# Design Process with Focus on Group/Partner Collaboration

**Author's Name:** Victoria Deng

**Coach Name:** Debra Dimas

**Host Organization:** Amazon

**ETP Type:** *Classroom*

**Subject/Grade:** Chemistry 10th - 12th

**Abstract** (~150 words)

The goal of this ETP is to see how Amazonian principles can be applied in the classroom to reinvent the laboratory design process with the help of collaboration. In the science classroom, laboratory procedures are generally provided for students. Alternatively, to foster critical thinking, this ETP will help students advance their skills in designing their own procedures with the goal of solving an issue, such as separating a mystery mixture that was involved in a murder. During the process, students will evaluate, reflect, and provide feedback for each others' work by using a rubric. Synonymous with Amazon's principles in engineering design and resolving failures using the 8D methodology, students will be using the same ideology to test out drafts of their process before finalizing a product.

**Focal Content & Supporting Practices**

The focal content of this ETP is to:

- CSTP 1.5 Promoting critical thinking through inquiry, problem-solving, and reflection.
- NGSS HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

**21st Century Skills and Applications** (1 - 2 bullets)

- Foster effective collaboration between diverse individuals and groups of students.
    - In lessons, students will be working in partners and/or groups. Additionally, students will be assigned roles paired with rotating role cards.
- Give and receive feedback thoughtfully by creating solutions-oriented feedback when giving or receiving feedback.
    - Using rubrics, students will be provided with rubrics. Using rubrics, students will be evaluating work from their peers, by writing feedback in coordination with action items.

**Measurable Objective(s)**

Through the process, students will be able to…

1. create a minimum of 2 drafts before finalizing a final version of a lab procedure.
    a. Students will have a set of detailed procedure that is sufficient for execution of the lab.
    b. Students learn how to solve a problem, such as how to separate a mixture to solve a murder case, with limitations on time and materials.
2. actively listen to their group members for feedback and utilize the feedback on additional drafts.
    a. During the two drafts, students are to identify and describe any issue as a reflection of their progress, while providing corrective actions necessary to reach the desired results.
    b. Students will complete graphic organizers to demonstrate revision of procedures.
3. apply the 8 steps in 8D problem solving methodology if they encounter problems during the design/execution of the procedure.

**Formative Assessment(s)**

Students will be assessed using their graphic organizer. Each person's organizer includes scenarios of design processes, specifically those found in laboratory procedures. Scenarios are built upon prior knowledge as students are slowly introduced to the idea of designing a lab that has a specific purpose.

Starting with the Bob-the-Builder activity as an example, students assess each other by providing individualized feedback with opportunities for additional check for understanding using drafts.

**Summative Assessment(s)**

An activity-based summative assessment will be used to evaluate student progress. As engineering design plays a major role in executing effective labs. Pairs of students will design and test their own laboratory procedures. Then, other pairs will provide feedback for each procedure. Lastly, students will reflect upon their process. Students will demonstrate their learning by completing their graphic organizers in detail.

**Fellowship Description** (300-500 words)

Amazon not only sells millions of products from various sellers, it also designs and produces its own devices from software to hardware. At Amazon's Devices Quality Department, a multi-authored playbook was written for employees to mitigate and/or resolve quality-related issues that may occur during production. Known as the Failure Resolution Playbook, it employs the 8D problem-solving method as the basis to deal with issues in quality during the manufacturing of Amazon devices such as Kindles, Echos, Fire Tablets, etc.

My role during the seven weeks is to translate the playbook into simplified Chinese and create training modules using the translated version for a broader audience. Starting with a more directly translated version, I will be working with key team members to review and improve upon the content and verbiage of the Chinese version. Over the course of review and updates, I will be simultaneously setting up an e-learning training development tool using Articulate.

With a large population of the Amazon Quality team situated in mainland China due to the location of the devices factories, creating a Chinese version of the playbook can allow for more inclusive training of the content and lessens the potential language barrier between teams in the US and overseas. Additionally, alternative versions of the playbook will be derived. One version is to expand the playbook to explain concepts in detail as the team is looking to expand the readership of the playbook to include manufacturers, suppliers, and more key players in production. Another version is the digital training modules that will have written and verbal (Mandarin) versions that will be accessible through a semi-interactive education website.

In the end, I will be writing a white paper that will be presented to the senior management team and/or leadership that presents my experience and what I have learned.

**Fellowship Connection to School/Classroom** (300-500 words)

This fellowship connects to my classroom in 3 major ways:

1. The population at Independence includes many students categorized as English Learners (ELs). When I was teaching sheltered chemistry, a class targeted towards ELs, language was a barrier to many students as chemistry can be heavy with content-specific vocabulary that may hinder understanding. Having alternative/translated versions of important content eliminates any misconceptions due to language.
2. Product development and production at Amazon is the work of thousands of people spread across the globe. Through effective communication and delegation of tasks, members are able to

produce amazing results. The same applies to science, it is a collaborative discipline that often involves team effort to reach results. In the classroom students are paired and grouped, each assigned a different position. Having the experience of working together with people of different backgrounds lends practice for students to prepare for their future. Furthermore, the diversity that spans an office floor to the team members working remotely in numerous countries could also be said in the classroom. At any given time, there could be up to a dozen languages/cultural backgrounds from the students. Each person brings unique attributes to the classroom.

3. Project management, timelines, and deadlines play an important role in the success of product development and production. Issue and project tracking software are used to keep all members of a team and its stakeholders updated. In the classroom, for the past three years, I have used a spreadsheet detailing agenda, homework, announcements, and more, which is shared with my students. This spreadsheet and sites like Canvas should be prioritized as management tools to keep students up-to-date. Having organized and easily accessible tools like spreadsheet allows students to practice their skills of being independent with their work instead of depending on others for basic information.
4. The resolution playbook at Amazon is based on the engineering design process paired with the 8D methodology for problem-solving. An iteration of these two can be found in the classroom whilst designing an effective procedure. Through the process of trial and error, students are able to utilize drafts to improve and test their designs. Then, using feedback from their peers, they have to implement corrective actions to improve.

**Instructional Plan** (This is the bulk of your ETP and may take several pages.)

**Note:**
This instructional plan utilizes the gradual release model. Although it is labeled as Sessions A to C, weeks will pass in between each session. Each session may extend over multiple days as well.

**Prerequisites:**
- No prior knowledge/skills are required for Session A.
- Some additional support may be required for Session B depending on the math skills of the students, scaffolding can be provided to help students build the connections between volume of water and volume of an object.
- Session C does not require any additional support if the unit sequence is followed. However, if the lab is used on its own, the teacher should cover separation techniques for both solids and liquids.

**Instructional Plan Outline:**
This instructional plan contains three sessions that are scaffolded either across a unit or throughout a semester/year.

A) Ignite: tower building competition to introduce students to providing and incorporating feedback.
B) Chunk-&-Chew 1: challenge students to find the volume of an irregularly shaped object by writing their own procedure.
C) Chunk-&-Chew 2: multi-stepped higher-level thinking activity that requires students to apply what they have learned in previous steps.

| **Session A** | **Ignite: Bob-the-Builder (Tallest Tower)** |
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| **Objective(s):**<br>Students are introduced to the process of using feedback from peers to improve.<br><br>***Focal question:***<br>*How can you work together as a group to achieve a goal using limited resources?*<br><br>*How can you use feedback to improve upon your work?*<br><br>**Time:** 30 - 45 minutes | **Set up**<br>- Students are to be in their table groups of 4 people.<br>- Each table group will receive a basket with the following supplies:<br>  - 10 pieces of paper<br>  - 3 wooden stir sticks<br>  - 1 foot of tape<br>  - 1 pair of scissors<br><br>**Activity - Slides**<br>1. Students are introduced to the activity.<br>2. Supplies are shown to the students but not yet given to each group.<br>3. Individually, for only 1 minute, students are to come up with a plan.<br>4. As a group, students have 3 minutes to convene and come with a plan.<br>5. Materials are given. With 5 minutes, students are to build the highest free-standing tower.<br>6. After building the tower, groups are to do a gallery walk around the other tables to see how the other groups did.<br>7. While walking around, students are to leave a written suggestion/feedback for each group.<br>8. Once everyone has viewed and written suggestions for the towers, each group will read the feedback.<br>9. Each group will discuss the feedback and discuss how they are improve on the next round.<br>10. New materials are given. With 5 minutes, students are to build the highest free-standing tower.<br><br>**Closure**<br>1. Individually, students will complete a reflection exit ticket, |

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| | either digitally or on paper. |
| **Session B** | **Chunk-&-Chew 1: Find the Volume of an Irregular Object** |
| **Objective(s):**<br>Students are to practice the process of using feedback from peers to improve on writing laboratory procedures.<br><br>***Focal question:***<br>*How can you use feedback to improve upon your work?*<br><br>**Time:** 30 - 45 minutes | **Set up**<br>- Students are to be in their table groups of 4 people.<br>- Each student will receive their own graphic organizer handout to write on throughout the class.<br><br>**Activity - Graphic Organizer**<br>1. Students are introduced to the activity.<br>2. Supplies are shown to the students but not yet given.<br>3. Individually, for 5 minutes, students are to write out a procedure on the volume that can be found.<br>4. Randomly (sticks or a generator), a student's procedure will be chosen. The teacher will follow the steps to find the volume. Alternatively, students can try each other's procedure.<br>5. Most of the student written procedures will not be detailed enough to produce the desired results. A simplified version of the 8D process will be introduced to students. If needed, use the following graphic organizer template.<br>6. Individually, students will try to apply using 8D and determine how their project does not reach the goal and how it can be fixed.<br>7. Students are given another chance to revise their procedures for 4 minutes.<br>8. Then, partners will trade their procedures with one another.<br>9. Using a colored pen, the partner will be providing suggestions and written feedback to make edits.<br>10. Using the feedback from their peers, each student will then rewrite their procedure.<br>11. If time and materials allow, students will trade their final procedures with one another. Then, each student will follow another student's procedure to determine the volume.<br><br>**Closure**<br>1. Individually, students will complete a reflection exit ticket, either digitally or on paper. |
| **Session C** | **Chunk-&-Chew 2: Separating a Mixture Lab** |
| **Objective(s):**<br>Students are to practice the process of using feedback from peers to improve on writing laboratory procedures.<br><br>***Focal question:***<br>*How can you use feedback to improve upon your work?*<br><br>**Time:** 45 - 60 minutes for writing and revision, 20 - 30 minutes for lab, 5 minutes for closure. | **Note:** this lab activity is part of a month-long unit sequence. See here for the remainder of the sequence. A lab that differs from separation of a mixture can be substituted to better fit the desired unit.<br><br>**Set up**<br>- Students are to be in their table groups of 4 people.<br>- Each student will receive their own graphic organizer handout to write on throughout the class.<br><br>**Activity - Graphic Organizer**<br>1. Students are introduced to the activity.<br>2. Supplies are shown to the students but not given.<br>3. Individually, for 10-15 minutes, students are to complete the flowchart.<br>4. After completing the flowchart, students are to discuss with |

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| | an elbow partner to revise their work.<br>5. After this first revision, students will turn to another student for additional feedback before moving on.<br>6. During this time, discuss again with students about troubleshooting issues and the steps of 8D to ensure the goals are reached.<br>7. After 2 revisions of the flow chart, students will begin writing their procedure, following the rubric.<br>8. One more round of feedback will be performed by a new peer.<br>9. Students will rewrite their procedure and perform the experiment using their procedure.<br><br>**Closure**<br>1. Individually, students will complete a reflection exit ticket, either digitally or on paper. |

**Additional Supports**

*Tools to meet the needs of all learners (SEL, distance learning, ELL, SPED)*

- Graphic organizers
- Rubrics
- Digital and printed versions

**Materials**

*Include links to all files within this ETP*

Graphic Organizer - Key - Determining the volume of an irregularly shaped object
- Materials: graduated cylinder, variety of irregularly shaped objects, water

Graphic Organizer - Key - Separating a mixture lab
- Materials: beaker with a liquid mixture (salt, sand, and iron filings), magnet, filter paper, funnel, Erlenmeyer flask, balance, plastic weighing boat, hot plate

Graphic Organizer - Key - 8D Template

Unit Sequence Handouts

**References**

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**Keywords** (2-4)

engineering design, lab procedures, feedback