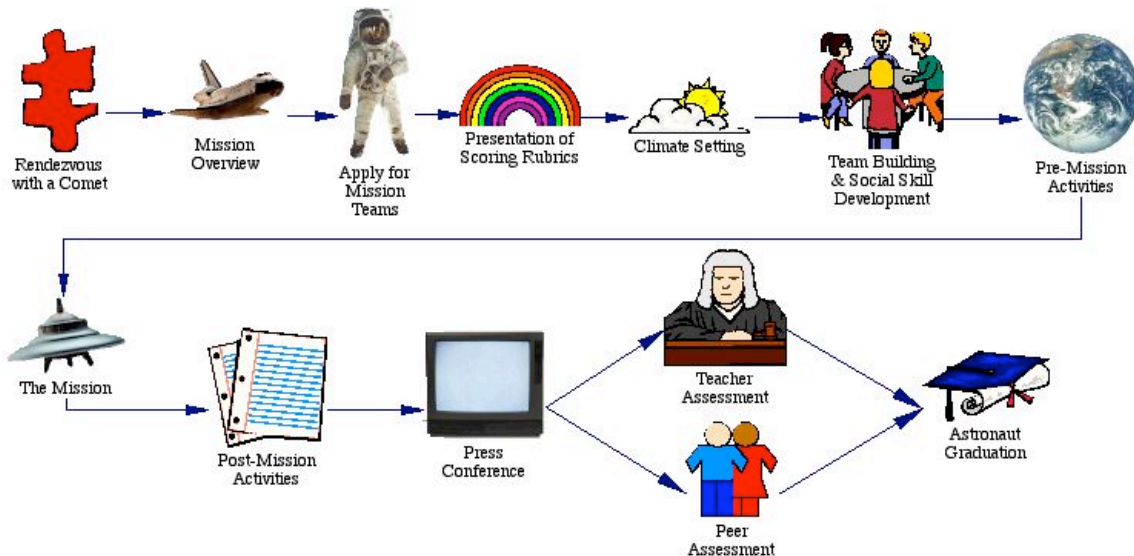


INITIATING PBL2: *Rendezvous with a Comet* – In preparation for the mission to your local Challenger Learning Center, your students will progress through PBL2 *Rendezvous with a Comet*. A flow chart showing the processes surrounding PBL2 can be found below.



The tasks associated with PBL2 are considerably more complex than those associated with PBL1. It is therefore essential that PBL1 not be skipped; it is the training ground for PBL2.

- **PBL overview for teacher**

PBL2, *Rendezvous with a Comet*, will have several steps, each associated with its own form of assessments. Overall, these are the steps of PBL2:

- 1) Students are provided orientation to *Rendezvous with a Comet*.
- 2) Teacher will work with students to conduct pre-mission activities. These include whole group activities, small team activities, and classroom connections (as desired for additional enrichment). The goal of the pre-mission activities is to prepare students for the CLC mission. To do so, students are required to prepare for and present before a “congressional hearing.” Each team will contribute one member to an overview team that will provide basic background information about comets; each team will deliver its own information before the “congressional committee.” Teams will justify their role in the mission in the hope of obtaining congressional approval for flight. Teams will make a presentation that includes an oral report and one of the following: poster, brochure, or PowerPoint.
- 3) The *Rendezvous with a Comet* mission is then “flow” at the local Challenger Learning Center.
- 4) The focus of post-mission activities will be primarily on conducting a press conference. The press conference will, in essence, be a panel discussion involving the

entire class, and will focus on such questions as “the next mission,” “impressions,” “discoveries,” and “future careers.” The teacher will serve as the lead for this press conference unless students have been assigned to PRESS TEAM positions in which case they can conduct the press conference. Prior to the press conference and following the CLC mission, students will first complete a “Team Reflection” followed by a “Self Reflection.” These reflections can allow for creativity in such diverse areas as art, poetry, music, short stories, careers, etc.

- **Provide mission overview to students**

Introduce students to the problem statement through the WebQuest site. The PBL2 *Rendezvous with a Comet* website can be found at the following address:

<http://www.phy.ilstu.edu/~wenning/clcrendezvoustg/students/webquest2/index.html>

Introduce students to the website and help them to move through the pages sequentially, being certain that they understand the content of each page before they progress to the next. It might be best at this point for the teacher to demonstrate the website with the use of a video projector attached to a computer rather than having each student sit down at his or her own computer. Do this first time as an overview. The Webquest will be visited time and again later as students need to identify specific requirements.

- **Teacher assembles teams**

In preparation to fly a mission at Challenger Learning Center, students "apply" for available positions and are assigned by their teacher to their roles. Challenger Center believes the classroom teacher is best suited to make the student assignments to teams that best match their abilities and interests. To ensure a positive learning experience for every student, please give careful consideration as you assign students to the teams.

To help you make those assignments, use the "Job Application" on the PBL2 website determine the students' personal preferences. Then use other information at your disposal, such as skill level or learning styles, to provide a good match of each student's abilities with the position requirements.

The team descriptions below outline the roles and responsibilities of each position to help teachers make student assignments. Challenger Center has characterized additional information about skill requirements and learning styles for each description to use as appropriate in making your student assignments.

TEAM	SKILLS	STYLE
COMMUNICATIONS (COM): As members of the Communications Team students will be responsible for all verbal communication between Mission Control and the Space Station.	Proficiency in reading and oral communications, ability to work in high stress situations, ability to prioritize.	Favor an auditory learning style

DATA (DATA): As members of the Data Team students will be responsible for data entry, synthesizing and summarizing data from the Research Program and the video link between Mission Control and the Space Station. Proficiency in reading and oral communications, ability to work in high stress situations	Proficiency in reading and oral communications, ability to work in high stress situations	Favor a visual or auditory learning style.
NAVIGATION (NAV): As members of the Navigation Team students will send and receive messages, calculate trajectories, and analyze and determine angles for launch coordinates.	Data entry skills, strong math skills, interest in astronomy.	Favor a visual or auditory learning style.
MEDICAL (MED): As members of the Medical Team students will monitor and analyze auditory and visual response time respiration rate skin temperature and heart rate of Space Station personnel.	Data entry skills, a strong interest in biological sciences, math skills (simple averaging).	Favor a visual learning style.
PROBE (PROBE): As members of the Probe Team students will be responsible for assembly, deployment, and monitoring of a space probe.	Strong mechanical skills, proficiency in math and reading, analytical problem solving.	Favor a kinesthetic learning style.
REMOTE (REM): As members of the Remote Team students will operate the robotic arm and collect and analyze mass, volume and chromatography data.	Strong mechanical and observation skills, proficiency in reading.	Favor a kinesthetic or visual learning
LIFE SUPPORT (LS): As members of the Life Support Team students will perform water supply tests, analyze data from pH tests, and read solar panels.	Strong problem solving skills, interest in environmental and biological sciences.	Favor a visual or kinesthetic learning style.
ISOLATION (ISO): As members of the Isolation Team students will be responsible for conducting research and data analysis of radioactivity, meteoroids, and hazardous materials.	Strong eye-hand coordination, use of measurement devices (balance), reasoning, patience.	Favor a kinesthetic learning style.
PRESS (PRESS): As members of the Press Team students will conduct interviews, take photographs, and write news releases.	Strong observation, communication and writing skills.	Favor auditory and kinesthetic learning style.

In addition to providing an authentic setting in which to apply skills learned in the classroom, every Challenger Learning Center also provides students with a dynamic, multi-sensory environment. Research shows that people use all of their senses to learn. That same research shows that while most people use a combination of particular sensory styles to process information, one dominant style usually dictates their preferred method of learning: kinesthetic, visual, tactile, and/or auditory. Kinesthetic learners learn best by hands-on physical involvement. Visual learners may prefer reading, taking notes, and making lists. Tactile learners may work best at their own pace in a comfortable secure

environment, while auditory learners may prefer group discussions and listening to lectures.

Each mission requires the cooperative effort of eight teams. Teams will do a "crew swap" so that each team will experience Mission Control as well as the Spacecraft during the course of the mission.

Have students:

1. Review the positions available for their mission as a class.
2. Complete a Job Application.
3. Submit completed job applications for position assignments.

Once you have assigned students to teams, complete the Crew Manifest and bring two copies to the Challenger Learning Center on the day of your flight. As you complete your manifest, assign two students to each team, one in Mission Control and one in Space Station. Put two more students at Navigation and Problem, then fill in the other positions as needed. Only if there are more than 32 students attending a given mission are the positions of Press filled. Otherwise, leave these positions empty unless you really do want to have a student photographer and/or reporter.

- **Present scoring rubrics**

Students need to understand what is expected of them. Scoring rubrics are an excellent way of making expectations known. Talk about the nature of a scoring rubric and how it will be used. Explain that both teacher and students will be using scoring rubrics to assess to performance of individual team members and other teams.

- **Conduct climate setting**

Point out to your students that the PBL approach is probably very different from anything they have encountered in a classroom before. They will not be treated like empty vessels to be filled with knowledge; they will be treated as active inquirers attempting to solve a complex, real-world problem that probably has no "right" or "wrong" answer.

- **Explain the rules of social engagement**

Indicate that we will be using a cooperative learning style where everyone is expected to contribute to the best of their ability. Point out that cooperative learning implies that everyone must work together following certain rules of conduct. No one wants to have to do all the work while others contribute nothing. It's a matter of fairness that everyone contributes meaningfully to solving the problems that they will be asked to address.

- **Establish small cooperative teams**

There should be eight (or nine if the class has more than 32 students) work groups if at all possible to ensure compatibility with staffing needs of the mission at your local Challenger Learning Center. There should be heterogeneity within groups and homogeneity among groups. Girls generally should be put into groups in pairs if possible. Each group should have a heterogeneous composition by ability. That is, each group should contain a representative number of students with high and low ability. In this way, all groups will be essentially the same in terms of overall academic ability.

- **Establish roles within teams**

It is often best to establish specific roles within cooperative student groupings. These roles can and probably should change on a daily basis. Consider appointing a questioner, a scribe, a critic, and so on. Explain the work of each role.

- **Re-state goal or pivotal question**

It's a good idea to re-state the problem from time to time using simple language.

- **Help students identify what is known, what needs to be known, and how to find out**

Start with a whole group process asking what's known, what do we need to know, and how will we find out?" In PBL2 *Rendezvous with at Comet* for instance, focus on what the mission is and what it must include. Focus strongly on the research tasks and research questions. Each of these questions should be addressed by each team as part of their written report. Later, address the question about how teams might find answers to their questions. Return to the WebQuest as necessary to find online resources; other non-computer-based resources can also be identified and used. Student teams can record their data on the *Know Need to Know* form.

- **Begin the mentoring process**

Once students understand what is known, what needs to be known, and how to find out, they begin a small group effort to solve the problem at hand and prepare the required student performance assessments. At this point they cooperatively use available resources to answer identified questions. Keep in mind that cooperative learning does NOT imply that everyone has to be doing exactly the same thing all the time. Teams will frequently use a "jigsaw" approach in which they take the larger problem, break it down on smaller com-

ponents, and then have team members work on that smaller component. They then reassemble the pieces like a jigsaw puzzle to bring the solution together.

- **Students complete products**

Only after students have become well versed in the content of their project do they begin assembling the final written report. Following the mission at the Challenger Learning Center, teams move on to preparing their oral reports for the press conference. Students should be directed to the guidelines for preparing the oral presentation.

- **Student pre-assessment of products**

Student should be asked to self-assess the quality of their products before they turn them in or present them for scoring. They can either be referred to the guidelines found on the WebQuest, or to the detailed scoring rubric used by the teacher.

- **Student presentation of products**

Students complete and hand in the written report by a specified date. The teacher then assesses each written report for content and style using the two detailed scoring rubrics. Following this submission and the CLC mission, students begin preparing for the oral report to be delivered at a press conference. Teachers should be certain to limit the size of the written report and the duration of the oral report in advance of students completing the work.

- **Student assessments**

Scoring of students' written and presentation work is conducted by the teacher using the appropriate scoring rubric. Students score presentations and team members using the appropriate scoring rubrics. Daily pre-mission whole group and small group activities can be used for the basis of grading by assigning, say, 10 points to daily projects. In addition to pre-mission activities, numerous activities are available for additional enrichment in the "Classroom Connections" portion of the online resources.

- **Team processing**

Students undoubtedly have learned something about working in small groups. Many times they learn how such groups should NOT function. Allow time for students to self-assess team performance. This will help build cooperative learning skills, and will improve performance in the future.