

## Chapter 9

### Curriculum and Instructional Design

Who should design the curriculum that technology educators teach? Should curriculum be developed by governments and ministries of education? Should curriculum design be privatized and limited to commercial vendors? Should teachers design their own curriculum? Who should design the instructional materials? Should all materials be professionally designed by a vendor? As we noted in the previous chapter, technology teachers have had a century of freedom in designing and customizing their curriculum and instruction to suit themselves, their community or the students. This had its advantages in diversity. The disadvantages, as we noted, related to the inconsistencies from school to school, even in the same district. When the teacher departed from a school s/he typically departed with the curriculum and instructional materials. New teachers often began their first school year with little more than what they carried with them from their teacher preparation programs and student teaching experiences. One major problem was that when it came time for governments to identify priorities in the schools, technology studies was overlooked because of its incoherent curriculum. As indicated in Chapter 8, the international trend is quickly shifting toward standards and unified curriculum in design and technology—the trend is toward a consistent scope and sequence of content for the study of technology. Common curriculum and goals along with content and performance standards are the trends. From a perspective of professional vitality and political finesse, these trends are healthy. These trends offer the potential for long-term sustainability of technology studies in the schools. Nevertheless, given that all curricula are fallible and have shortcomings, teachers will always have a need for dispositions toward, or skills and knowledge in, curriculum and instructional design.

The questions "what should be learned?" and "how should it be organized for teaching?" are eventually resolved, whether by consensus, fiat or might, through processes of ***curriculum and instructional design***. One is basically a question of content, the other a question of form. Neither can be resolved without changing the other—the questions are dialectically related. We can say that curriculum and instructional design involve the forming of educational content and the contents of educational forms. Curriculum theorists take it for granted that curriculum flows from the "*what*" of "what should be learned?" Instructional designers take it for granted that instruction flows from the "*how*" of "how should it be organized?" Theorists neglect design.

Designers neglect theory. Teachers, however, cannot afford to neglect either theory or design; they have to be theorists and designers. In this chapter, curriculum and instructional design are explained along with a focus on the design of projects, units and modules. This chapter combines background knowledge with techniques of curriculum and instructional design. In some of the previous chapters, the emphasis was on "what should be learned?" This chapter focuses on "how should it be organized for teaching?"

## Curriculum Design

The practice of organizing curriculum— activities, environments, goals, knowledge, student and teacher interests, social conditions, technologies, values and the like— into a containable pedagogical form involves a series of judgments. Judgments are necessarily made on what and whose knowledge is of most worth, the scope and sequence of this knowledge, how student desires will be focused, what technologies to deploy or purchase and so on. Curriculum designs lend form to, and chart provisions for, the processes of learning and teaching and become concrete and operational at various stages of educational practice. The very nature of student experiences are shaped by the way we choose to design, or not design, curriculum. In other words, different curriculum designs provide varied qualities and powers of experience and knowledge. Curriculum design might at first glance appear to be about the economics and pragmatics of teaching, about arranging content and assignments, apportioning time on timetables, and allocating resources. Curriculum is, and is much more than, scope and sequence. Mundane *and* profound judgments are made when we plan, shape and judge human experience. Congruence between educational outcomes and curriculum documents is virtuous; but when curriculum design is seen as the moral and political endeavor that it is, the issue takes on deeper significance.

What should be learned? How ought it be organized for teaching? *Curriculum design* involves a form into which curriculum is cast or organized. Curriculum is generally organized through designs such as: **Disciplines** (e.g., mathematics, engineering, humanities, sciences); **Fields** (e.g., art, civics, design, home economics, industrial arts, social studies); **Units** (e.g., bicycling; child labor; feminism, jazz; mass media; queer fiction; verbs; water colors); **Organizing Centers** (e.g., activities, modules, minicourses, problems, processes, projects, tasks and competencies); or **Personal Pursuits** (e.g., aerobics, autobiography, cooking, bird watching,

guitar playing). **Core** or **Interdisciplinary** designs employ combinations of disciplines or broad fields (Petrina, 1998). Disciplinary, field and interdisciplinary designs typically employ units and organizing centers to engage students in pre-structured knowledge. Here, problems and units are developed to establish understandings of organized bodies of disciplinary knowledge. Curriculum designs are generally selected for their powers in bolstering political causes and conferring political status, and since the early 1960s, disciplinary designs have been politically valued over the others. High school humanities and sciences employed disciplinary designs in the early 1960s to secure economic and liberal roles. Projects and units conferred a progressive status in the 1910s and 1920s for newcomers in the school curriculum such as industrial arts, audio-visual education and social studies. Just as teaching methods are associated with different theoretical "families," curriculum designs have theoretical orientations.

A consensus in *curriculum theory* formed around five orientations to organizing curriculum: academic rationalism, cognitive processes, self-actualization, social reconstruction, and utilitarianism (Eisner and Vallance's, 1974). Academic rationalist orientations are primarily about disciplinary knowledge and cultural canons. Cognitive process orientations are primarily about intellectual reasoning skills such as problem solving. Self-actualization, or personal relevance, orientations stress psychological conditions and are concerned with individuality and personal expression. Social reconstruction, generally called critical pedagogy, stresses sociological conditions, social justice and collective reform. Utilitarian orientations are primarily concerned with functional competencies, performance, procedure and instructional efficiency. Curriculum designs are conceptually grounded in any one or a mix of these orientations. In 1992, a special issue of the *Journal of Technology Education* was published to explore each of these five designs (see Herschbach and Sanders, 1992). A basic conclusion from this is that generic, neutral theoretical orientations and designs for organizing curriculum simply do *not* exist (Beyer and Apple, 1988; Eisner, 1979; Zuga, 1989).

Nevertheless, theorists of these five designs play into the hands of educators and policy makers who for centuries ranked curriculum by political value: liberal arts and university preparation curriculum are valued over practical or technical curriculum. Four theoretical orientations, generally ranked in the order previously introduced, hold not only historical status, but also theoretical status over the instrumental or utilitarian curriculum. Furthermore, theorists conflated utilitarian orientations with technology, making things more confusing. As a result,

any school curriculum that takes "practical" work as its subject has a low theoretical status and, as it has nearly always been, a questionable historical status. Today, business, home economics and technology in the curriculum connote instrumental, transmissive and technical practices. Historically, business educators, home economists and technology educators *may* have designed instrumental curriculum, but this was never any more instrumental or utilitarian than the arts, humanities, maths or sciences for instance.

Other theorists conclude that there are three basic orientations to curriculum—transmissive, transactive and transformative curriculum or technical, practical and emancipatory curriculum. If we can hold off on ranking these, there is great value in theorizing **transmissive, transactive and transformative** orientations to curriculum. In fact, teachers can be quite empowered by the knowledge and skills in designing curriculum that is at times transmissive, and other times transactive or transformative. A transmissive orientation typically means that information is transmitted from teacher to students. For example, safety procedures are best taught from a transmissive orientation. Here, the teacher simply has to say "pay attention, this is the way it is done— step 1 through step 6." A transactive orientation typically means that the question "what should be learned?" is democratically negotiated. Here, the teacher may work with small groups and say: "Let's discuss your ideas for how we should handle this situation." In a transformative mode, the teacher provides content and methods that are truly empowering for the students. For example, the teacher may provide a civil liberties lesson that empowers the students to take advantage of their freedoms of speech in a zine or on a web site. There are time when teachers consciously ought to be transmissive and other times when they ought to be in a transactive or transformative mode. The key is to know and recognize the difference in designing curriculum.

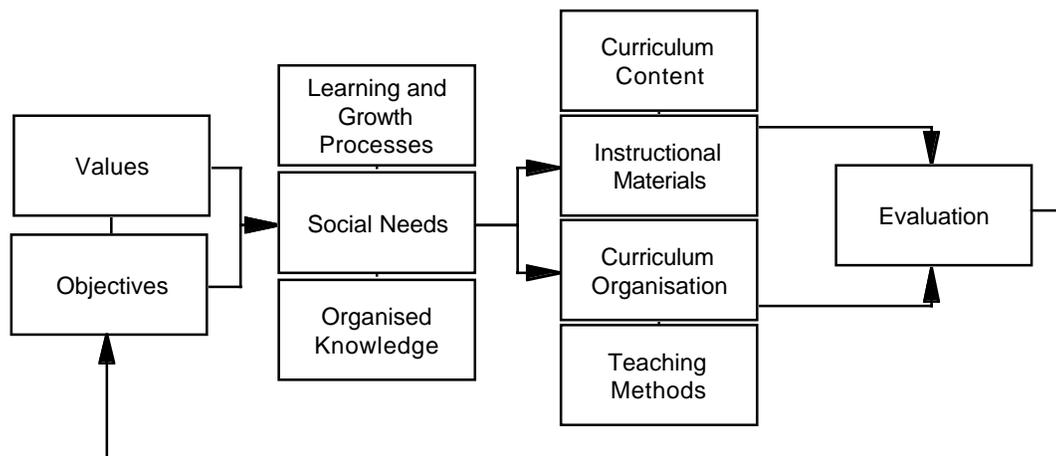
In 1949, Ralph Tyler summed up centuries of curriculum design into four simple steps. For Tyler, the process of curriculum design amounted to a way of resolving four questions, or a rationale:

1. What educational purposes should the school seek to attain?
2. How can learning experiences be selected which are likely to be useful in attaining these purposes?
3. How can learning experiences be organized for effective instruction?
4. How can the effectiveness of learning experiences be evaluated?

In the 1960s, curriculum designers such as Hilda Taba reduced Tyler's curriculum rationale into a simple procedure:

1. Diagnosis of needs.
2. Formulation of objectives.
3. Selection of content.
4. Organization of content.
5. Selection of learning experiences.
6. Organization of learning experiences.
7. Determination of what to evaluate and the ways and means of doing it.

This procedure has defined curriculum design since that time. Curriculum design became little more than a determination of goals, activities, content, delivery systems and assessment techniques. Curriculum design became basically little more than an exercise in solving a series of problems (Fig. 9.1).



*Figure 9.1. Model of the Curriculum Design Process*

Rather than a technical procedure of writing objectives, choosing activities, content and methods and modes of assessment, curriculum theorists in the mid to late 1970s pointed out that curriculum design involves extremely important questions about the world. Each time that teachers purchase educational software, a textbook, wood for carpentry or other materials from a vendor, they are addressing questions about what kind of student and world they want. Each time that teachers assign a project, design an activity or curriculum materials they address these questions. Currently, theorists remind us that the simple questions "what should be learned?" and "how should it be organized for teaching?" are quite complex and political. They caution us to think carefully about the decision we make on behalf of curriculum design. Curriculum design now involves a rationale with a greater moral weight than Tyler's of the 1950s (Fig. 9.2).

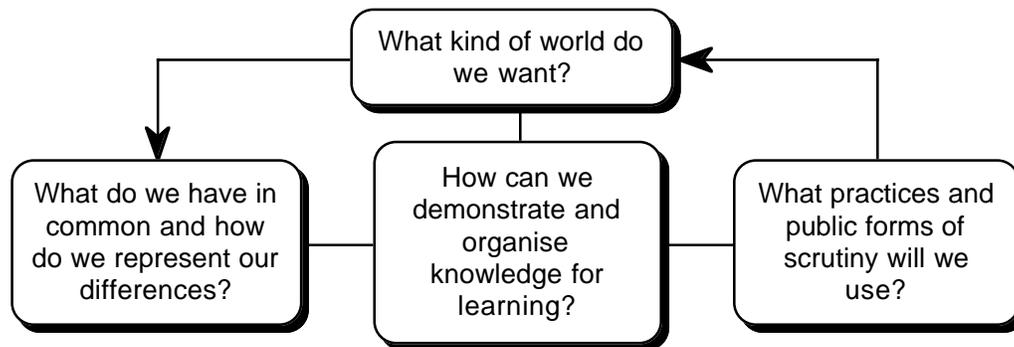


Figure 9.2. *Critical Design of C&I.*

In the next section, the background and process of instructional design is explained. Subsequent sections deal with projects, units and modules. The intent is to move from theory to procedure to practice as this chapter progresses.

## Instructional Design

In the 1950s, generally when *instructional design* (ID) was established from a field of media specialists, educational psychologists and industrial and military trainers, instructional designers shrank Tyler's rationale to fit the act of instruction. Although some argue that the reverse was true— instructional designers reduced instruction to fit Tyler's rationale— the rationale was tailor-made for curriculum and instruction (Fig. 9.3).

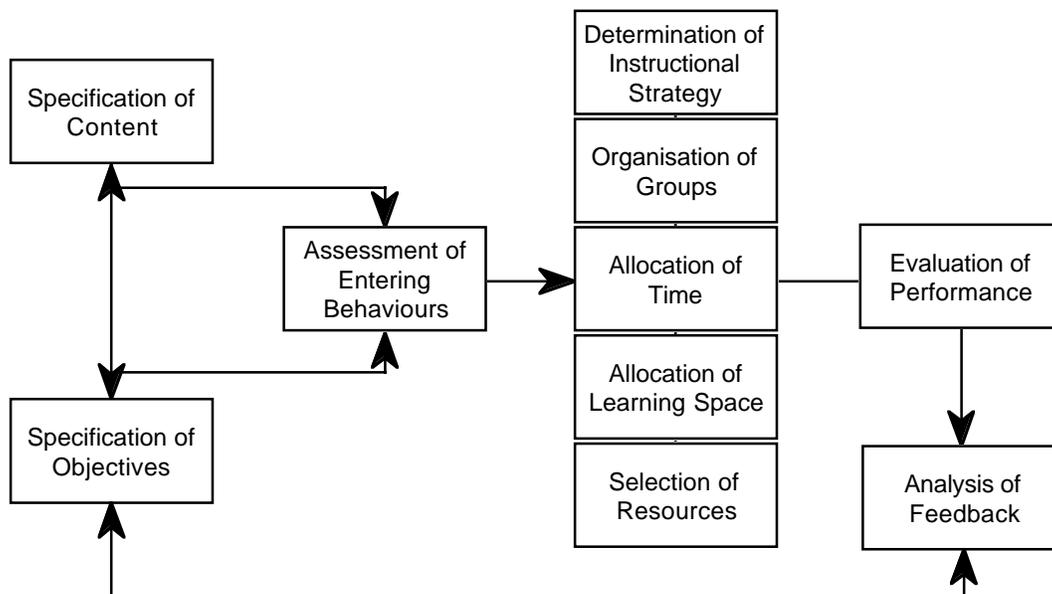


Figure 9.3. *Model of the Instructional Design Process*

Unable to completely identify with Tyler's rationale, instructional designers contrived an ID rationale:

1. For whom is the program developed? (characteristics of learners or trainees)
2. What do you want the learners or trainees to learn or demonstrate? (objectives)
3. How is the subject or skill best learned? (instructional strategies)
4. How do you determine the extent to which learning is achieved? (evaluation procedures)

And similar to Taba's simplification of curriculum design, instructional designers reduced ID to a simple procedure (Fig. 9.3):

Not wanting to limit ID to isolated instructional episodes and events, designers extended the notion of an instructional system to include a larger share of curriculum design. Basically since the 1970s, the process of ID included:

1. Analysis of Needs, Goals and Priorities
2. Analysis of Resources, Constraints, and Alternate Delivery Systems
3. Determination of Scope and Sequence of Curriculum and Courses; Delivery Systems Design
4. Determining Course Structure and Design
5. Analysis of Course Objectives
6. Definition of Performance Objectives
7. Preparing Lessons Plans (or Modules)
8. Developing, Selecting Materials, Mass Media
9. Assessing Student Performance (Performance Measures)

In effect, ID is the same as curriculum design. If there is a difference between curriculum and instructional design, it is that curriculum designers place more of their stock in the question "what should be learned?" while instructional designers pin their work on the second question, "how should it be organized for teaching?"

Both curriculum and instructional design prompt us to think *ecologically* and *systemically* about C&I, as mentioned in Chapter 4. Systems involve relationships, conditions, processes, causes, effects and feedback. Ecologies involve interdependencies and webs of exchange. When we design an instructional system we also necessarily design a learning system. When we design curriculum we also design instruction. When we focus on content we also focus on form. Designers, including the best designers of products or images, are quite adept at tuning C&I into

particular components of ecologies or systems while minding the wider spectrum of processes and relationships that characterize the system. They are able to focus and keep their mind on the big picture— at the same time. The same is demanded of educational designers. Teachers and teacher educators tend to focus in on teaching and the performance of teachers at the expense of attending to students and learners. Curriculum designers tend to focus on content and instructional designers on form or process, neglecting the larger picture. The great contribution of ID is a well-articulated and empirically-tested range of principles that help us focus and keep our minds on details *and* the big picture— at the same time.

## Principles of Curriculum and Instructional Design

C&I design is effective when principles are consistently followed and deployed. C&I materials and activities ought to adhere to basic principles of design, such as accessibility and equity. While guidelines and principles of C&I design are quite simple and specific, they are often neglected in practice. In teacher education, students often wonder how professors can so readily talk about the importance of principles while neglecting the principles in their own classrooms, materials and activities! There are eight general principles of C&I design, which were articulated rather clearly by the University of Guelph (Fig. 9.4):

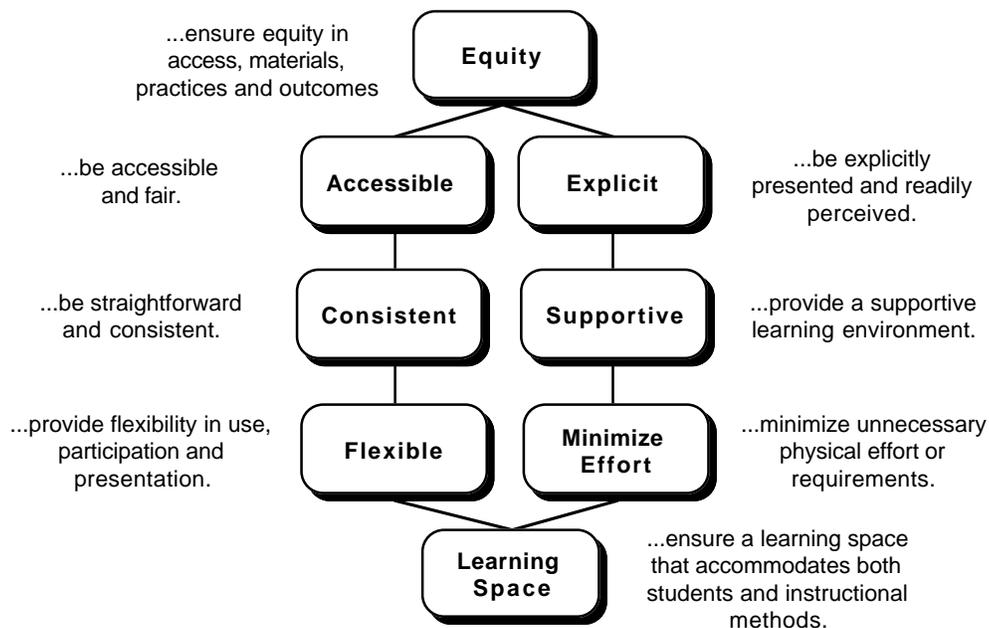


Figure 9.4. Instructional Design Principles

In addition to these eight general principles that ought to guide C&I design, there are a number of principles that are more specific. Park and Hannafin (1993) and Sherry (1996) developed a matrix of twenty principles and their corresponding applications for designers of C&I. The principles are derived from a synthesis of research into cognition and learning. Use these general and specific principles as guidelines for designing activities, demonstrations, modules, projects and units.

*Table 9.1. Principles for Designing Interactive Media*

<b>Principle</b>	<b>Application</b>
1. Related prior knowledge is the single most powerful influence in mediating subsequent learning.	<ul style="list-style-type: none"> <li>• Layer and abstract information providing various perspectives</li> <li>• Let learners assemble their own connections between known and new knowledge</li> </ul>
2. New knowledge becomes increasingly meaningful when integrated with existing knowledge.	<ul style="list-style-type: none"> <li>• Make lesson explicit</li> <li>• Embed cues and prompts to make students generate their own meaning</li> <li>• Summarize key relationships</li> </ul>
3. Learning is organized by the supplied organization of concepts to be learned.	<ul style="list-style-type: none"> <li>• Organize with multiple modes (audio, video, text, demonstration, interfaces, etc.)</li> <li>• Use organization of knowledge techniques (mind maps, schematics, tables, timelines, etc.)</li> </ul>
4. Knowledge to be learned needs to be organized in ways that reflect differences in learner familiarity with lesson content, the nature of the learning task and assumptions about the structure of knowledge.	<ul style="list-style-type: none"> <li>• Allow for different responses to content</li> <li>• Provide movement from general to specific</li> <li>• Use relational learning techniques</li> <li>• Use hierarchies and outlines</li> </ul>
5. Knowledge utility improves as processing and understanding deepen.	<ul style="list-style-type: none"> <li>• Provide time to reflect and talk about the lesson</li> </ul>
6. Knowledge is best integrated when unfamiliar concepts can be related to familiar concepts.	<ul style="list-style-type: none"> <li>• Use relational learning techniques to draw relationships</li> <li>• Use familiar visual, procedural, verbal and conceptual cues</li> </ul>
7. Learning improves as the number of complementary stimuli used to represent learning content increases.	<ul style="list-style-type: none"> <li>• Use media and examples that relate directly to and complement information</li> </ul>
8. Learning improves as the amount of invested mental effort increases.	<ul style="list-style-type: none"> <li>• Use techniques to focus learners' attentions by highlighting and asking questions</li> </ul>
9. Learning improves as competition for similar cognitive resources decreases, and declines as competition for the same resources increases.	<ul style="list-style-type: none"> <li>• Present new and challenging information by using familiar conventions and avoiding superfluous information</li> </ul>
10. Transfer improves when knowledge is situated in authentic contexts.	<ul style="list-style-type: none"> <li>• Create authentic examples and contexts for lessons and learning</li> </ul>
11. Knowledge flexibility increases as the number of perspectives on a given topic increases and the conditional nature of knowledge is understood.	<ul style="list-style-type: none"> <li>• Use methods that allow for differing perspectives and cross referencing</li> </ul>
12. Knowledge of details improves as instructional activities are made more explicit, while understanding improves as the activities are made more integrative.	<ul style="list-style-type: none"> <li>• Provide activities that clearly define tasks and that integrate diverse elements</li> <li>• Ask focus questions and open-ended questions</li> <li>• Use advance organizers</li> </ul>

Principle	Application
13. Feedback increases the likelihood of learning response-relevant lesson content, and decreases the likelihood of learning response-irrelevant lesson content.	<ul style="list-style-type: none"> <li>• Provide timely, clear, constructive feedback</li> <li>• Use sandwich feedback techniques</li> <li>• Use debriefing method</li> </ul>
14. Shifts in attention improve the learning of related concepts.	<ul style="list-style-type: none"> <li>• Emphasize key concepts, terms, principles and skills by amplification and repetition</li> </ul>
15. Learners become confused and disoriented when procedures are complex, insufficient or inconsistent.	<ul style="list-style-type: none"> <li>• Provide clear procedures</li> <li>• Use consistent techniques for presenting procedural knowledge</li> <li>• Prompt clear routes for on-line navigation</li> </ul>
16. Visual representations of lesson content and structure improve the learner's awareness of both the conceptual relationships and procedural requirements of a learning system.	<ul style="list-style-type: none"> <li>• Use mind maps, schematics, graphs, tables, animations and other techniques to visualize relationships</li> </ul>
17. Individuals vary widely in their needs for guidance.	<ul style="list-style-type: none"> <li>• Individualize procedures by using modules</li> <li>• Provide feedback to individual students that directly relates to their situation</li> </ul>
18. Learning systems are most efficient when they adapt to relevant individual differences.	<ul style="list-style-type: none"> <li>• Provide individualized feedback</li> <li>• Individualize procedures by using modules</li> </ul>
19. Metacognitive demands are greater for loosely structured learning environments than for highly structured ones.	<ul style="list-style-type: none"> <li>• Assist learners to monitor their own learning by using self-checks, asking questions</li> <li>• Provide opportunities for learners to develop directions, rules of thumb and strategies</li> </ul>
20. Learning is facilitated when system features are functionally self-evident, logically organized, easily accessible, and readily deployed.	<ul style="list-style-type: none"> <li>• Provide access to resources that are pre-organized</li> <li>• Design modules that are clearly defined</li> </ul>

## Evaluating C&I Products

In the first half of the book, we explained the theory that underwrites the adoption, design or creation of C&I and materials, such as overheads, videos and manipulatives. In the first and second chapters, we emphasized the goals of formal communication, noting that the materials and resources you create and use reflect on your professionalism. Visuals (images, text, etc.) play an essential role in the communication of both procedural and propositional knowledge. Visuals reinforce our demonstrations and the image our students develop of the demonstrator. In Chapter 4, we noted that an additional reason to create effective visuals relates to the accommodation of different learning styles. Some students are visual learners. In Chapter 6, we elaborated on how visuals and manipulatives are supported by learning theories. For example, Dale's Cone of Experience arranges the three major modes of learning (**Enactive** (direct experience), **Iconic** (pictorial experience) and **Symbolic** (highly abstract experience) into a hierarchy. This helps us to understand the interrelations among the three modes. They reinforce

each other. We did not, however, address the evaluation of C&I resources, or the criteria that teachers use for adoption.

Criteria for evaluating products of C&I are divided into four categories: Content, Instructional Design, Technical Design, and Ecological and Social Considerations. There are also additional media-specific criteria. Teacher-evaluators must be aware of general learning resource considerations in these four general areas (Table 9.2).

*Table 9.2. General Criteria for Evaluating C&I Materials (BC MOE, 2000)*

<b>Content</b>	<p><i>Materials should:</i></p> <ul style="list-style-type: none"> <li>• be relevant to the philosophy, goals, and learning outcomes of the curriculum</li> <li>• be one of a variety of media presentation modes</li> <li>• be accurate and current and, where appropriate, use family structures and kinship relationships other than those of mainstream European society</li> <li>• preferably involve both local and global content</li> <li>• be suitable for classroom use in terms of ease of use, durability, and packaging</li> </ul>
<b>Instructional Design</b>	<ul style="list-style-type: none"> <li>• draw students into group and cooperative learning as well as provide for individual growth</li> <li>• promote hands-on activities and an applied approach to learning</li> <li>• encourage students to question, think, react, reflect, and decide in ways that develop critical-thinking and decision-making skills</li> <li>• offer choice and flexibility as appropriate to meet needs relating to individual aptitudes, abilities, learning styles, and interests</li> <li>• be reasonable in terms of cost/usage expectations in a classroom setting (e.g., if using a resource as intended takes more classroom teaching time than is reasonable)</li> <li>• be supportive of continuous learning by the individual</li> <li>• provide for both formative and summative evaluation as appropriate</li> <li>• be relevant to the needs of the student</li> </ul>
<b>Ecological &amp; Social Criteria</b>	<ul style="list-style-type: none"> <li>• reflect sensitivity to gender and sexual orientation, the perspective of and cultural and ethnic heritage</li> <li>• be supportive of the commitments to Aboriginal education and multicultural content</li> <li>• promote equity</li> <li>• support/promote students' self-esteem and that of others</li> <li>• recognize the integration of students with special needs as part of the classroom</li> <li>• reflect sensitivity to the diversity of family backgrounds, configurations, and values</li> <li>• reflect good safety practices in text and visuals (e.g., use of eye or hearing protection)</li> <li>• portray positive role models</li> <li>• use language appropriate to the intended audience and not include slang, vernacular, or expletives that detract from meaning</li> <li>• demonstrate careful use of resources and ecological considerations for the earth</li> </ul>

There are two primary dimensions to the evaluation of C&I materials. The first is the policy dimension. Most educational ministries or governments, and local school districts, have policies in place for the creation and adoption of materials and resources. Some policies are overly restricting, placing limits on the professional judgment of teachers. There may be a list of "approved" resources— everything else may require special approval *via* special forms. Vendors are submitted to policies similar to teachers. Other policies merely maintain the standards of copyright law and licensing. And still others are constructive. Within the first week or two of student teaching or employment, it is important that teachers become aware of their school's policy on adopting and creating curriculum materials. The second dimension in the evaluation of C&I materials is practice. We need to develop a certain level of connoisseurship for making decisions on the C&I materials we adopt or create. This has a special significance in the context of digital media and technology products and projects. The following general considerations for selecting websites ought to be considered.

Teacher-Evaluators must consider the wide range of students that are represented in the average technology class, as well as those that are not represented. This means that teachers model respect for all groups regardless whether or not they are represented among the immediate group of students. Special considerations in technology studies include the first language of the students, gender and the existence of special needs. These issues will be addressed in Chapter 11. The purpose, characteristics and use of various media— print, video and digital forms— also demand special criteria. In technology, as we will explain in Chapter 11, there are various considerations for applications, architecture, devices, materials, machines, manipulatives and various products designed, purchased and used. There is a significant incentive (e.g., access, ecology, flexibility) to adopt and create digital materials for C&I. Specific criteria apply to the evaluation of digital materials, in addition to our general criteria. An example digital resources evaluation form from British Columbia is provided below (BC MOE, 2000).

 Province of British Columbia	Ministry of Education Curriculum Branch	<h1 style="margin: 0;">Digital Resources Evaluation Form</h1>
Title		Preview No.
SA - Strongly Agree SD - Strongly Disagree		For each of the following statements, check the circle which best reflects your judgement of the resource. If the statement is not applicable, stroke out all the circles. Use the space following each item for comments, including relevant page numbers.
SA      SD	<b>CONTENT</b>	Comments
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	1. Content is current	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	2. Content is accurate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	3. Supports BC curriculum	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	4. Scope (range) and depth of topics are appropriate to student needs	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	5. Material has significant Canadian content	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	6. Level of difficulty is appropriate for intended audience	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	7. Content integrates "real-world" experiences	
<b>INSTRUCTIONAL DESIGN</b>		
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-1. Instructional prerequisites are stated or easily inferred	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	8. Instructional goals and learner objectives are clearly stated	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-2. Opportunities are provided for different levels of instruction	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-3. Opportunities are provided for different levels of interactivity	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-4. Interaction promotes meaningful learning	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	12. Promotes communication skills	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	13. Encourages group interaction	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	14. Encourages student creativity	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	15. Allows/encourages students to work independently	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	17. Materials are well organized and structured	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	18. Materials have unity/congruency	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	19. Concepts are clearly introduced	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-5. Content chunking and sequencing are appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-6. User navigation through program is appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-7. Content depth is appropriate to target audience(s)	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-8. Integrates with other activities in the same subject	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	23. Non-technical vocabulary is appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	24. Technical terms are consistently explained/introduced	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	25. Pedagogy is innovative	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	26. Adequate/appropriate pre-teaching and follow-up activities are provided	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-9. User inputs are appropriately monitored and responses are provided	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-10. Feedback is non-threatening, immediate, positive, motivational, and user-sensitive	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-11. Feedback is appropriate to user's previous responses	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-12. Quantitative feedback is used where appropriate	
<b>TECHNICAL DESIGN</b>		
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	29. Appropriate support materials are provided	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	30. User interface is interesting/effective	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	31. Illustrations/visuals are effective/appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-13. Makes balanced use of graphics, animation, and video	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-14. Input and output is used effectively	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-15. A help function is provided and appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-16. Where appropriate, material can be networked or shared across platforms, or retrieved using standard Internet tools	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	32. Onscreen text is clearly readable	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	33. Screen layout is logical and consistent	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	34. Users can easily employ the resource	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	D-17. Teacher control of feedback and progress is provided and appropriate	
<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	36. Makes effective use of the medium	

S - Suitable or appropriate  
 NS - Not suitable or appropriate

For each of the following statements, consider whether the resource addresses the following issues appropriately. If the statement is not applicable, stroke out all the circles. Use the space following each item for comments, including relevant page numbers, or include comments and notes on a separate sheet.

	S	NS		<b>SOCIAL CONSIDERATIONS</b>	Comments
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	37. Gender equity/Role portrayals of the sexes	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38. Portrayal of sexual orientation	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	39. References to belief systems	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	40. Age portrayals	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	41. Socio-economic references	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	42. Political issues bias	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	43. Regional bias	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	44. Multiculturalism and anti-racism content	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	45. Aboriginal culture/roles	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	46. Portrayal of special needs	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	47. Ethical/legal issues	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	48. Language use	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	49. Portrayal of violence	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	50. Safety standards compliance	

Describe the major reasons for recommendation for inclusion in the grade collection

List any components of this package which are not considered essential for inclusion in the grade collection

Describe the major reasons for non-recommendation for inclusion in the grade collection

**SUMMARY**

Shortlisted for grade collection

Not shortlisted for recommendation

*(choose one)*

*(choose one)*

Comprehensive resource

Does not meet ministry evaluation criteria

Additional resource

Not eligible for grade collection

Evaluator: \_\_\_\_\_

Date: \_\_\_\_\_

Evaluator: \_\_\_\_\_

Date: \_\_\_\_\_

Given what we know about digital and instructional design, the following general considerations for selecting websites ought to be considered.

### **Reliability/Validity Considerations**

- clearly indicate author, contact information, latest revisions/ updates, and copyright information
- distinguish between internal links to other parts of the resource and external links that access other resources
- reflect an author, designer, or publisher with a credible reputation
- where any information is collected, the site has a stated privacy policy

### **Content Considerations**

- support curriculum outcomes
- include, where appropriate, works of local producers
- have relevance to students' lives and interests
- include adequate information to judge the accuracy of factual or historical information
- present information logically
- present information of sufficient scope and depth to cover the topic adequately for the intended audience
- model correct use of grammar, spelling, and sentence structure

### **Audience Considerations**

- promote individual or group interaction as appropriate
- provide for a variety of reading levels, language abilities, and multilingual capabilities, as appropriate
- provide content that is appropriate for the intended age, grade level, classroom demographics
- present information in a manner that stimulates imagination and curiosity
- provide interaction that is compatible with the physical and intellectual maturity of the intended audience

### **Social Considerations**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• ensure material is appropriate in terms of:</li> <li>• gender equity/role portrayal of the sexes</li> <li>• portrayal of sexual orientation</li> <li>• references to belief systems</li> <li>• age portrayals</li> <li>• socio-economic references</li> <li>• political issues bias</li> <li>• regional bias</li> <li>• if applicable, ensure product advertising is not intrusive</li> </ul> | <ul style="list-style-type: none"> <li>• present information in an objective, balanced way, including alternative perspectives</li> <li>• multiculturalism and anti-racism content</li> <li>• Aboriginal culture/roles</li> <li>• portrayal of special needs</li> <li>• ethical/legal issues</li> <li>• language use</li> <li>• portrayal of violence</li> <li>• safety standards compliance</li> </ul> |
|--|---|

## **Projects**

Projects have characterized technology studies from its earliest days. Historians note that projects date to 16<sup>th</sup> century Italian architects, who had their students devise elaborate plans of public buildings and churches, most of which could not be built. French engineers in the 18<sup>th</sup> century, and American mechanical engineers in the 19<sup>th</sup> century adopted a similar practice, but

required students to actually produce the machine parts they drafted. The first manual training high school in the US, founded by Calvin Woodward, brought the project method into the schools. For Woodward, projects were supposed to be "synthetic exercises," culminating particular steps in a student's progression through manual training. Woodward argued instruction should progress from elementary principles to practical applications, through projects. In his terms, students, *via* projects, should progress from instruction to construction. Dewey disagreed with Woodward on an important point. Dewey argued for a psychological rather than logical order to projects. Rather than derived logically from instruction, Dewey's projects were derived psychologically from the student. In other words, Dewey thought that projects should derive from the students' interests rather than from the logic of the steps on instruction (Knoll, 1997). For Dewey, rather than a vehicle for the exercises of skill development, the project was a vehicle for bringing the spirit and conditions of modern life into the school. Technology educators have inherited the two approaches, and for most of the 20<sup>th</sup> century, they valued the project as a vehicle for skill development *via* logical steps of instruction over Dewey's notion. This led to the notion of the project as a product or thing to be developed. Contrary to this, Dewey reminded us, the project serves as a method of instruction for disclosing the workings of life, as noted in Chapter 6.

Embedded in the very nature of Dewey's notion of projects, whether agricultural, domestic, industrial or sociological, was a subversive element. Without project work, which by definition requires students to dirty their hands, proponents rightfully noted that educational practices in the schools smack of cultural elitism. Theoretically at least, projects contradicted the "regime of coercion" associated with conventional curriculum by giving students freedom of purpose or volition (i.e., will). Projects discharged responsibility to students and in this sense could undermine the authority of the teacher. Projects concentrated a considerable amount of power (and responsibility) in the students' hands. Following Dewey, Kilpatrick (1918, 1921) effectively discharged powers for organizing curriculum to students. If Woodward's instructional process for projects was logical, beginning with preparation and presentation and proceeding through drill and practice, Kilpatrick defined this process from an individual student's perspective. Kilpatrick's form of projects, "purposing, planning, executing and judging," was not so much an instructional form as a psychological form. He tried to reform traditional connotations of social projects, such as chicken raising, dressmaking, census taking or house

building by noting that projects followed a common form (purposing, planning, executing and judging). In other words, the students develop a purpose for doing the project, plan out its course with the teacher, execute the project and make judgments on its completion and on what was learned. In the next section, we will see how this process was scaled up in the form of "units."

For Kilpatrick, a project undertaken by the will of the students, as opposed to coercion, was the epitome of self-determination and "thus the typical *unit* of the worthy life in a democratic society." For that reason he later defined a project as a "*unit* of purposeful experience" or "*unit* of experience." Obviously, when he referred to a project as a *unit* of life or experience—a part, piece or slice of significant features of life—he invested the form with some fairly heavy theoretical work of Dewey who suggested that education was not merely the preparation for life but was life. The common theme of projects was the *unity* within the students' heads, hearts, hands and feet. This unity is what makes a project a project. What is a project? What are the advantages and guidelines for an adequate or educational project?

### **What is a Project?**

- A project is a method whereby students work through a series of activities and problems culminating in the completion of something tangible (e.g., artifact, media, performance). A form of individualization whereby learners choose and work on projects and activities that facilitate and support the development of skills and knowledge. Often, learners not only choose topics but also the means of their conduct and production.
- A significant, practical unit of activity of a problematic nature, planned and carried to completion by the student in a natural manner and involving the use of physical materials to complete the unit of experience... the solution of problems on the real plane of activity (Bossing, 1942).

### **Advantages of Projects**

- Projects serve as a vehicle to understanding key principles and concepts as well as to the development of dispositions.
- Projects place students in realistic, problem-solving environments.
- Projects can build bridges between school and other life experiences. The problems resolved in the pursuit of a project are valued and shown to be open to systematic inquiry.
- Projects require an active and sustained engagement over extended periods of time.
- Projects can promote links among disciplines and can erode subject boundaries.
- Projects are adaptable to a wide range of student interests and abilities.

### **Guidelines for Projects**

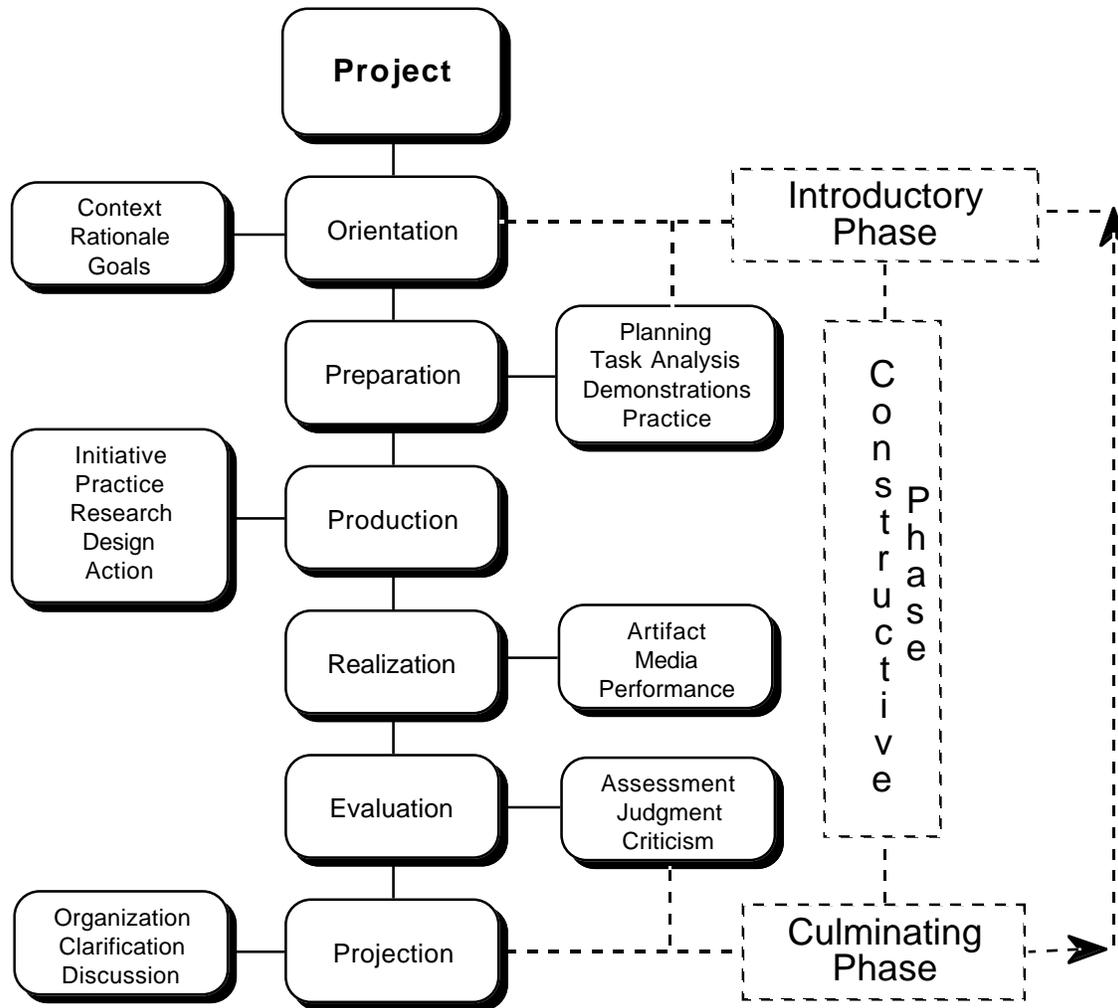
- The project is not merely the thing. It is also a method.
- Projects must have definite educational values as tempered by ecological and social values.
- Intrinsic values ought not override the purpose of the project as a method. (Do not be overly persuaded by the students desires).
- Projects should be situational or relevant to the students and the context.
- Projects should serve as a vehicle for disclosing the conditions and processes of modern technology, or content.
- The time consumed must be commensurate with the values that accrue from execution of the project.
- The adaptability of the project to the regimentation of the school should be carefully considered.
- To be educational, a project "must be of such a nature as to offer a large opportunity, not only for the acquisition of new skill, and experience in practical manipulation, but also for the application of old, and learning of new, 'related' knowledge— art, science, mathematics, administration, hygiene, social science, etc." (Sneddon, 1916, p. 421).

Ideally, students are to pursue projects that involve non-trivial problems requiring sustained attention. In most cases, the outcomes of a project cannot be fully fixed from the outset, or the process will be overly restrictive. Projects typically culminate in an artifact, media or performance that relate to the original purpose. The artifacts and media range from digital images and text to three-dimensional models, drawings, paintings, sculptures, songs and useable products. The issue of the functional, useable artifact has nagged technology teachers for over a century. Some technology teachers continue to argue that students must take a tangible artifact home. The value of the process is invested in the artifact. This has its place in technology studies, but the trend is to moderate this emphasis by focusing on the process rather than the product. In many cases, the project became an end in itself and was the sole purpose for the unit, course or group of courses. The product overshadowed the value of the process. After the completion, the product was assessed for quality. For example, in a woodworking course in industrial education, a clock or table would be assessed and given a mark. In information technology, an image would be created and assessed. Technology teachers lost sight of the potential of projects to, as Dewey noted, bring into the school the conditions and processes of modern technology. Of the two extremes described, the project as vehicle for the exercises of

skill development was valued over the project as a vehicle for bringing the spirit and conditions of modern life into the school. However, this is changing.

One difference between technology studies and industrial or audio-visual education is the emphasis placed on the project. Technology teachers began to shift their emphases in the 1980s and 1990s toward Dewey's original notions of the project as a vehicle for disclosing the workings and conditions of everyday life (see Chapter 6). This could mean the use of a project to disclose mathematical or scientific principles underlying a particular technology as well as the social conditions underlying how workers use that particular technology. This trend toward the refocusing of the project in technology studies from product toward process cannot be overstressed. The bulk of projects in technology studies ought to be vehicles for disclosing a range of content. Their purpose must be driven with this in mind. Of course, most projects will, and ought to, provide for the expression and development of creativity, but this purpose is secondary to the disclosure of content. Projects continue to be extremely important in technology studies, but their purpose has been refocused.

Projects have a coherent curriculum form that progresses through the stages established nearly a century ago (Fig. 7.5). Today, the form of projects is very similar generally based on Kilpatrick's form of purposing, planning, executing and judging. Projects should be designed so that instruction progresses through introductory, constructive and culminating phases. If any of these are skipped, the project is incomplete. However much projects are characterized by student initiative and production, they are extremely instruction-intensive. To make a project work, teachers do a considerable amount of planning and behind-the-scenes management. Teachers have to time their demonstrations to coincide with particular tasks in the project. Some teachers prefer to front-end the demonstrations and skills, but invariably find themselves doing various just-in-time demonstrations as well. Ultimately, there has to be a realization of the artifact, media or performance. And with the realization ought to come assessment, criticism and judgment. When it's all said and done, the teacher has to step back and help the students organize the content of what was learned.



*Figure 9.5. Project Model*

Design projects take a similar form, although it is expressed differently (Fig. 9.6). The progression begins with an emphasis on conditions—the conditions of the world, the local scene, and of needs, wants and desires. The second phase is constructive and results in an expression of forms in tandem with an interpretation of this expression. Interpretation and expression go hand in hand. The process is culminated with a public critique. Design processes were detailed in Chapter 5.

Projects cause a considerable amount of anxiety for technology teachers. Teachers have been known to panic over what projects to incorporate into the curriculum. Some teachers feel that without an adequate number of projects there can be no curriculum. Anxiety leads to choices of products that compromise the subject. Instead of asking what content can serve this project, technology teachers are now asking what projects can serve this content. The order of priority has toggled 180 degrees. The project is no longer the thing. The project is a method for disclosing content.

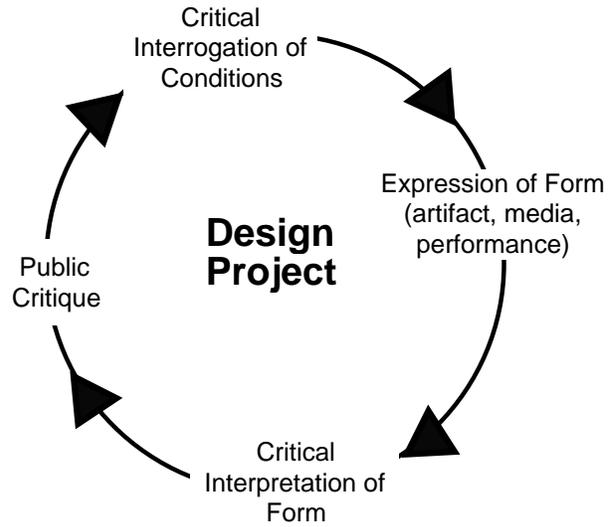


Figure 9.6. *Design Project Model*

## Units

In the mid 1920s, Henry Morrison (1926, 1931) combined the initial notion of unit (i.e., unit of experience) with disciplinary notions for his practices in the secondary school at the University of Chicago. Here, unit meant a large block of related subject matter, which provided a theme, combined with activities, problems and projects over several weeks to generate understandings of the theme and related knowledge. For example, Morrison used themes such as the French Revolution in history, and the Earth as a Planet in science. The form of a unit was divided into five steps:

1. Exploration— teacher explores what students know through pre-test and discussion
2. Presentation— teacher provides a concrete sketch of the unit and theme
3. Assimilation—students scatter for individualized and small-group work; teacher evaluates
4. Organization— teacher organizes knowledge, represents unit and theme
5. Recitation— students demonstrate attitudes, knowledge and skill; public performances

By the 1950s, the form of a unit was generally a combination of Kilpatrick's idea of a project and Morrison's ideas. Our current form for a unit was established at this time as a progression from an introductory phase through constructive and culminating phases. A unit is basically a three-day to three-week progression that includes methods such as activities, modules, projects, lessons and demonstrations that coalesce around a theme (Fig. 9.7).

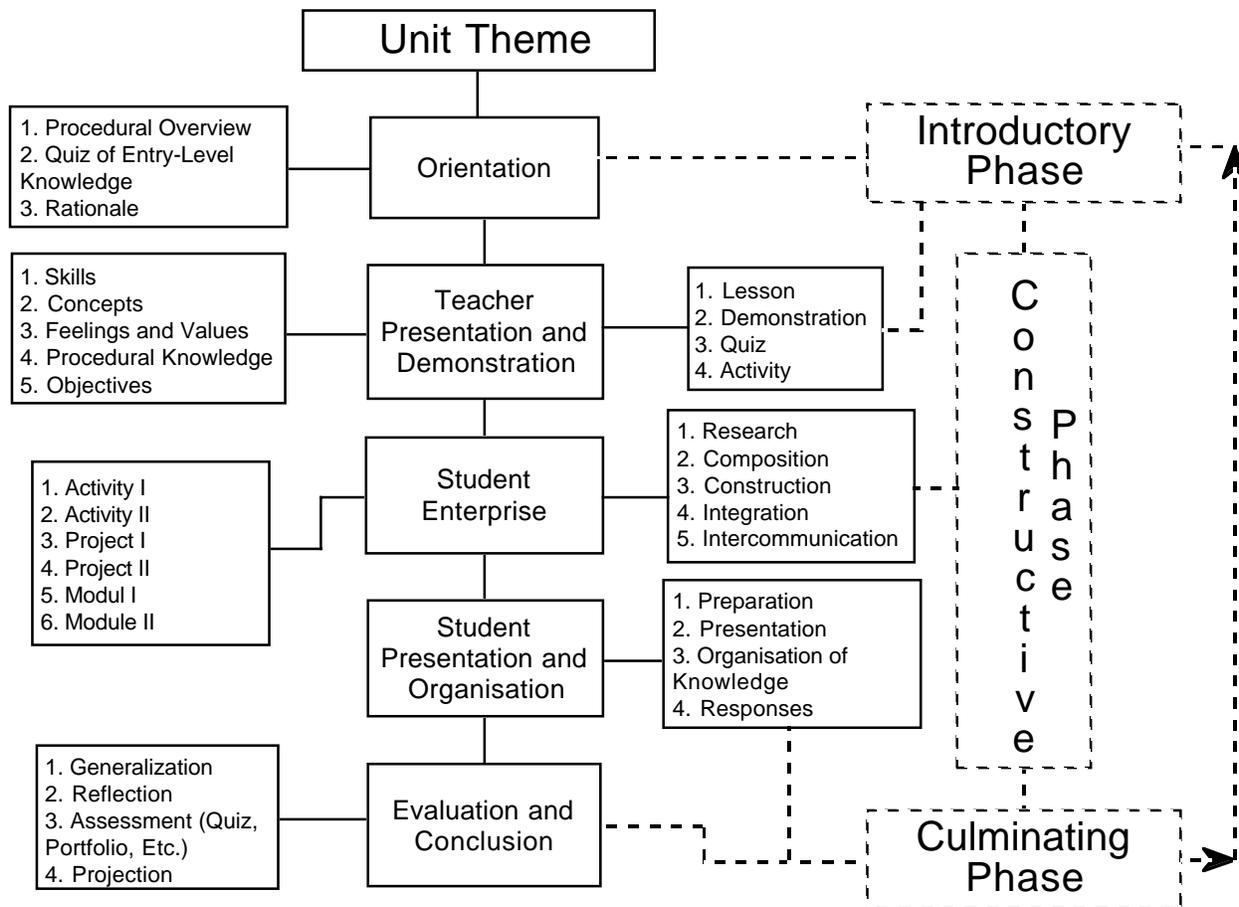


Figure 9.7. Unit Model

The intention of a unit is to allow for depth while at the same time a breadth in different areas. A unit is an intentionally designed, integrated, thematic organization of curriculum and knowledge involving combinations of demonstrations, discussions, activities, modules, problems, and projects. It is a thematic organization of ecological-natural, ethical-personal,

socio-political and technical-empirical aspects of tools, machines, information and software, instruments and processes, or technologies. A unit is *not* merely a collection of activities that relate to disciplinary subject matter. A course should involve units that are broad in scope, where each unit provides a depth in content while focusing on larger themes. Units can be anywhere from 3 days to 3 weeks. They should involve a variety of activities, where some activities extend over more than one day. Units typically mean that existing activities or technical skills are "contextualized," or cast into a larger frameworks to provide unity.

### **Essential Characteristics of a Unit**

1. It has wholeness and coherence across activities, modules, projects, lessons, etc.
2. It transcends subject matter boundary lines and provides for the integration of subjects.
3. It contains short and long-range objectives and learning experiences.
4. It provides a wide range of methods adaptable to learning styles.
5. It draws from current information as contrasted with textbooks containing information that may be dated.
6. It promotes cooperation, democratic planning and a wide range of insights. It is unified.

The determination of the types of units designed is typically up to the teacher, who must fulfill responsibilities to the larger structures of content, courses and government dictates. Of course, as in the case of projects, students ought to have input into the process designing the unit. Units are typically broadly conceived to accommodate individuality. Technology units for a high school group could conceivably be organized as: technology and rights; mass production; digital animation; energy, environment, and personal consumption; old materials, censorship and digital expression; communicable disease and modern medicine; apparel, fashion and style.

Within a high school, a unit titled "The bicycle: Prescription for conservation, health, and personal transportation" might take shape (Petrina, 1992). Here, unity and relevance are addressed through thematic use of a common product in which most students in high school are interested. The technology of bicycles is also advantageous in its historical significance, social importance, and multi-cultural utility, as well as in its relationships to physics, engineering, physiology, economics, geography, safety and health, sport and leisure, urban design, industry and environmental policy. Through their simplicity and performance, bicycles challenge students to apply techniques related to design, invention, experimentation, maintenance, and

repair. Bicycles can inspire the formation of clubs, affiliation with mountain biking or trick cycling organizations, and planned bike tours. Most importantly, the centrality of bicycles to youth can be used to meet a range of content within the design, transportation and physical technology areas of the curriculum. Emphasis is on connecting abstract content to concrete technology. For instance, a group of students might: design and conduct a survey to determine the extent of bicycle use in their community, and report the results as compared to national and international trends; determine the needs of a cycling society and agitate for bike routes and trails; design cities of the future that accommodate a variety of modes of transportation; design and construct bicycle trailers with concern for specific speed and payload factors; survey and map geographic regions for potential bikeways; investigate the bicycle use of teen-agers in developing countries; design and conduct experiments that focus on physiological demands of cycling; print posters to promote bicycle use; or design a sculpture, and write songs or plays that express feelings toward human-powered transportation.

The key to a unit is planning. The most effective units entail a great amount of planning. Remember, the scale of curriculum increases as one moves from lesson plans and demonstrations to activities, modules and projects and ultimately to units and courses. A unit plan is actually a collection of resources for the teacher and students. A unit plan allows the teacher to proceed with confidence and foresight. The unit format provided below is comprehensive and recommended for planning. In general, the unit plan is a blueprint and provides the rationales, semantics, logistics, scope, sequence and resources for the initiation and completion of the unit. Typically, a planning grid accompanies the unit plan and serves as the daily work order for the unit (Table 9.3). Many teachers trivialize a unit by merely collecting a bunch of resources, collating them and calling them a unit. Or, teachers organize the scope and sequence of content and call this a unit. But units are much more than this, especially in technology studies and other experience-based subjects. We have to take C&I design seriously and unit plans help us to do this. Our units, and our projects, ought to look like the model explained earlier in Figure 9.7.

## Unit Plan Format: Rationales, Semantics, Logistics, Scope, Sequence, Resources

**Title:** Choose a thematic, encompassing, and personally relevant title.

**Rationale and Ends:** Why is a study of the technologies in this unit relevant to the students? What provides the unit's "real-world" relevance? What is the ecological, cultural or socio-economic *context* for the technologies selected? This section refers to relevance to the students lives, NOT merely relevance to government curriculum documents. Be sure to include the social importance of the technologies. What context or framework will you choose to cast the study of the technologies (e.g., literacy, leisure, work, etc.)? What thematically ties this unit together? How will the technologies of interest relate to the ecological-natural, ethical-personal, socio-political and technical-empirical dimensions of technology? What are the major messages concerning the technologies used? What are the major goals and objectives? (1 page of context and goals)

**Outline of Content (Scope and Sequence):** How are parts of the unit combined? In outline form, lay out the scope and sequence of content for the entire unit. This should be a descriptive outline from introduction to the end of the unit. Use a framework of introductory, constructive and culminating phases. This will reflect the content, lessons and activities to be critically selected, and the week-by-week sequence-order of curriculum. (2-3 pages of outline)

**Planning Grid (Scope and Sequence):** A planning grid is absolutely necessary and acts as a flowchart that provides the details for putting the unit in action. In the order in which they will be introduced, briefly annotate (describe) the lessons, activities and means of assessment, and list the objectives and materials reference. (5-6 pages of grids)

**Outcomes:** List the objectives or intended learning outcomes. Include a balance of affective, cognitive and psychomotor objectives and outcomes. Consider alternative and various ways of teaching. These ought to relate to the assessment schemes. Include these in the planning grid.

**Activities & Projects:** Include Activity and Project Descriptions, Resources, Time and Sequence, Knowledge, Cross curricular Subject Links, Safety, and Evaluation Scheme. These can be original OR existing activities. IF existing activities, note the improvements made by you. This will reflect the depth of the content that you critically select. What activities and projects will be used for experience and expression? Consider alternative and holistic modes of student expression and ways of knowing. **This may include handouts for the students.** (3-4 pages of activities)

**Assessment:** Include criteria, rubrics and schemes for the assessment of individual activities. Provide details for quizzes, observations, portfolios and project assessments with which students will be assessed. Indicate how results of assessments will be communicated. **This may include handouts for the students.**

**Lesson Plans:** Include lessons plans for all of the formal lessons that the teacher will deliver. (Number of pages will vary, depending on number of lessons)

**Semantic or Concept Maps:** How do the parts relate? Unit Design, organization of knowledge, relationships of subject matter, and skill relations maps. (3-4 Maps) Maps may or may not be computer generated.

**Resources:** As best as possible, indicate resources or sources that are necessary for you and your students to enrich the unit. Assume a standard lab or shop environment with average tools, materials and equipment. Do not list all software, tools and machines as resources, as they will be assumed as necessary. List books, Web sites, special software or tools, etc. (List with bibliography- 1-3 pages)

Table 9.3. Example Planning Grid

Grade 11		CAD		10 Hrs (Week 1-2)
Topic and Time	Objectives and Outcomes	Activity	Assessment	Resources
Intro to CAD (1 Hour)	Students will: appreciate the precision and uses of CAD. Describe a CAD system.	Sample drawing manipulation	Observations	PowerPoint Intro
CAD file manipulation (1 Hour)	Open, close and save files	Simple CAD drawing exercise	Observations	CAD file handout
Etc.				

### Normative Units

The "normative unit" was developed in the 1950s to provide a framework for dealing with controversial issues (Chapter 4). The form of a normative unit is derived from a general form of progressing from an introductory phase through constructive and culminating phases. However, a normative unit focuses on the resolution of a controversial issue. The form of a normative unit is as follows:

1. Social and moral orientation of students.
2. Sympathetic recognition of opposing positions, practices and policies, or fact finding.
3. Conscious recognition and criticism of personal motives, aspirations, beliefs and outlooks.
4. Presentation of personal and social views.
5. Resolution or fusion of social directions and standards of judgment with facts and descriptive principles into programs and plans of action.

The very form of the unit is designed to discourage fence sitting. Neutrality and apathy on the part of the students are signs that their core beliefs and feelings have not been touched by the unit. Normative units hold a possibility for providing insight into controversial issues such as those listed in Chapter 4 (Fig. 9.8).

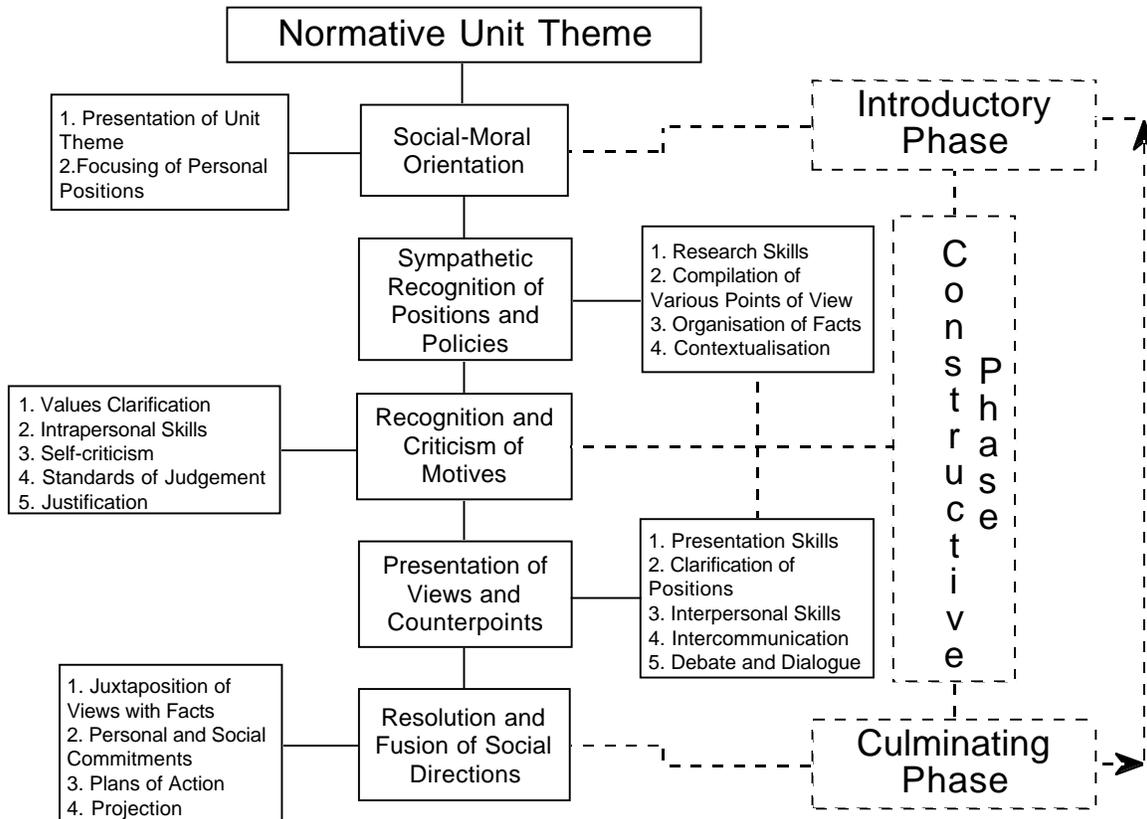
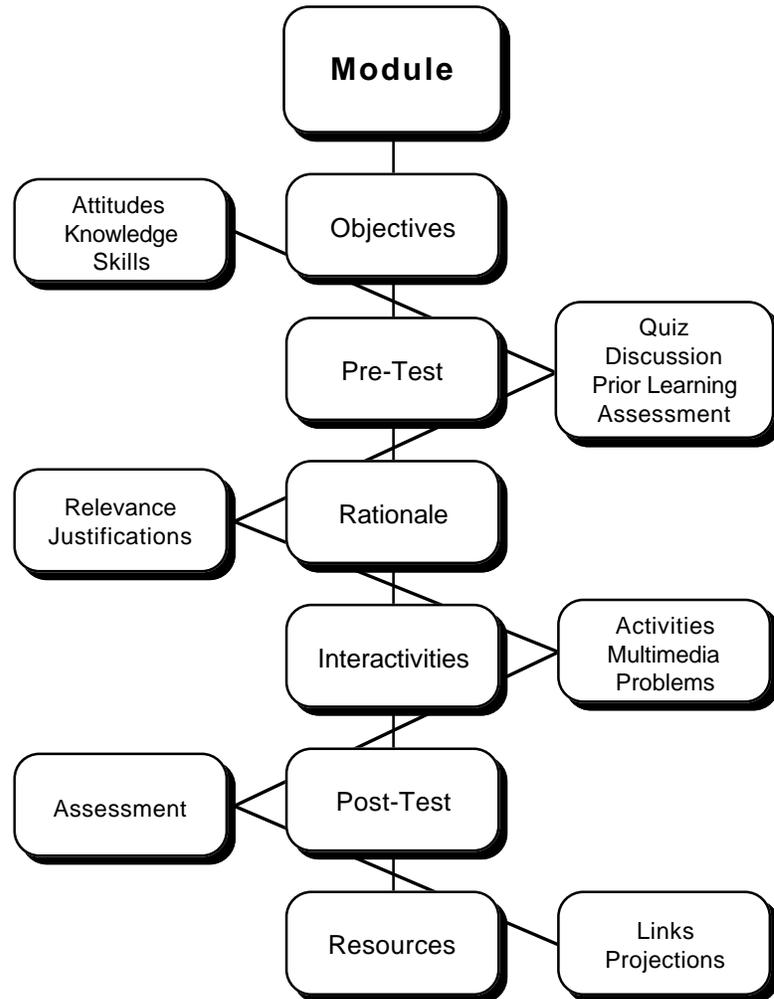


Figure 9.8. Normative Unit.

## Modules

In the early 1970s, an individualized learning package or container for modular teaching was called a module— "a self-contained, independent unit of a planned series of learning activities designed to help the student accomplish certain well-defined objectives." Modules are free-standing, self-contained and comprehensive instructional packages, meaning that basically everything that the student needs is in the module. Whereas a unit is directed by the teacher and may involve the use of modules, a module provides for self-direction, or self-paced learning of a realm of content. In the late 1980s and through the 1990s, modules became immensely popular in England and Scotland in a context of "flexible learning," educators' response to flexible economics. One proponent of modularity referred to this proliferation in higher education as "The Container Revolution," reflected in the 700+ modules at Oxford Polytechnic. Modules are currently a world-wide phenomenon and the preferred containers for distance education *via* the

world wide web. The basic form of modules was established by instructional designers in the 1970s (Fig. 9.9).



*Figure 9.9. Module*

Modules are immensely popular and extremely important for anyone interested in the development of digital learning resources and on-line education. Most schools are moving toward mixed modes of teaching, which invariably involves the use of digital modules. Modules need not be digital, but a vast majority are taking a digital form in this context. In the next section, the details of a digital module format are provided.

In technology studies, the popularity of modular instruction increased throughout the 1990s. In 2001 in the US, 72.5% of technology education programs in public schools were using teacher-made modules and 48.5% use commercially vended modules (Sanders, 2001). During the 1990s, the commercial production of modules became an attractive endeavor for vendors

who marketed their modules at prices ranging from \$8.00 for a paper packet to \$12,980.00 for integrated learning systems (Petrina, 1993). It is important to stress that there are *two* connotations of modules: (1) The self-contained instructional (often digital) packages already described; and (2) Self-contained instructional packages integrated within a self-contained architectural station. This second type refers to modular "stations" that are basically self-contained mini-facilities. We can think of the first type as software modules and the second type as a integrated stations of software, hardware and architecture (Chapter 11). Hence, modules range from do-it-yourself packages to desk-top trainers to architectural spaces defined by specialized equipment.

### **Projection and Reflective Practice**

We began this chapter by asking "who should design the curriculum that technology teachers teach?" We acknowledged that technology studies traditionally drew on the curriculum an design skills of the teacher. This had its advantages. However, this was a disadvantage in terms of consistency in curriculum, as was noted in the previous chapter. During the 1990s, a fair amount of curriculum design in technology studies was vendor driven and commercially produced. The internet also added a new dimension of portability of curriculum materials for teachers who were part of the learning objects movement. While more curriculum is commercially and publicly available and convenient than ever before, technology teachers must continue possess the ability to design an effective materials, projects, units or modules. The principles of ID and formats provided are essential tools for each technology teacher.

To practice the techniques of curriculum design two assignments are provided below. The first challenges you to design a normative unit, or a unit of a controversy in action. This builds on the controversial issues method explained in Chapter 4. The second assignment is a digital module. Digital modules provide technology teachers with a complex learning object that can be transferred from school to school with ease in portability. Proceed with each assignment with the principles of ID in mind. In the next chapter, the topics of assessment and evaluation are addressed. In order to complete the assessment components of the normative unit and digital module it is recommended that you read Chapter 10.

## 1. Unit Assignment:

### Unit of a Controversy in Action (Normative Unit)

The intention of this project is to help you develop curriculum for engaging your students in a controversial issue. Choose a controversy in medicine, science and technology (e.g., Crime & DNA, Disease & Treatment, Cancer & Risk, Privacy & the Internet, CFCs & the Ozone, Deforestation & Jobs, Organic Farming, Alternative Medicine, Wildlife Management, Habitat Preservation, Acid Rain, War). Select a current or historical controversy— It will be much easier to collect materials for a current controversy. Provide resources to represent the plural views of the controversy. Use the controversial issues method for structuring the materials and the overall unit. What is at issue? What is at stake? What makes the issue controversial? What are the arguments? Who is arguing (for) what? What are the underlying assumptions of these arguments? What will settle the controversy, if indeed there can be settlement? Who will do the settling? How public or private is the issue? How public or private will the settlement be? What role is the media playing?

Prepare the case as a normative unit in controversy. Prepare the curriculum materials as a professional package that is comprehensive. To represent plurality in the controversy, include primary (original documents) AND secondary (analyses and commentary on the originals) source material from the sides involved. For elementary and middle grades, you may have to rewrite the source materials, and choose a controversy that has a children's literature base (e.g., rainforests).

### Unit Plan Format:

**Title:** Choose a thematic, encompassing, and personally relevant title.

**Rationale and Ends:** What is the controversy? Why is a study of the controversy in this unit relevant to the students? What is at issue? What is at stake? What makes the issue controversial? What are the arguments? Who is arguing (for) what? What is assumed? What are the underlying assumptions of these arguments? How are the arguments manipulated? Use the controversial issues method for structuring the materials and the overall unit. What will settle the controversy, if indeed there can be settlement? Who will do the settling? How public or private is the issue? How public or private will the settlement be? What role is the media playing? Use the controversial issues method for structuring the materials and the overall unit. (2-3 Pages)

**Outline of Content (Scope and Sequence):** How are parts of the unit combined? In outline form, lay out the GENERAL scope and sequence of content for the entire unit. Pay attention to interdisciplinary connections. (1 page)

**Planning Grid (Scope and Sequence):** A planning grid is absolutely necessary and acts as a flowchart that provides the details for putting the unit in action. In the order in which they will be introduced, briefly annotate (describe) the lessons, activities and means of assessment, and list the objectives and materials reference. (2-4 pages of grids)

**Outcomes:** List the objectives or intended learning outcomes. Include a balance of affective, cognitive and psychomotor objectives and outcomes. Consider alternative and various ways of teaching. These ought to relate to the assessment schemes. Include these in the planning grid.

**Activities & Projects:** Include Activity and Project Descriptions, Resources, Time and Sequence, Knowledge, Cross curricular Subject Links, Safety and Evaluation Scheme. These can be original OR existing activities. IF existing activities, note the improvements made by you. This will reflect the depth of the content that you critically select. What activities and projects will be used for experience and expression? Consider alternative and holistic modes of student expression and ways of knowing. **This may include handouts for the students.** (3-4 pages of activities)

**Assessment:** Include criteria, rubrics and schemes for the assessment of individual activities. Provide details for quizzes, observations, portfolios and project assessments with which students will be assessed. Indicate how results of assessments will be communicated. **This may include handouts for the students.**

**Lesson Plans:** Include lessons plans for all of the formal lessons that the teacher will deliver. (Number of pages will vary, depending on number of lessons)

**Semantic or Concept Maps:** How do the parts relate? Unit Design, organization of knowledge, relationships of subject matter, and skill relations maps. (3-4 Maps)  
Maps may or may not be computer generated.

**Resources:** As best as possible, indicate resources or sources that are necessary for you and your students to enrich the unit. Assume a standard lab or shop environment with average tools, materials and equipment. Do not list all software, tools and machines as resources, as they will be assumed as necessary. List books, Web sites, special software or tools, etc. (List with bibliography- 1-3 pages)

**2. Principles of ID Matrix** for existing, new, or to-be-designed digital curriculum. Produce a principles of ID heuristic or matrix for assessing curriculum materials. The matrix ought to enable an assessment of a wide range of digital materials and learning resources. Produce a professional looking document or web page. (Group project-- groups of two)

Length: 2-3 pages

Criteria for Marking:

Content (format, substance, comprehensiveness, sentence structure, paragraphs, spelling)

Presentation (appearance, organization, style)

### 3. Module Assignment:

#### Digital Module

Design a module to introduce students to a concept or process that can be individualized. Design the module for a specific subject area or grade level. A module is a free-standing, self-contained and comprehensive instructional package, meaning that basically everything that the student needs is in the module. The module should last 3-5 one-hour days and should encompass attitudinal, skill and cognitive dimensions. In other words, the module should involve the ecological-natural, ethical-personal, socio-political and technical-empirical dimensions of technology. (Group project-- groups of two)

#### Criteria for Feedback:

**Design, Content and Presentation**– (60%)

**Context:** Is it obvious that this is a **module** for students?

**Content:** Is the module substantial? Are there examples? Is it free-standing? Does it adequately address the ecological-natural, ethical-personal, socio-political and technical-empirical dimensions of technology? Is the content accurate?

**Information Structure:** Is the conceptual framework of the site evident? How well do text and images work together? How effectively do the displays communicate?

**Interactivity:** How interactive is the site? Are navigational aids and options made clear? Is the site easy to "get around" from one point to another, and back to points of origin? How device "independent" is the site? Are pages a manageable length?

**Comprehensiveness:** Are the contents comprehensive?

**Media sophistication**– (40%)

**Hypermedia or multimedia:** Does the module take advantage of available navigational technologies? Are tables and sub-headings used where appropriate? Is essential information obscured by "bells and whistles" or other features? Do pages load quickly?

**Visual Impact:** Is the composition of the module based on principles of design and appealing?

**Visual Style:** Is the style sharp, clean and together? Is the style consistent across pages, but within a range of possibilities? How well do the colors work together?

**Experimentation:** Was there some risk-taking in design (but not in content)?

#### Module Format: \*Length: 20-30 pages of digital copy

1. **Objectives-** State what the students will learn from the module (attitudes, knowledge and skills).
2. **Pre-test-** Provide a quiz for the students to create dissonance between what they know, do not know and will learn in the module.
3. **Rationale-** Provide a clear statement on why this module is important and relevant.
4. **Interactivities-** Create audiovisual, hypertextual or multimedia pathways for the students to complete the module.
5. **Post-test-** Provide a quiz for the students to test whether they learned what was in the module.
6. **Resources-** Provide a list and description of resources for students to explore the topic in more depth.