

Engineering is Elementary®

Just Passing Through: Designing Model Membranes

Repurposed for Mandarin immersion by the Minnesota Mandarin Immersion Collaborative (MMIC)
MMIC Engineering is Elementary® “Model Membrane” Unit

Integrated Performance Assessment Overview

CONTEXT

Program Particulars

Program model (one-way/two-way; total/partial, etc.): Early, total, one-way foreign language immersion

Immersion language(s): Mandarin Chinese

Grade level: Third grade

Student Characteristics

Ethnolinguistic background: All native speakers of English; 3% African American, 65-67% Anglo American, 25-30% Asian American (many adoptees from China)

Estimated proficiency levels:

L1: Native-like speaking and listening; reading and writing unknown

L2: Junior intermediate low speaking, junior intermediate mid listening (Center for Applied Linguistics (CAL) CAL Oral Proficiency Exam/Student Oral Proficiency Assessment (COPE/SOPA) Rating Scale, 2010); novice high-intermediate low reading and writing (National Council of State Supervisors for Foreign Languages (NCSSFL) LinguaFolio® Self Assessment Grid, 2009)

Listening	Jr. Intermediate mid	<p>I can understand the main idea and many details on familiar topics in a series of connected sentences, conversations, presentations, and messages (Linguafolio®, 2009).</p> <p>Understands sentence level speech in new contexts at a normal rate of speech although slow-downs may be necessary for unfamiliar topics.</p> <p>Carries out commands without prompting (CAL, 2010).</p>
Speaking	Jr. Intermediate low	<p>I can provide information on familiar topics using a series of sentences with some details (Linguafolio®, 2009).</p> <p>Goes beyond memorized expressions to maintain simple conversations at the sentence level by creating with the language, although in a restrictive and reactive manner.</p> <p>Handles a limited number of everyday social and academic interactions (CAL, 2010).</p>

Reading	Jr. Novice high	I can understand some ideas in simple texts that contain familiar vocabulary (Linguafolio®, 2009).
Writing	Jr. Intermediate low	I can write on familiar topics and experiences using a series of sentences with some details (Linguafolio, 2009).

DESIRED RESULTS

Big idea: Bioengineers use knowledge of nature and biology to design technologies that solve real-world problems.

Unit Theme: Organisms, basic needs, and bioengineering

Possible Enduring Understandings

Unit-Level Goals

Potential Enduring Understandings and Essential Questions

Enduring Understandings: Students will understand that...

1. We can observe and learn from nature to help us solve problems.
2. Failure is the mother of success. 失败乃成功之母。
3. Each organism has its own way to fulfill basic needs.
4. Engineers and scientists use specific methods to solve problems and to learn about the world.
5. Everything that we create to solve problems is “technology.” (Museum of Science, 2008, p.36)
6. People transfer and apply knowledge from one context to another. 学以致用。
7. Bioengineers use what they know about biology to solve problems that living things might have.
8. Cultural practices, products and perspectives vary from country to country.
9. There is power in teamwork. 团结就是力量。
10. A membrane is a thin protective layer that lets some things through and blocks others.
11. Humans impact the environment, sometimes positively and sometimes negatively.

Essential Questions: Students will ask...

1. How can observing nature help us solve problems?
2. How can we learn from our mistakes?
3. How do living organisms meet their basic needs?
4. What methods do engineers and scientists use to learn solve problems and learn about the world?
5. What is technology?

6. How can what we learn in one situation help us in another?
7. What is a bioengineer?
8. How and why are countries the same or different?
9. How is teamwork valuable?
10. What is a membrane—what are its characteristics/properties?
11. How do humans impact the environment?

OVERVIEW OF THE ASSESSMENT TASKS

The comprehensive Integrated Performance Assessment (IPA) is designed to provide students an opportunity to demonstrate transdisciplinary content and language understandings and skills. A series of interrelated language-dependent tasks will elicit knowledge gained during this unit in the disciplines of science and engineering, social studies/culture, math, and Chinese language arts. The tasks will also invite reflection and critical thinking about the Juan Daniel narrative, the Salvadoran/Chinese/US cultures and student experiences with the model membrane design process.

The interrelated IPA tasks are meaningfully embedded within the end-of-unit activities and begin with one of two tasks that target the presentational mode. **Presentational Task (Oral):** Student groups will present their improved model membrane designs and report on what they did differently and learned during implementation of Step #5 of the engineering design process (EDP): Improve. While each student group presents, observing groups will collaborate to provide feedback to presenting groups. During this time, presenting students will individually complete MMIC 13-6/IPA 1-1: Presentational (Oral) Scoring Rubric on their own. This presentational task provides a chance for students to compare their EDP Step #5 experiences and results and notice their own individual and peer use of specific required language. The teacher will independently evaluate group presentations using MMIC 13-6/IPA 1-1: Presentational (Oral) Scoring Rubric. As part of the IPA feedback loop, the teacher and students will review and debrief peer and teacher assessments and further refine content and language necessary to report on the model membrane design process.

Next, two interpretive tasks provide an opportunity for students to demonstrate listening and reading comprehension skills with a new chapter of *Juan Daniel's Fútbol Frog*. Because this chapter book is designed at an “instructional level,” the teacher has read most of Chapters 1-6 aloud to students and provided extensive scaffolding for meaning. As the class begins Chapter 7 of this eight-chapter story, students are familiar with language related to the main characters, settings, story topics and events from earlier chapters. They are now ready to demonstrate their abilities to interpret both orally presented and written language for meaning.

To begin the **Interpretive Task (Listening comprehension)**, students will listen as the teacher reads aloud the beginning section of Chapter 7 from *Juan Daniel's Fútbol Frog*. After listening twice to the same section of the chapter, students will be asked to complete IPA 2-1: Listening Comprehension Assessment. This assessment involves tasks such as picture sequencing, multiple choice, true/false, and making predictions about future story events. The teacher will then ask students to exchange papers for peer correcting and will review and debrief answers and predictions with the whole class. It is important that all students understand this section of the story before moving on to the second interpretive task that assesses reading comprehension skills.

Once the teacher is confident that the whole class clearly understands the beginning events of Chapter 7, students will move to **Interpretive Task (Reading comprehension)**, during which

time they will be asked to finish reading the chapter on their own and then to complete IPA 2-2: Reading Comprehension Assessment. Students are asked to demonstrate use of reading comprehension strategies and demonstrate comprehension of main events and supporting details. The teacher will collect and grade student work. After returning graded work to students, teacher and students will review and discuss answers, and call attention to important reading comprehension strategies. Finally, the class will brainstorm other examples of how useful it is to apply what we learn in one situation (example here: engineering design process) to a different one (example here: Juan Daniel's championship game).

After students' oral presentations and interpretive tasks are completed, the class will move to the **Presentational Task (Written)**. They will read the final chapter of *Juan Daniel's Fútbol Frog*. In this chapter, Juan Daniel draws a diagram of his frog container and membrane and sends it to the bioengineer, Ms. Peters. Extending this idea, student groups (working with their presentation groups) will be asked to write emails to the engineer who visited their classroom. In the email, students will thank the engineer for his/her feedback on the initial model membrane design, include pictures of first and "improved" model membranes, and describe their experience with the model membrane design process. Some instructional activities precede the actual email writing; these activities include leading a wrap-up discussion of the final chapter in the storybook and introducing students to more formal stylistic differences when writing to a professional. As part of the IPA feedback loop, student groups will give and receive peer feedback on first drafts of their email. This feedback will be in the form of a checklist. Student groups will also receive teacher feedback on their first drafts in the form of a more detailed rubric. Time for completing final revisions will be allotted during IPA interpersonal tasks.

This portion of the IPA begins with an activity to engage students in a review of the unit's cross-cultural chart and discussion of the similarities and differences among Salvadoran, Chinese and US cultures, inviting students to make connections between these cultures and their own lives. These activities will assist in preparing students for the final part of the IPA, the interpersonal tasks. **Interpersonal Task 1:** Joint sort and sequence task (Engineering Design Process and Scientific Method) allows students to demonstrate understanding of the Engineering Design Process and Scientific Method by collaborating to sort and then sequence the steps in these two processes. This interactive activity is then followed by an informal discussion about each students' favorite step. **Interpersonal Task 2:** Peer-peer question and answer discussion of *Juan Daniel's Fútbol Frog* and cross-cultural information regarding El Salvador, China and the US. Pairs will be asked to reflect on the story and then highlight similarities and differences among these three cultures.

Professional Curriculum Development References and Resources

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