2023 Arnoud Onnink
- Students' development & reflections assessed by Leonie, Linlin, Arnoud and Jéré van Lente

HOW DID WE IMPLEMENT ESSENTIAL-SKILLS TEACHING AND ASSESSMENT AT CSE?

- Examples from BSc CSE M2 and from MSc CSE
- Today: focus on "Teamwork" and "Intercultural knowledge and competence"

1. Inquiry and analysis
2. Critical thinking (incl. Listening)
3. Creative thinking
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5. Oral communication
6. Reading
7. Quantitative literacy
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9. Teamwork
10. Problem solving (incl. Design & Modelling)
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CHEMICAL SCIENCE & ENGINEERING

M2 WORKSHOP ON INTERCULTURAL TEAMWORK

The aims (and learning goals) for the workshop are:

1. to become more aware of expectations;
2. to identify differences in (prior) education;
3. to explore ways to get the most out of your education here;
4. to work in a (project) group of diverse people

CONTENTS OF CSE M2 WORKSHOP

INTERCULTURAL TEAMWORK

1. Introduction: what are we going to do today, and why?
2. Exercise A: identify yourself to your project group (“name game”)
3. Exercise B: universal, vs. cultural, vs. personal characteristics
4. Exercise C: define together “what is culture?”
5. Theory: interculturalism and intercultural communication
6. Exercise D: your current “position” in time & communication
7. Expectations: in NL, at UT and at CSE; do they match with yours?
   - Exercise E (optional): discussion of cases
8. Reflection per group: assignment (due 28 Nov)
9. Outlook workshops M2

CULTURAL DIFFERENCES

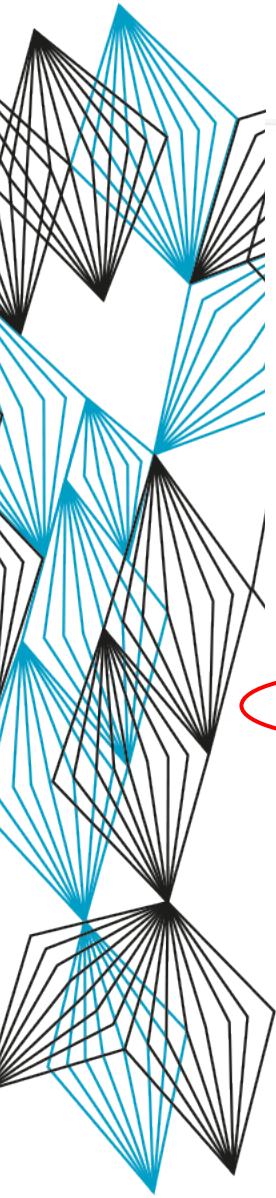
Communication	High context (indirect)	Low context (direct)
Time	Synchronic (flexible)	Sequential (more strict)
Emotions	Affective (show feelings)	Neutral (controlled)
Business	Relationship-oriented	Deal-oriented
Management	Hierarchical	Egalitarian

CONTENT

M2 WORKSHOP ON TEAMWORK AND TEAM ROLES

- Recap “effective meetings” (Module 1)
- Recap “working in diverse teams” (Module 2)
- Tuckman: stages of development (team performance & effectiveness)
- Belbin: team-role definition
- DIY: self-perception inventory
- Belbin: your team roles
- Importance of team roles
- Check your project team (peers)
- How to continue in Module 3

CANVAS TOOL: BUDDYCHECK



2023-202000724-1B › Buddycheck

2023-1B

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Peer evaluations

41 instructors with full access · Here you see all evaluations for the course 'CSE M2:

+ Create evaluation

Evaluation

› Group dynamics

This team member contributes a lot to the discussions

	Self	Received	Diff Avg (3.8)
Student A	3	2.8	-1
Student B	5	4.4	+ 0.6
Student C	5	4.8	+ 1
Student D	4	3.8	0
Student E	4	4.6	+ 0.8
Student F	3	2.4	-1.4

→ Group discussion with staff
→ Input for reflections!

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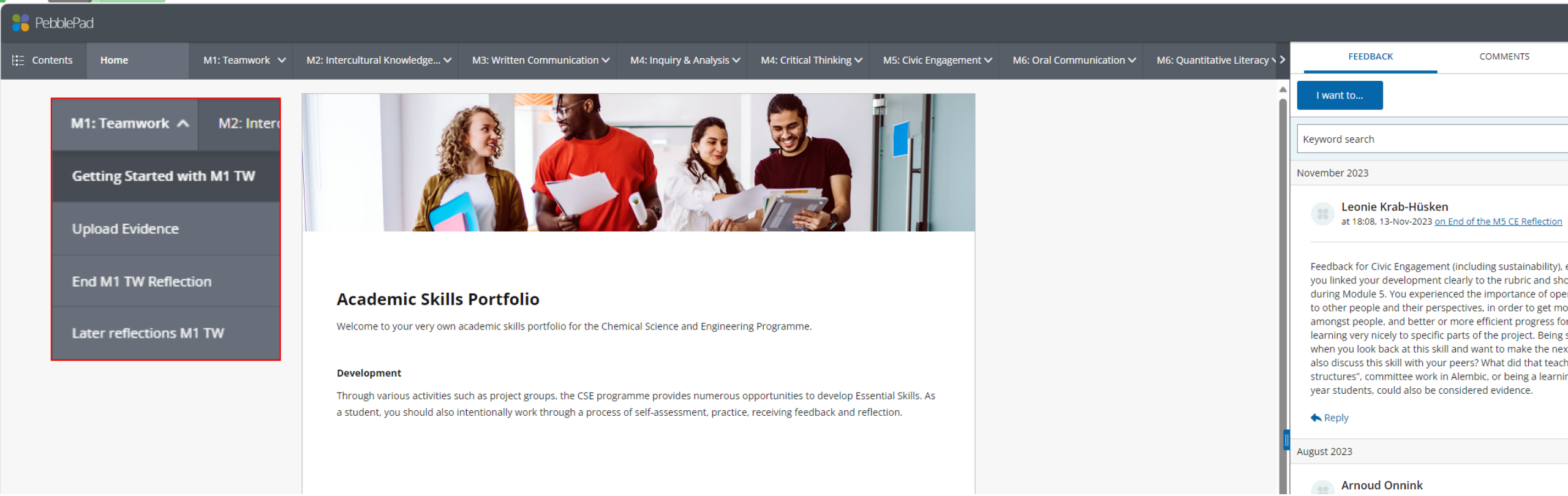
OUR APPROACH FOR REFLECTION

- AACU Value system, using rubrics for all essential skills
- Rubrics articulate fundamental criteria per learning outcome
- Performance descriptors demonstrating progressively more sophisticated levels of attainment

TEAMWORK RUBRIC	Emerging 1	Developing 2	Developing 3	End of Bachelor's 4
Individual Contributions Outside of Team Meetings *(one of the criteria for this skill)*	Completes all assigned tasks by deadline.	Completes all assigned tasks by deadline; work accomplished advances the project.	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and advances the project.	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and advances the project. Proactively helps other team members complete their assigned tasks to a similar level of excellence.

CSE example

PRACTICAL TOOL: SELF-ASSESSMENT, REFLECTIONS, FEEDBACK



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WHAT DOES IT LOOK LIKE FOR STUDENTS? (1/2)

M1: Teamwork | M2: Intercultural Knowledge... | M3: Written Communication | M4: Inquiry & Analysis | M4: Critical Thinking | M5: Civic

PebblePad

Workshop Essential Skills (deadline: Friday in week 1 of M1)

First Self-assessment

Success begins with self-awareness. To make a conscious decision on possible actions to achieve your goal, you must first understand what you want and what you are capable of doing. The teamwork rubric can provide more information about your current level of certain skills. We anticipate that our students will complete their programme at level 4, "End of Bachelor's." You are, however, perfectly fine starting with level 1, "Emerging."

Please evaluate your teamwork skills using the table below:

Deadline: M1, Friday in week 1

	Emerging (1) 1 pts	**Developing (2)** 2pts	**Developing (3)** 3pts	**End of Bachelor's (4)** 4pts
Contributes to Team Meetings	Shares ideas but does not advance the work of the group.	Offers new suggestions to advance the work of the group. ✓	Offers alternative solutions or courses of action that build on the ideas of others.	Helps the team move forward by articulating the merits of alternative ideas or proposals.
Facilitates the Contributions of Team Members	Engages team members by taking turns and listening to others without interrupting.	Engages team members in ways that facilitate their contributions to meetings by restating the views of other team members and/or asking questions for clarification. ✓	Engages team members in ways that facilitate their contributions to meetings by constructively building upon or synthesizing the contributions of others.	Engages team members in ways that facilitate their contributions to meetings by both constructively building upon or synthesizing the contributions of others as well as noticing when someone is not participating and inviting them to engage.
Individual Contributions Outside of Team Meetings	Completes all assigned tasks by deadline.	Completes all assigned tasks by deadline; work accomplished advances the project.	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and

FEEDBACK | COMMENTS | PROGRESS

I want to... | Close

Keyword search

End of CSE M4 feedback, Inquiry & Analysis. It is good to see that you recognise the importance of practice and focus. You will of course develop all essential skills during all the modules, but at times it can be more productive to focus more on specific sets that you are interested in improving. In the case you describe, you will have more time later to focus more on the research skills. It is especially important that you got significant practice in developing sub-topics. The development of sub-research questions later on is an incredibly important skill for a researcher

Reply

February 2023

Leonie Krab-Hüsken
at 09:26, 20-Feb-2023
Released

End of M2 feedback: Well done for understanding the difference between low- and high-context cultures and putting your intercultural skills to use in your project. It's impressive that you uncovered surprising cultural practices, such as arranged marriage. Your project has certainly helped you build intercultural understanding and teamwork skills. Regarding time management differences, it's great that you have proactively planned for potential challenges in the future. We're curious about your reflections on the feedback from your peers through BuddyCheck. Well done, keep up the great work!

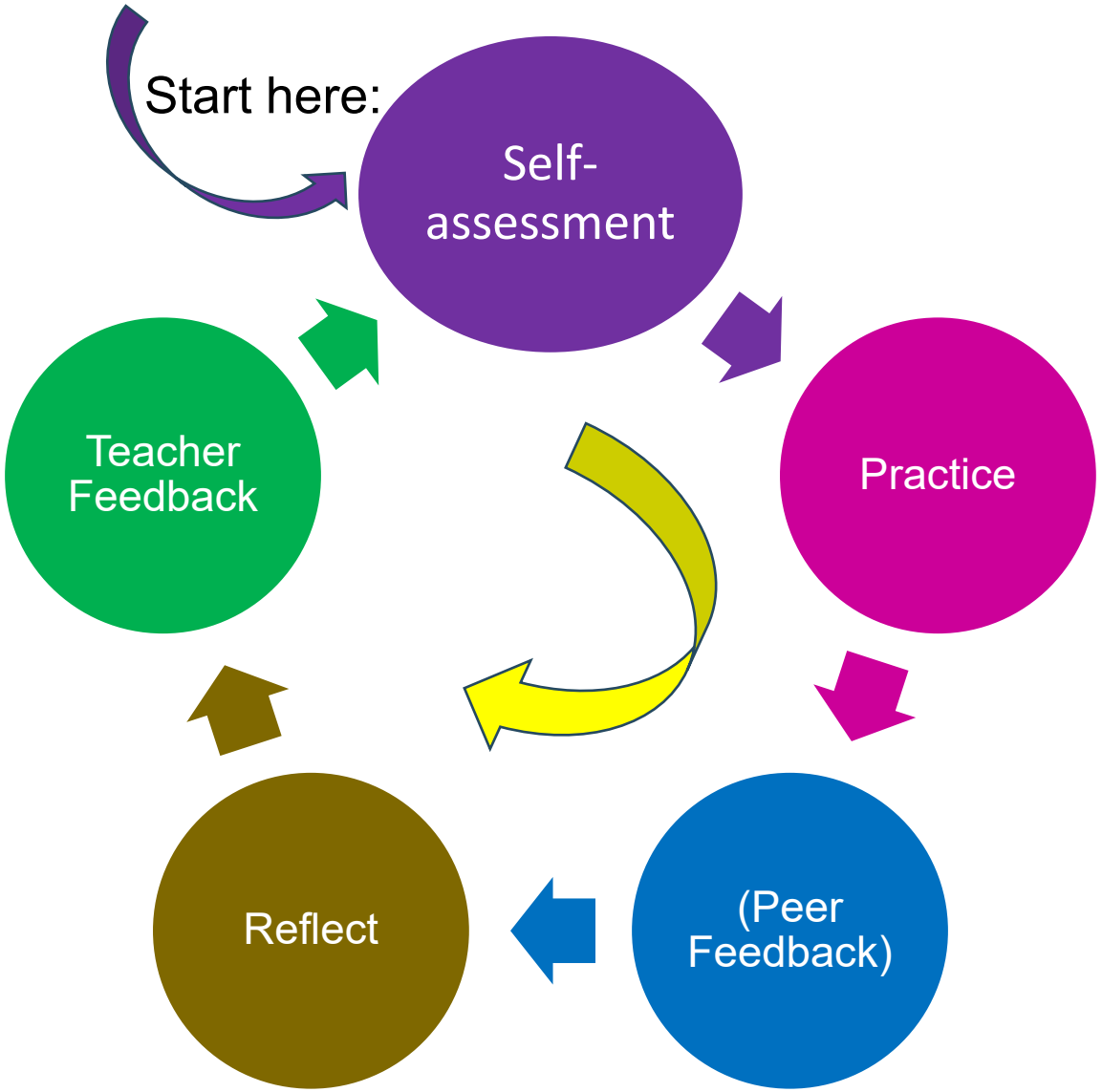
Reply

November 2022

Linlin Pei
at 13:14, 21-Nov-2022
Released

End of M1 feedback: In general, we recognize and agree with your self-evaluation. We clearly see how your evidence proves your development in *Contributes to Team Meetings* and *Facilitates the Contributions of Team Members*. We clearly see how

ESSENTIAL SKILLS: LEARNING PROCESS



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WHAT DOES IT LOOK LIKE FOR STUDENTS? (2/2)

M2: Intercultural Knowledg... | M3: Written Communication | M4: Inquiry & Analysis | M4: Critical Thinking | M5: Civic Engagement | M6: Oral Communicatio

	Emerging (1) 1 pts	Developing (2) 2pts	Developing (3) 3pts	End of Bachelor's (4) 4pts
Knowledge: cultural self-awareness	Shows minimal awareness of own cultural rules and biases (even those shared with own cultural group(s)) (e.g. uncomfortable with identifying possible cultural differences with others.)	Identifies own cultural rules and biases (e.g. with a strong preference for those rules shared with own cultural group and seeks the same in others.)	Recognizes new perspectives about own cultural rules and biases (e.g. not looking for sameness; comfortable with the complexities that new perspectives offer.)	Articulates insights into own cultural rules and biases (e.g. seeking complexity; aware of how her/ his experiences have shaped these rules, and how to recognize and respond to cultural biases, resulting in a shift in self-description.)
Knowledge: cultural worldview frameworks	Demonstrates surface understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communication styles, economy, or beliefs and practices.	Demonstrates partial understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communication styles, economy, or beliefs and practices.	Demonstrates adequate understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communication styles, economy, or beliefs and practices.	Demonstrates sophisticated understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communication styles, economy, or beliefs and practices.
Skills: empathy	Views the experience of others but does so through own cultural worldview.	Identifies components of other cultural perspectives but responds in all situations with own worldview.	Recognizes intellectual and emotional dimensions of more than one worldview and sometimes uses more than one worldview in interactions.	Interprets intercultural experience from the perspectives of own and more than one worldview and demonstrates ability to act in a supportive manner that recognizes the feelings of another cultural group.
Skills: verbal and	Has a minimal level of	Identifies some cultural	Recognizes and	Articulates a complex

Next to the rubric, students upload a reflection. They receive feedback in this environment.

Arnoud Onnink
at 12:09, 20-Oct-2023 on End M2 IK&C Reflection

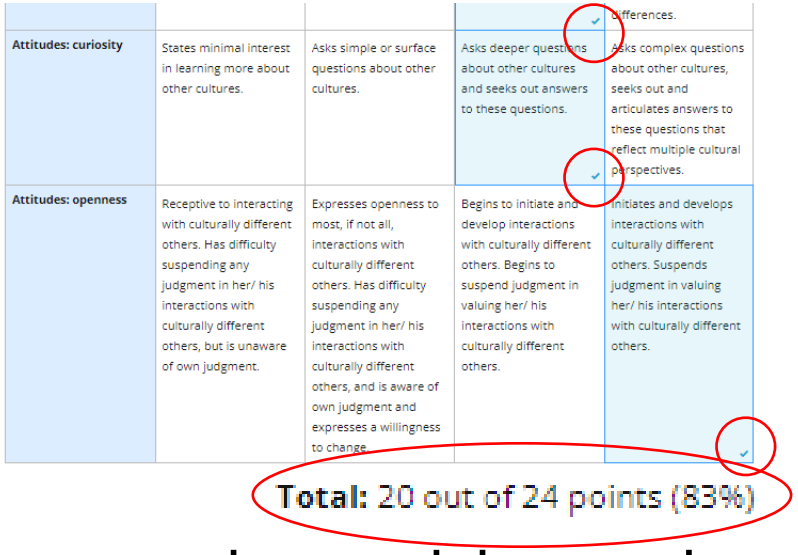
Released

End of M2 feedback: Great to see that you love interacting with people from other cultures, and learning from this. It is also good that you give a concrete example of a situation where cultural differences play a role in teamwork, and what you learned from this. Because this is an academic reflection, it would be more fitting to write in an academic style; for example, instead of "the way I interpret stuff" you could write "my interpretations of...". This also forces you to be more specific (your interpretations of what exactly?). What we miss most are your thoughts on the feedback you received from your peers through BuddyCheck. If you include a reflection on that, you may learn more about how others perceive working with you. Especially if some outcomes would surprise you, we highly recommend delving deeper into your thoughts about that. Overall, your reflection makes it clear that you are open to working with people from other cultures, and able to connect with them.

Reply

PebblePad

WHY PEBBLEPAD?



				differences.
Attitudes: curiosity	States minimal interest in learning more about other cultures.	Asks simple or surface questions about other cultures.	Asks deeper questions about other cultures and seeks out answers to these questions.	Asks complex questions about other cultures, seeks out and articulates answers to these questions that reflect multiple cultural perspectives.
Attitudes: openness	Receptive to interacting with culturally different others. Has difficulty suspending any judgment in her/ his interactions with culturally different others, but is unaware of own judgment.	Expresses openness to most, if not all, interactions with culturally different others. Has difficulty suspending any judgment in her/ his interactions with culturally different others, and is aware of own judgment and expresses a willingness to change.	Begins to initiate and develop interactions with culturally different others. Begins to suspend judgment in valuing her/ his interactions with culturally different others.	Initiates and develops interactions with culturally different others. Suspends judgment in valuing her/ his interactions with culturally different others.

Total: 20 out of 24 points (83%)

- Very practical tool
  - Checking boxes in rubrics and counting these scores gives quick overview for students and facilitates assessment;
  - Tool to reflect and to steer students' learning;
  - Feedback from small group of teachers or hand-picked peers
- GDPR (AVG)
  - Separate from Canvas! Privacy of students guaranteed; very limited access.
- LLL (LLO)
  - Students keep access after graduating

OUTREACH

- BSc Chemical Science & Engineering
- MSc Chemical Science & Engineering
- BSc Advanced Technology
- MSc Sustainable Nanotechnology (UT + Tech de Monterrey + DTU)
- Educational research