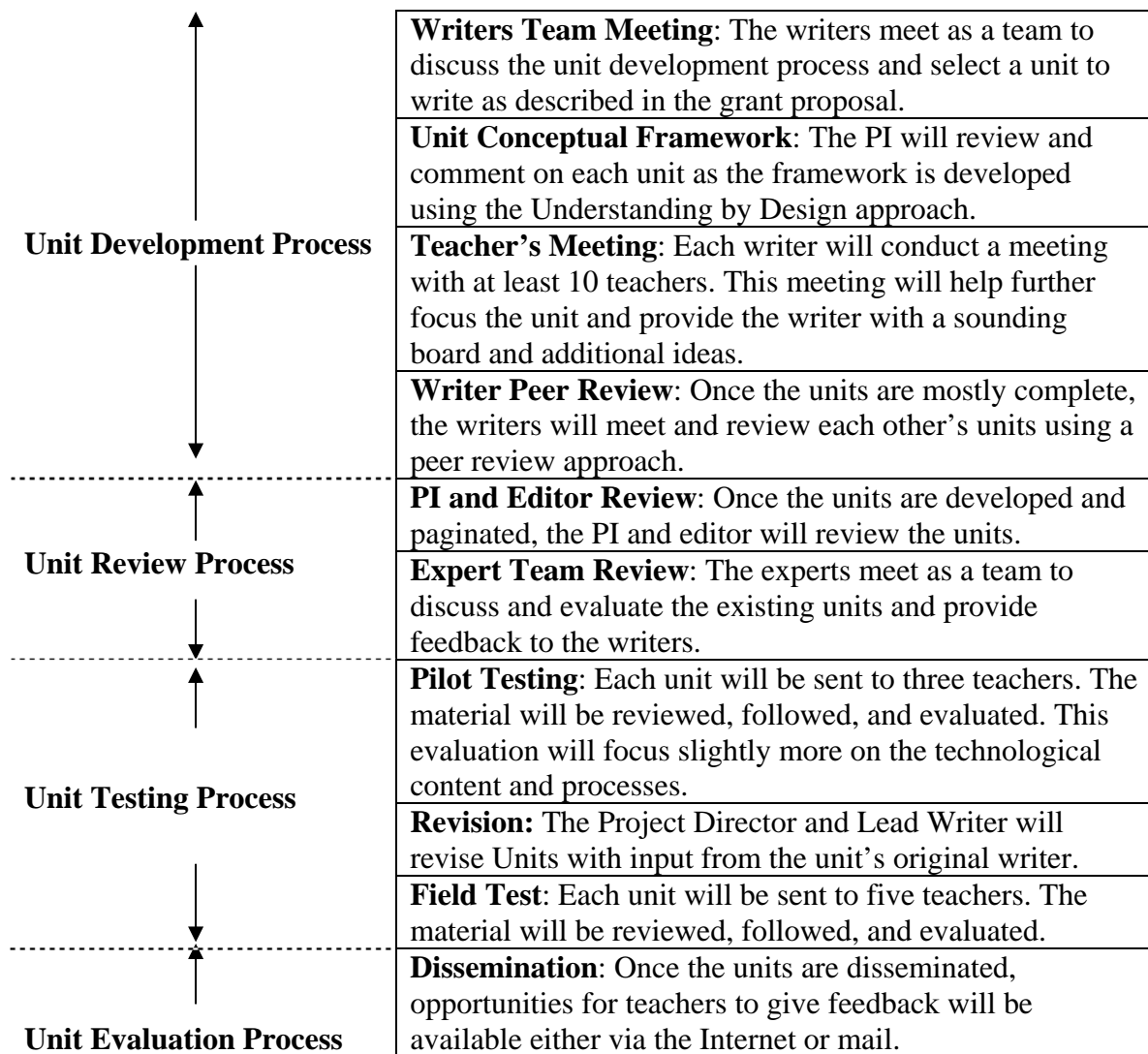


Invention, Innovation, and Inquiry

Unit Development and Evaluation Process

The Invention, Innovation, and Inquiry (I³) project is designed to develop 10 units that promote technological literacy for students in grades 5 and 6. Each unit is to be written so that it is “self-contained” in so much that the teacher does not need special training to conduct the unit. The units are to be 8 to 10 days in length that can be taught in 40-50 minute sessions. To create units that are accurate, developmentally appropriate, advance technological literacy, and are effective the process showed below will be followed.



The distinctions between each of these processes were developed to facilitate accountability, validity, and reliability in the each of the units. The arrows in the diagram indicated that this is modified linear approach. Although a general development process if followed, each step impact on the results and action to be taken in the following step. At

times it may be important to go back a step or two ensure the quality of each unit. Further explanation of each step is described below.

Unit Development Process

Writers Team Meeting

A writers team meeting was held to allow all writers to meet discuss issues, select unit topics, and understand the unit development process. Writers were given an overview of standards, the Understanding by Design curriculum development approach, deadlines, developmental characteristics of a “typical” 5th and 6th grade student, and how to conduct the Teacher’s Meeting

Unit Conceptual Framework

Each unit, since they are to be standards-based, is to be conceptualized using the Understanding by Design approach created by Wiggins and McTighe (1998). In this approach, curricular units are designed based on the standards, essential questions, and other “big ideas”. Next, evidence of student attainment for each of the standards is identified. This ensures that units are not simply a collection of “fun” activities, but rather cohesive in nature by making sure that appropriate content and processes important for technological literacy are adhered to. Finally, instructional approaches that match the assessments are designed along with student activities. The worksheets used for this process were adapted from the *Understanding by Design Workbook* published by ASCD in 1999. It is important to note that the worksheets are used to conceptualize the unit. The units will take on a different layout to be used for field-testing and dissemination. Once each writer completes his/her unit concept, the PI will review it for accuracy, alignment between standards, assessments, and instruction, and appropriateness.

Teacher’s Meeting

Each writer will conduct a meeting with at least 10 teachers. These teachers should mostly be 5th and 6th grade teachers in self-contained classrooms since they are ultimately the target audience. Teachers with experience in teaching Technology Education, Science, and Mathematics should also be in attendance. The teachers should also be a diverse in areas such as experience, gender, ethnic background, school demographic setting, and technological understanding.

This meeting will help further focus the unit and provide the writer with a sounding board and additional ideas. The writer should discuss the general outline and structure of the unit so participants understand the concept of the unit. The teachers should feel free to recommend changes, comment on the unit, ask questions, and act as a sounding board. The intent of the meeting is that the unit will have some initial validation before all the material is developed. It is important to develop units that not only “work”, but also are important.

Writer Peer Review

Once the units are mostly complete, the writers will meet and review each other’s units using a peer review approach. The purpose of this peer review is to help each writer improve his or her unit. The emphasis should be on constructive criticism and consistency. The general steps that will be followed at the peer review meeting include:

1. Exchange papers with the other writers.
2. Read through the manual quickly without making comments.
3. Go back through the unit making clear comments in the margins.
4. Finish by offering, on a separate sheet, a summary of your suggestions ranked in order of importance.
5. Print two copies of the summary and give one to the PI and the other copy to its author with the marked draft.

Unit Review Process

PI and Editor Review

Once the units are developed and paginated, the PI and editor will review the units. The PI will primarily look for content accuracy, instruction, assessment, and standards alignment, and appropriateness of the unit. The PI will also ensure that the unit focuses on technological literacy development. The editor will review the unit primarily for issues related to pagination and layout, although the editor will also examine the content and appropriateness of the unit.

Expert Team Review

The experts will meet as a team to discuss and evaluate the developed units and provide feedback to the writers. The experts will prepare evaluative feedback in two forms: as a group and individually. The group report is designed to be a listing of comments to the writers that are general in nature. The individual report will include comments in the margin and the completion of a review form entitled “Expert Unit Review Form”. This document contains 17 questions are answered using a Likert scale and six open-ended questions including:

1. What did you see as the major technological/scientific/mathematical concepts and processes in the activity?
2. Are there any aspects of the unit that are not technological/scientific, mathematically sound? Please explain.
3. Discuss any parts of the unit that could be improved by integrating additional technological/science/mathematics content, without changing the overall scope of the unit.
4. What are the most beneficial aspects of this unit?
5. What aspects of the unit are difficult to understand?
6. Please comment on the overall sense you have about the unit.

Unit Testing Process

For this project unit testing will occur in two phases for each of the I³ units. The goals for this testing are identified in the table below and a short description of each phase and selection criteria for the field test teachers follows.

	Unit Testing Goals	Data Collection Instruments
Is the Unit Usable?	1. Is the teacher background material is helpful and accurate?	✓ Teacher survey ✓ Phone interview/visitation ✓ Log notes
	2. Is the content accurate?	✓ Comments written in the unit
	3. Does the unit fit the 8-10 day, 40-50 minute session structure?	✓ Teacher log ✓ Meeting with teachers
	4. Can a teacher without “special training” conduct the unit?	✓ Teacher survey ✓ Phone interview/visitation
	5. Can the unit be implemented in a “typical” 5 th or 6 th grade classroom?	✓ Teacher survey ✓ Meeting with teachers
Is the Unit Valuable?	6. Does the unit to bring about technological literacy understanding in the students?	✓ Samples of student work ✓ Pre-test/Post-test
	7. Does the instruction and assessment align with the stated standards?	✓ Teacher survey ✓ Phone interview/visitation
	8. Do the students accept the units?	✓ Samples of student work ✓ Student survey ✓ Meeting with teachers
Is the Unit Effective?	9. Does the unit achieve its objectives?	✓ Teacher survey
	10. Are the student activities appropriate, engaging, exciting, and worthwhile?	✓ Samples of student work ✓ Teacher survey
	11. Are the assessments appropriate for the students?	✓ Comments written in the unit ✓ Teacher survey
	12. Are the instructional materials is appropriate and effective?	✓ Comments written in the unit ✓ Teacher survey
	13. What type of teacher support material needs to be developed?	✓ Teacher survey ✓ Phone interview/visitation ✓ Meeting with teachers

Pilot Test

There will be 3 sites selected for pilot testing each unit. Pilot testing is designed to ascertain the usability of the unit, specifically examining the content, processes, activities, assessments, and appropriateness for the intended audience. The pilot testing will also provide information about the effectiveness of the data collection instruments that were used.

Revision

The Project Director and lead writer will collaborate to make revisions on each unit after the initial pilot testing. Any unit needing significant changes will be discussed with the original writer. All changes will be documented and filed.

Field Testing

The field-testing will be more rigorous since most of the shortcomings in the units should have been worked out. During this phase there will be at least 5 sites for each unit and the units' effectiveness and value, as well as the usability will be evaluated. It is important to note that there will not be any direct professional development given to the participants since each of the units must stand on their own. Web support will be available later in the project when units are complete.

Unit Testing Participants Solicitation

To locate field test participants, information will be sent to the following:

1. IDEA Garden listserv
2. CTTE listserv
3. TrendScout (ITEA electronic publication)
4. State supervisors
5. Elementary members of ITEA
6. Writers and Experts currently in project
7. ITEA-CATTS members
8. NSTA listserv (possibly)
9. NASA listserv (possibly)

Selection of Pilot and Field Test Participants

To become a pilot or field test participant, the following items must be satisfied.

1. Bachelors or advanced degree in education.
2. Certified to teach elementary school, middle school science, or technology education
3. Complete unit and return feedback forms by established date each semester.
4. Minimum 3 years teaching experience
5. Permission of school administrator
6. Willingness to conduct telephone interview and/or site visit
7. Varied school settings including rural, urban, and suburban

NOTE: Since the first round of pilot-testing focuses on the accuracy of the content and processes, preference will be given to teachers with some experience and/or training in technology education. Subsequent field test sites will not require these prerequisite skills.

Once a site is selected the following will occur:

1. Congratulations letter sent to teacher and school administrator. Letter will require school administrator to return signed form to allow the school to participate.
2. Unit will be mailed to field test participant

3. Evaluation forms will be emailed (or mailed if necessary) to participants.
4. Telephone interview
5. Unit returned with sample of student work, summary evaluation, and receipts for subsistence reimbursement for school (\$50 maximum)

Unit Evaluation Process

Dissemination

Once the units are completed, they will be disseminated. The method of dissemination has not yet been finalized. Teachers will be able to access web-based support material. Opportunities for teachers to give feedback will be available either via the Internet or mail.