Chapter 1
Communicating and Planning for Instruction

One of the great ironies in this age of communication and information technologies is that communication skills for many people have atrophied. The average email and internet sentence is six words and the average paragraph is three sentences. Students have taken low levels of communication and high levels of information overload for granted. This state of affairs has dire consequences for education, where clear, cogent communication is a prerequisite to learning. While it is tempting to "get with the times" by reducing communication to brief, sloppy exchanges, our challenge as teachers is to contradict these practices by modeling formal communication and information skills. This chapter begins with a description of an effective teacher to remind us that teaching involves a wide range of dispositions, knowledge and skills. The remainder of the chapter focuses on demonstrations, lesson planning and instructional objectives. Lesson plans and objectives are fundamental tools for demonstrating the applications, explanations and implications of technologies to your students. Demonstrations are the single most effective method for technology teachers. Organization and communication are the keys to effective demonstrations.

The intent of this chapter is to provide you with the instructional tools that ground the practice of teaching technology studies. Communication, demonstrations, lesson planning. These are the tools that will help you to immerse yourself in the craft of teaching. Recalling the model of reflective practice explained in the introduction, this book takes the form of cycles that begin with you as a teacher. Over the first four chapters, you will be challenged to identify with certain instructional practices and techniques, and choose among those with which you most identify. This chapter provides the tools for scaffolding a wide range of curriculum and instructional dispositions, knowledge and skills. The operative word in this chapter is practice. Practice, practice, practice!

Characteristics of an Effective Teacher

A good teacher is a good person. Simple and true. A good teacher rather likes life, is reasonably at peace with her or himself, has a sense of humor, and enjoys other people. Among other things, a good teacher is good because s/he does not seem to be dominated by a narcissistic self which demands a spotlight, or a neurotic need for power and authority, or a host of anxieties and tremblings which reduce her/him from the leader of the class to its mechanic. (Hamacheck, 1969, p. 343)

Dr. Donald Maley wrote one of the very best descriptions of an effective technology teacher. After a life of work in technology studies education, Maley passed away in 1993. But his description, titled "Identifying the Skills and Attitudes Technology Educators Must now Possess," is as timely today as it was when written in 1990. Maley described the cultural, social and technological
changes that were underway and anticipated the response that technology teachers would have to make if they wanted to remain relevant in the new century. In the attitudinal or affective dimensions, the following are significant:

<table>
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<tr>
<th>Attitudes for Teaching</th>
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<tr>
<td><strong>Attitude Toward Learning</strong>: A commitment to continuous learning across the life span and to the processes of learning how to learn.</td>
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<td><strong>Attitude Toward Students</strong>: A belief and feeling that all students, regardless of ability, class, gender, race or sexuality is worthy of a full and quality education.</td>
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<td><strong>Faith in the Intelligence of Students</strong>: Optimism concerning what is possible in the education of students in the teacher's charge.</td>
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<td><strong>Holistic Nature of Education</strong>: Sensitivity to the interdisciplinary nature of knowledge and the whole student.</td>
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<td><strong>Value and Need for Professional improvement</strong>: Evaluative stance toward one's own performance, knowledge and skills and disposition toward improvement through professional development.</td>
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<td><strong>Education in a Multicultural Society</strong>: Attitude of understanding and respect toward the worth and dignity of all persons regardless of ability, class, gender, race or sexuality.</td>
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<td><strong>Teaching as a Valued Profession</strong>: Responsibility to see that technology studies education, with all of its values, is a vital part of education.</td>
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<td><strong>Educating the Future Generations</strong>: Interest and enthusiasm toward technology studies necessary to affect and inspire the action of students.</td>
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<td><strong>Toward a World Society</strong>: Sensitivity toward the total world community.</td>
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<td><strong>A World with Finite Resources</strong>: Sensitization of students to the wise use of resources.</td>
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All technology teachers would do well to adopt these attitudes. When Maley described an effective technology teacher, he included two skill dimensions to complement the attitudinal dimension. Direct teaching skills are those that normally come to mind when we think of curriculum and instruction. For technology teaching, he included technical skills for designing labs, workshops, projects and various teaching aids. The second group of skills is for personnel support and relate to those necessary to manage classroom problems, resolve conflicts and network outside of the school.
Direct Teaching Skills

- **Design of Learning Experiences**: Ability to analyze and design learning experiences.
- **Managing the Teaching & Learning Processes**: Integrating, coordinating and interfacing the many aspects of lessons and activities.
- **Technical and Manipulative Skills**: Variety of refined in the use of applications, devices, instruments, machines and tools.
- **Organizing and Managing Facilities**: Organizational skills necessary to the management of labs and workshops.
- **Planning**: Ability to plan and strategize for lessons, activities and facilities management.
- **Evaluation**: Variety of skills for assessing students and evaluating programs.
- **Organizing for Change**: Skills involving self-change and program change.

Personal Support Skills

- **Communication Skills**: Ability to communicate effectively through various media.
- **Interpersonal Skills**: Skills for responding effectively to individuals and groups
- **Community Relations Skills**: Measure of diplomacy, communication and human relations through a dedicated sense of mission.
- **Learn-to-Learn Skills**: Ability to take advantage of new media for learning.
- **Democratic Process Skills**: Ability to democratically manage students.
- **Decision-Making Skills**: Ability to analyze courses of action, alternatives, consequences and operational impact.
- **Problem-Solving Skills**: Ability to trouble-shoot and figure things out.
- **Inquiry Skills**: Ability to locate, assess and organize information.
- **Computer Use**: Skills in networking, procurement and information dissemination.

Malay's list is a complement to generic lists of what makes an effective teacher. Think about your teachers from the past. What qualities did they possess? What qualities ought any teacher possess? Your characteristics will probably include what Maley suggested, the following characteristics and more:

A good teacher expresses (Clark, 1988)

- Belief in and development of human capacities
- Awareness of one’s vocation to become human
- An expanded social imagination
- New organizing ideas
- Deep sensitivity to tools in human relationships
- A learned immunity to technical goals
- Ability to make complex value choices
- Highly developed moral awareness
- Sophisticated information handling skills
- Expanded consciousness of the future
Think about the multiple roles that a teacher, or a design and technology teacher, must assume. The variety of roles can be mind-boggling. However, this is one reason that design and technology teaching is so exhilarating! Among other roles, a good technology teacher is a:

- Care-taker
- Worker
- Manager
- Crafts-person
- Engineer
- Technician
- Tinkerer
- Ecologist
- Artist
- Designer
- Activist
- Poet
- Media Critic
- Critical Consumer
- Public Intellectual

Our expanded notion of what a technology teacher is distills to some very basic fundamentals. Good technology teachers are effective communicators and are well prepared for the demonstrations and presentations that they give. These are the very basic fundamentals of teaching: Communication, preparation, demonstration and presentation.

**Communication**

"Don't talk, communicate" is a popular saying among communication specialists. This simple saying contradicts the common notion that talking and communicating is the same thing. Communication requires a conscious effort to effectively speak and listen. It requires a conscious effort on the part of all parties involved. *Casual communication* is part of everyday life, but in order to for a teacher to exert an influence over students and to motivate them in a chosen direction, communication must be formal. *Formal communication* assumes that there is information worth communicating and therefore it worth ensuring that this information is accurately received and understood. Ensuring that information is accurately received and understood is a complex challenge. Formal communication requires that the speaker have a high regard for accuracy, efficiency and precision. It is the speaker's (or sender's) responsibility to ensure that messages are clearly expressed and understood. Effective speaking—formal communication—is a unified act. One does not assemble separate techniques of emphasis, gesture, material, movement, vocabulary, vocal modulation and teaching aids into adequate proportions for a perfect formula. Nevertheless, these individual facets of communication and others are important to consider and work on. As a technology studies teacher, you ought to be able to give clear, accurate instruction, to organize and give demonstrations, to be a good listener, to converse freely about plans and procedures, give adequate, ethical feedback, and to deliver persuasive public presentations at meetings with administrators and parents.

Generally, there are six facets to the formal communication cycle: Audience Analysis, Preparation, Practice, Delivery, Feedback and Reflection. Each facet has several dimensions that, when addressed, make for effective formal communication. Whether it is a teacher demonstrating or presenting to a group of students, or an administrator presenting to a group of parents, these
dimensions are important to consider. In most cases of formal communication, the presenter will know, ahead of time, at least a few characteristics of the intended audience. The grade level of the students or their general abilities, interests and expectations are characteristics that will allow the teacher to make some generalizations for preparing a lesson. Preparation involves selecting the content or information, synthesizing information into succinct points, designing a strategy for introducing the topic, developing an outline or plan and organizing necessary communications media and technologies.

Practice means going over the lesson to iron out the flow and pacing, and to massage the lesson into an allotted time frame. Delivering the lesson involves proper dress and posture, configurations of the environment and students, vocal tone and confidence, eye contact, engagement with the students and an allowance for interruptions or feedback. Feedback can mean formative feedback that involves your own monitoring of the situation. Summative feedback refers to the time following your delivery, such as questions from the audience, feedback you give to the individuals following their questions, or any peer feedback that you may receive on the demonstration or presentation.

Reflection will involve your analysis of the effectiveness of your demonstration or presentation and an internalization of commitments and revelations on improvement. Of course, reflection ends one cycle and opens another (Fig. 1.1).

**Figure 1.1. Cycle of Formal Communication**

**Audience Analysis**

Formal communication begins with an analysis of the intended audience. Without actually surveying the audience for demographics and characteristics, or asking the audience what they know or want to know, we have to make assumptions. Teachers work in close proximity with their students day after day. And this usually means that more informed assumptions are made than those of presenters who do not know their audience. In either case, informed assumptions have to be made. We can ask ourselves some general questions as we begin to prepare our demonstrations and presentations.

- How many students (people) will be present?
- What are the commonalties of their background, demographics (ability, age, class, gender, race, sexuality) and interests?
• What do they already know about the topic? What will they expect to learn?
• What other expectations might they have?

Preparation
Once we derive some fundamentals about our audience, we can begin to prepare a general outline or lesson plan. A standard lesson plan for technology studies is provided later in this chapter. Once the topic of the lesson is established, which for us is usually an application, device, instrument, tool or machine, we decide on a central message. This is the focus or the organizing element for the ideas and information of the demonstration or presentation. The following criteria will help you to develop a good central message:

• What is your purpose? Is it to inform or educate, entertain, persuade or stimulate action? Is the purpose to provide knowledge of a procedure? Or is it to provide knowledge of conditions?
• What are the objectives? What will the students learn by observing or participating in your demonstration or presentation? What direction or focus will you provide for their practice session or activity? Instructional objectives are described in the last section.
• Keep your message simple. If you cannot summarize a central message in one or two sentences, the topic is probably too expansive. Narrow the topic until you have a clear focus and purpose.

Once you have a focus, purpose or objectives, decide on three to six key points that you want to emphasize. These may be nothing more than steps in a process. Develop a way to support each key point. You will want to include descriptive information, examples or brief stories. Develop a good introduction: How will you get the students' attention? What strategy will you use to introduce the topic? What sequence will you follow? What media will you need? How will you conclude?

Prioritize your information and make sure you are not going to overwhelm your audience with too much. Use this checklist to judge and prioritize what you want to say:

• What does my audience need to know?
• What is it that is nice or them to know?
• What is it that they really do not need to know?

Plan to use conversational language. Use contractions to make your language accessible. Avoid acronyms and jargon. Use short words and sentences, plus active verbs. Sentence fragments are typically ok, as this is how people talk. However, do not attempt to co-opt your students' language and jargon. Use sentences and phrases that people will remember and recall. Plan to repeat your main points. Do this throughout your lesson and again at the end. Use examples from
your experience, illustrations, comparisons, contrasts, quotes, statistics and anything to help your audience grasp what you are saying.

If you are preparing to give a lesson to students as opposed to a formal presentation, plan to ask plenty of questions! Ask a range of redundant questions and more challenging, high-level questions. Questioning is an effective way to maintain the attention of your audience. Generate four questions you would most like to be asked and the four questions you fear the most. Then prepare answers to those eight questions.

Develop an effective closure: Be sure to bring closure to your demonstration and presentation. You may want to simply reiterate your central message, purpose or objectives. Use a short story related to the message or ask a final question. Comment on what comes next. The purpose of a formal communication is to move your audience to action or understanding.

How much of what you will say do you want to type out? Many teachers and presenters use note cards filled with key points instead of typed pages. If you are giving a demonstration, it is a good idea to use your lesson plan when you deliver the lesson. Overhead transparencies, or PowerPoint slides, serve as effective cues. With anything that you will be reading, use 16-20 pt text and double or triple space. Do not staple pages together and number the pages. Use your visual aids effectively. Research shows retention of information presented with visual support is 65% after five days, compared with only 5% without. But do not allow your visuals to become a crutch. Your visuals must be sharp, as described in another section. Remember, your visuals are you—your technologies reflect your professionalism. There is one formula to keep in mind:

\[
\text{Respect & Status} = (\text{Image} \times 50\%) + (\text{Capability} \times 0.25\%) + (\text{Finesse} \times 0.25\%)
\]

Practice

Once you have completed the first draft of your lesson plan or presentation outline, walk yourself through it. Do a trial run in your head following the outline. This will allow you to make revisions and refine the outline or lesson. Practice the lesson or presentation at least once before you deliver it. Rehearse your delivery in front of a mirror if you can, or speak into a tape recorder. Stand up and visualize the audience in front of you. It is a good idea to do a lab or room analysis. If possible, go to the lab or room where your lesson or presentation will be given in advance to help eliminate surprises. Is the room arranged, as you want? Are the media, materials and technologies available?
Delivery

Prior to the delivery of your lesson or presentation, you will probably feel nervous and anxious. This is normal: Do not panic! Even the most seasoned of teachers feel jitters prior to their lesson, the degree of depending on the audience. There are techniques that help to relieve nervous tension. Of course, the better prepared you are, the more confident and less nervous you will feel. Stretching your joints will relieve nervous tension that builds up immediately prior to the demonstration or presentation. Flexing your hands and taking deep breaths are good ways to settle your nerves. Clearing your throat will do the same. Use the adrenalin you have generated to get off to a good start, but be careful you do not go too fast. The more you speak in class or public the less stressful the experience will be.

Dress appropriately and wear something comfortable and conservative. Avoid bright white shirts, big jewelry and brass buttons, any of which will be a distraction. Always look professional, even in a laboratory or workshop. Arrive early to prepare your media and any teaching aids that you need. Write on the board anything that needs to be written ahead of time. If you are using computers, make sure the proper software is booted and ready to use. If you are using other technologies (devices, machines or tools), make sure are they set-up, useable and ready.

Once you are prepared, or once it is time, get your audience's attention. Make an immediate connection with the audience by appearing prepared and sincere. Greet the audience. Provide a proper introduction to the lesson or strategy. Introduce the purpose and an indication of what the demonstration is about, or what you hope to accomplish. Describe the sequence of your demonstration or presentation (First I will…, second I will…, and then…). Tell the audience what you will say, how you plan to say it and how long you the presentation will take. Use a watch or alarm to stay on time. Note the time and stay conscious of the time.

Stand tall and take deep breaths. Move when you can and remember that too much movement is distracting. Don't grow roots however! Maintain eye contact with your audience. Move your gaze around the room, fixing on different students to make a point. Vary your tone of voice (this takes practice) and rate of delivery. Show emotion and enthusiasm for your topic with your voice. Strike a balance: don't speak too quietly, too loudly, too slowly or quickly. We all use verbal fillers such as "um," "uh" and "you know," but try to get in the habit of pausing silently instead. Use gestures and facial expressions effectively, but be careful not to overdo it. Smile when appropriate, but do not treat formal communication as a joking matter. Use hand gestures when appropriate. Between gestures, rest hands at your sides or lightly on a table.

Always use inclusive language, whether groups are represented or not. In formal communication, you must model respect. Avoid the mistake that if you say men, you mean all people; or if you say him, you mean her. Avoid exclusive language such as craftsman, fisherman...
or repairman. Instead, use artisan, angler and mechanic or technician. There are always options. When in doubt, consult the Guide to Non-Sexist Language. Ask plenty of questions if you are demonstrating to students and be prepared to address questions. Decide ahead of time whether you will field questions during your demonstration. On most occasions, it is best to defer uninvited questions and interruptions until you are finished. Keep your answers to questions short and to the point: do not ramble. Be honest—if you do not know the answer to a question, say so.

Most researchers indicate humor is the seventh sense necessary for effective formal communication. However, you will want to be careful with humor. Don't be a clown. Be cautious, as you can insult or hurt someone with even mildly offensive humor. Humor, used cautiously, we help you relax, will break down the rigidity of barriers between you and your audience, and will assist you in delivering sanctions and other necessary unpleasantries. Do not goof around with sensitive material!

Do not be apologetic with your material. If you have to apologize, either you did not prepare or the information you selected is not important. A mild apology may be in order if you ventured off topic. Conclude the demonstration or presentation with confidence and certainty. Review what you said, the central message, and the main points. Project what you demonstrated with what you or the students will be doing next. Close by letting the audience know that you appreciated their cooperation. Breathe a sigh of relief!

Feedback
In this section, we discuss the type of feedback you will want provide your students during and following your demonstrations and presentations as well as the feedback you want to practice with your students on a daily basis. Respond positively to the questions and to appropriate behavior. Stay interested in the students' answers and to their questions. Sincerity goes a long way in demonstrations and presentations. In general there are five guidelines for providing feedback:

• Focus on behaviors and questions, not personality.
• Focus on specific situations, not on abstract issues.
• Focus on the present.
• Attend to your students' receptivity to amount tone of the feedback.
• Make verbal and non-verbal messages congruent.

Remember, to provide feedback, you must observe and listen. Good listeners do not interrupt, especially to correct mistakes or make points. Good listeners do not make swift judgments and think before answering. Effective feedback and listening require that you face your students and attend to the biases or values that distort what you hear. Look for the feelings and basic assumptions underlying actions, remarks or questions. When giving feedback, concentrate on
what is being said and refrain from rehearsing answers while you are listening. Feedback requires that you be judicial: do not insist on having the last word.

When giving feedback, say Jung and associates (1973), it is useful to describe the behaviors you observed along with the reactions they caused. If at all possible, make sure that the student is prepared to receive feedback. Avoid surprises. Your comments should describe, rather than merely interpret. Feedback should focus on recent events and actions or behaviors that can be changed. Effective teachers give plenty of positive feedback in a timely manner. Reserve extremely sensitive feedback for private meetings with your students and peers. Avoid anger or personal attack and accept criticism of your own practices without becoming defensive.

There are four tried and proven techniques for giving feedback. One technique is paraphrasing. The real purpose of paraphrasing is not to clarify what the other person actually meant, but to demonstrate that you are actively listening. This typically means restating your student's original statement in more specific terms, using an example, or restating it in more general terms. Another technique is perception checking. Perception checking is a concerted effort to understand the feelings behind the actions and words. You may want to describe your impressions of your student's feelings on what s/he is doing. On the issue of skills for example, you may say: "I understand your resistance to this and see that you feel that you are not improving, but my impression is that there has been a lot of improvement in your skills. Avoid expressions of approval or disapproval. A third technique involves describing behavior. The most useful behavior description focuses on specific, observable actions without judgments. Avoid making accusations or generalizations about motives, attitudes, or personality traits.

The final technique is sandwiched feedback. The most effective and preferable feedback involves the sandwiching of constructive criticism between two positive, supportive comments. Sandwiched feedback focuses primarily on current behaviors and secondarily on products. For example, regarding the development of a web page by your student, you might say: "I see that you have progressed from paper to screen on this project, but you are too impatient with the time necessary for neatness. Break this down into five steps and concentrate. Your enthusiasm is great and I know you can do a great job!"

Reflection

Reflection in the cycle of formal communication occurs quite naturally. We think about what we said, what we should have said and what we should not have said or done. We think about our actions and feelings. We ask ourselves how what our demonstration of presentation was received by our audience. Most of the time, we are our own harshest critics.

Intentional reflection typically involves providing ourselves with direction over time. The most effective way to engage in intentional reflection is through a review of a video recording of your
demonstration or presentation. This requires that arrangements be made to tape your demonstrations or presentations with the intent of following up with analysis and reflection. In most cases of teacher education, video analysis is best done with peers. This allows for focused discussion on particular moments of the demonstrations or presentations. It may be easiest to begin your reflection by completing sentence stems:

- I learned that…
- I was startled by…
- I remembered to…
- I found it difficult to…
- I enjoyed…
- I plan to change…
- I anticipate that…

Reflection also involves a commitment to act on your realizations and resolutions. When beginning your teaching career, it is best to keep your commitments focused on specific abilities. Resolve to work on specific issues such as articulation, enthusiasm, facilitation, questioning technique, vocal pitch and volume or conclusions. Practice the abilities you committed to in subsequent demonstrations. Another cycle is now completed and begun.

These techniques that promote reflection and the analysis of communication are included in what is generally called meta-communication. Meta-communication, somewhat like meta-cognition where we think how to think, is a practice where we communicate how we communicate.

**Presentation Media and Communication Technology**

Since the early 1980s, we have been witnessing a transformation in the technologies of communication. This transformation is captured in one word: Convergence. There has been a convergence of communication, media and information technologies (computer, copier, fax, messaging, phone, printer, audio & video player etc. convergences), modalities (image, print, sound, etc. convergences), practices (art, communication, design, fashion, film, marketing, programming, technology, etc. convergences) and corporate formations (cable & internet providers, music, newspaper, radio & television convergences). For the average teacher, convergence has been overwhelming. However, the average technology teacher welcomed the changes as new curriculum, practices and topics of study.

The curriculum of communications technology, as we know, goes far beyond human-to-human communications. Machine-to-human and machine-to-machine communications are exciting topics as well. The cybernetic nature of communications technology was captured in the classic model of Shannon and Weaver (Fig. 1.2). While the model mechanizes the process of human-to-human communication, the basic components of this model are helpful to consider.
In any communication process, there are transmitted messages through some imperfect medium toward some destination. The challenge is to minimize the noise, or distractions and interruptions in communication. The basic question, "Who says what, in which channel to whom with what effect?" is important to consider in any situation involving communication. Formal communication, often taking the form technical communication, depends on our consideration of this model and question.

Technical communication refers to a field concerned with how technical information is communicated and mis-communicated. There is a challenge in communicating knowledge in science and technology. On one hand, this knowledge can be complex and difficult to articulate. On the other hand, this knowledge often assumes a technologically literate audience, meaning that communication depends on a system of shared artifacts, signs and signals. The level of understanding of these signs differs from situation to situation. To overcome these challenges, scientists and technologists resort to graphic and visual forms. Imagine the common set of directions for the assembly or use of a commercial product. Most written directions would be indecipherable without visual forms. Animations, charts, diagrams, drawings, figures, schematics and tables are used liberally in technical communications. The new technologies have transformed the appearance of technical information, but basic principles of graphic design continue to underwrite the new visual aids.

Visual aids, when used properly, do not merely contribute to the communication content of demonstrations and presentations. That act as visual cues for you and can actually add credibility to your efforts. By definition, a visual aid is a form of graphic medium that aids the audience in understanding your material. An effective visual aid will reduce the time necessary to convey ideas and increase the understandability of the words being spoken.

Never use presentation media you haven't practiced with or checked to see how it projects. To assist your audience, visual aids should be clear, simple, legible, and readable and should express only one or two ideas. The presentation media should support what you say. Be sure to compensate with your voice to overcome your audience's divided attention. Face your audience,
not your presentation media. Use media in a proper sequence: wait to display them until you are ready to talk about their content.

A sentence is readable when it is grammatically correct and flows without distracting words. Readability is an issue for handouts and books. Since visual aids use a minimum of words, they are more concerned with legibility. Legibility enables the audience to focus attention and register the point without mistake. The word **Yield** on a traffic sign is a good example of legibility. For overhead transparencies and PowerPoint slides, the height to text should be 20-24 point, preferably in a sans-serif font such as Arial, Geneva or Helvetica.

**This means that text should be at least this big!**

Try to use key phrases and words rather than complete sentences. Overheads and slides should be understood at a glance, so eliminate clutter and unnecessary details. Most visual aids tend to be overly complex. Use a series of slides and transparencies as a solution. Be direct and simple with your visual aids. Be succinct.

The most popular media for presenting is the overhead transparency. However, with the reductions in prices of LCD projectors, digital media for presentations are increasing in popularity. For technology teachers, the issue can be one of sustainability. The LCD projectors can significantly reduce transparency consumption. LCD projectors can be purchased with document cameras attached, which allows for the projection of 3D objects or sheets of paper placed on a table. The most common software for digital projections is Microsoft PowerPoint. If using PowerPoint or similar software for the Mac OS or Linux, attend to the same guidelines for other visual aids. Refrain from the bells and whistles that presentation software offers. Beginning teachers ought to adopt an application such as PowerPoint for all of their overhead materials and presentations. In my experiences with new teachers, rarely is enough attention paid to teaching aids. Applications such as PowerPoint have templates that automatically contain the size of text and the amount of information that can be placed on a single slide. These are very helpful constraints for beginning teachers.

Your presentation media, like your handouts, represent you. Every technology teacher ought to develop skills that will help present themselves as capable and sharp in communication and media. This means that you will have to have proficiencies in arrange of audio, database, graphic and text technologies. The interrelations between knowledge and graphic media are addressed in the next chapter.

Instructional materials and activities ought to adhere to general principles of instructional design, such as accessibility and equity. As we proceed through our study of curriculum and instruction, we will keep the eight principles in mind (Fig. 1.3). These eight principles were
adapted from the universal design of materials and activities at the University of Guelph. In Chapter 9, we will deal with principles of instructional design in a more detailed way.

Figure 1.3. Instructional Design Principles

Demonstrations
A demonstration is a teaching method based predominantly on the modeling of knowledge and skills related to the relevance and effective use or operation of applications, experiments, tools, machines, instruments and processes. First and foremost, the goal of a demonstration is to communicate and model how to do something and how to talk about the task or technology at hand. Hence, the demonstration must be clear and effective. The demonstrator must demystify the tool or process, explaining what is to be accomplished, what knowledge is applied and the roles of certain skills and senses. The demonstrator will, of course, demonstrate more than how to perform a task. The demonstrator will also model what s/he knows and the level of skills and safe practice attained. The necessity of a demonstration derives from the inadequacy of words to depict technological processes.

Demonstrations are used in a wide variety of disciplines including architecture, art, engineering, home economics, mathematics, science and technology. Some of the best demonstrations can be found on the popular chefs’ cooking shows on television. If you cannot pull off an effective demonstration you will not be an effective design and technology teacher. As a matter of fact, it is not easy to give an effective demonstration, whether it is a five minute or thirty
minute demonstration. Practice is the operative word when it comes to demonstrations. Prepare to practice and perfect the art and science of demonstrations. It is as simple as that.

Demonstrations are typically planned and delivered according to a pre-established sequence. There is no universal sequence, however, there are components that can be found from demonstration to demonstration. The most common components are the following:

1. Introduction (What will be demonstrated?)
2. Relevance (Why demonstrate this?) (Use Questions, Story, Description, etc.)
3. Use of application, instrument, machine, process or tool (How to effectively and safely do or use this?) (Actual execution of proposed process)
4. Conclusion (Recap—Summarize, What was covered—Where to go next?)

Demonstrations that have a different emphasis might involve a common fifth component:

- Context or Implications: (Personal, Current Concerns, Historical, Psychological, Sociological, etc.)

Demonstrations specific to tools and machines typically involve a few more steps at some point in the sequence. For example, in the sequences common to demonstrations of instruments, tools or machines, the steps listed above are found, but in different parts of the sequence. There is not a correct sequence. Even for the same application of a process, software or a tool, sequence #1 may work best on one day while sequence #3 works best on another day. The best advice is to experiment with sequencing. This requires you to play close attention to the sequence of your demonstrations.

**Sequencing:**

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<th>Sequence #1</th>
<th>Sequence #2</th>
<th>Sequence #3</th>
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<tbody>
<tr>
<td>1. Introduction</td>
<td>1. Introduction</td>
<td>1. Introduction</td>
</tr>
<tr>
<td>2. Relevance</td>
<td>2. Relevance</td>
<td>2. Relevance</td>
</tr>
<tr>
<td>5. Safety—Care</td>
<td>5. Use</td>
<td>5. Implications</td>
</tr>
<tr>
<td>7. Conclusion</td>
<td>7. Conclusion</td>
<td>7. Conclusion</td>
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</table>

The best demonstrations are dependent on very basic communication and teaching skills, such as thorough planning, advanced organization, creative strategy and effective communication. The most seasoned of demonstrators plan in advance, rehearse and reflect. They experiment with a variety of techniques from demo to demo. They experiment with delivery, sequence, staging and strategy and media. In technology studies, there is always the opportunity to integrate the technologies with other subjects. When integrating, your task is to demonstrate the underlying principles of the technologies of interest. For example, it may be important to demonstrate the
concept of lift and the underlying Bernoulli principle. You will have demonstrated the application as well as the explanation. For relevance, you will have to demonstrate the implications as well.

### Examples of Sequences for Integration

<table>
<thead>
<tr>
<th>Sequence #1</th>
<th>Sequence #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction/Review</td>
<td>1. Introduction/Review</td>
</tr>
<tr>
<td>2. Application</td>
<td>2. Application</td>
</tr>
<tr>
<td>3. Implications</td>
<td>3. Explanation (Relevance)</td>
</tr>
<tr>
<td>4. Explanation (Relevance)</td>
<td>4. Relations (Content)</td>
</tr>
<tr>
<td>5. Relations (Content)</td>
<td>5. Implications</td>
</tr>
<tr>
<td>6. Conclusion</td>
<td>6. Conclusion</td>
</tr>
</tbody>
</table>

The key for the demonstrator is staying organized! If you are well organized, your audience, the students, will cue into the finer points of what you demonstrate rather than focusing on what is disordered. It is as important to organize the materials you need for the demonstration as the knowledge you will demonstrate. Pre-organize procedural and conditional knowledge on your lesson plan. Organize procedural knowledge for students by listing procedures on an OH transparency or the chalkboard. List new terms and safety procedures.

Empathize with your audience. Work from the level of the students to new levels, from their comfort zones to an expanded zone. Assume an intelligent, but inexperienced audience for your demonstrations. This means that you will have to be extremely clear about basic things. This means you have to communicate. Be certain of factual information and keep it simple. Use proper terminology. Use multiple teaching aids and multimedia. Props and models work well in addition to OH transparencies. Providing information, procedure and safety sheets for handouts to supplement the demonstration is usually necessary. Most successful demonstrators prefer to pass handouts around, or models, before or after the lesson.

Use the technologies that you are demonstrating. Rarely, if ever, should you attempt to demonstrate a technology that is not available to you or your students. You also should always actually **use or apply** the technology that you are demonstrating. In other words, do not deliver a demonstration without having used the tool or material that you are demonstrating! Models of the technologies you are demonstrating are perfectly acceptable proxies. Work from the objects or technologies through principles (explanations) and back to the technologies (applications). Demystify the technologies— In language, application, explanation and implication.

Ask plenty of questions during the demonstration— From redundant to more challenging, high-level questions. Questioning is the best way to maintain the attention of your audience. Respond positively to the questions. Stay interested in the students' answers and to their questions. Sincerity goes a long way in demonstrations. Use volunteers when possible in order to involve the students. But always demonstrate **before** asking a student to demonstrate. There is no
advantage to either endangering or embarrassing a student. Remember, you can easily be upstaged by a participant so approach your audience with a bit of humility. You will invariably make mistakes. In most occasions, it is not worth trying to cover-up your mistakes. Try to play with mistakes if possible. The key to a successful demonstration is planning.

### Guiding Principles for Demonstrations

(Vaughn and Mays, 1924, pp. 93-98)

1. The demonstration should be timed as to meet the immediate needs of the class with the work at hand.
2. The demonstration must present a single fundamental use, procedure or general fact (should leave a single strong, indelible impression in the minds of the students).
3. The demonstration must be brief.
4. The work of the demonstration must be creatively and skillfully done.
5. The whole performance must be accompanied by concise and discriminating questioning and by a clear, accurate statement or discussion of the vital points involved in the demonstration.
6. The demonstration and accompanying questions must not be confused by discussions of various related matters. Do not confuse the demonstration with subsequent discussions of details or content.

### Lesson Plans

There is one genuine purpose to lesson planning: Preparation. A lesson plan that is not used or usable is a useless lesson plan. There is no single, universal format for a lesson plan. There will be some common elements, but for the most part, teachers customize from a number of different formats. In technology studies, we use a format that supports demonstrations, yet is comprehensive enough for discussions and group or individual activities. The lesson plan is comprehensive in that it involves all major components of a demonstration and ought to contain enough information to deliver a range of lessons, from six minutes to thirty minutes. A lesson plan is not a day planner or a week planer. It is not a unit plan or activity. It is a plan for a lesson, a framework for a demonstration, quite detailed in places.

Lesson plans are essential to demonstrations and provide a reference during the demonstration. In other words, lesson plans are used, handled during demonstrations. They are used as checks on our memory as well as guides to the process of the demonstration or lesson. Get in the habit of glancing at your lesson plan during your demonstrations. Check to see if you have sufficiently addressed what you wanted. For demonstrations where chemicals, electricity, tools or machines are involved, the lesson plan serves as a legal document. This suggests the seriousness of planning and preparation. If you prepared a lesson plan but failed to cover crucial points, you can be held accountable if an injury were to occur. Design and technology lesson plans have the components listed below, but that does not mean that each lesson or demonstration will have all of these components:
TITLE

1. Introduction - Explain a bit about the technology to be demonstrated.
2. Objectives/Goals and Major Messages - List three objectives, one from each domain (doing, feeling, knowing). List the goal of the lesson.
3. Lesson Strategy - Describe what you will do to get and hold the students' attention and to introduce the technology of interest.
4. Instructional Materials - List the necessary teaching materials.
5. Tools and Materials - List the materials and tools needed.
6. Procedure - This is the most important section. List the procedural knowledge necessary for using or applying the tool or process. These details will prompt you to be clear and comprehensive.
7. Assessment - Describe the assessment strategy that you will use during or after the activity or practice session that will follow the demonstration.
8. Special Safety - List any special safety precautions.
9. Integration - List subjects or topics with which this technology integrates.
10. Implications (Ecological or Social Context) - Describe relevant ecological or social implications regarding this technology.
12. Questions - List three questions that you might use during the lesson or on a quiz at some point.
13. Summary - Summarize the lesson or demonstration.

The key to lesson planning is to design and create the plan as comprehensively as possible. From each lesson plan you ought to be able to give any number of demonstrations. For one purpose you may give a six-minute demonstration and for another purpose a fifteen-minute demonstration from the same lesson plan. DO NOT create a lesson plan that is merely applicable for a five-minute demonstration and another that is merely applicable to a twenty-minute demonstration. Similarly, you may use the same lesson plan for any number of emphases. Using the micrometer as an example, on one day you may demonstrate how to use the micrometer. On the next day you may review how to read the micrometer and emphasize the mathematical and scientific principles underlying the operation of the micrometer and precision measuring instruments in general. In the first demonstration you emphasized use. In the second you integrated math, science and technology. In a third demonstration you may emphasize the social implications of precision measurement and interchangeable parts or mass production. The point is that three lesson plans were not created. Rather, one fairly comprehensive lesson plan was created. Each lesson may be supplemented with handouts such as information sheets (what and why of the technology) and procedure sheets (how of the technology). So, you will not get into everything during a single demonstration, but your lesson plan prepares you to eventually cover a range of topics through a range of teaching methods.

Study the example lesson plan provided, "An Awareness of Precision Measuring Instruments." Note the details of particular sections, especially the objectives and procedure section. Use this format for your lesson planning.
An Awareness of Precision Measuring Instruments— The Micrometer

I. Introduction
Machinists use a variety of precision measuring instruments to obtain the actual size of tool stock and parts. The micrometer is the most commonly used measuring instrument when accuracy is required. The most basic micrometer is used to measure in thousandths (.001) of an inch—the sleeve of the micrometer is divided into 1000 equal segments. Vernier micrometers enable us to measure in ten-thousandths of an inch.

II. Objectives, Goals and Major Messages
The overall goal is to acquaint the students with the micrometer. The students will demonstrate the ability to:
1. Identify reasons for using the micrometer in metalworking and machining.
2. Properly adjust a micrometer and read measurements that are accurate to three decimal places (thousandths on an inch).
3. Handle and properly care for the tool and appreciate the tool as a precision instrument.

Major Message: Close enough is NOT close enough!

III. Lesson Strategy
The students will be challenged to measure a piece of paper, but of course they will not be able to give a thickness dimension. Enter the micrometer. Several pieces of metal will be measured. Care of the tool will be stressed, and techniques for remembering how to use the micrometer will be given. Students will be asked to read the micrometer.

IV. Instructional Materials
1. Micrometer transparencies & Overhead projector
2. White board

V. Tools and Materials
Standard micrometer
Strand of human hair
3 gauges of sheet metal
50 in alum rod
Outside calipers
Steel rule
Engine lathe

VI. Procedure
1. Be ready to work safely
2. Challenge students to measure paper
3. Introduce micrometer (measuring various gauges of metal)
   a. why machinists use micrometers, types, parts, care
   b. applications in quality control, standardization of parts
4. Reading the micrometer:
5. Note the last # on the sleeve. Multiply this by .100
6. Count the # of small lines visible past that #. Multiply this by .025
7. Add the number of divisions on the thimble from zero to the line that coincides with the index line. These are thousandths. Add these three #s together.
   a. An easy method of reading the micrometer is by relating the #s to monetary values.
8. Note the last # visible on the sleeve. Count these as dollars.
9. Note the number of small lines to the right of that number. Count these as a quarter—add the quarters.
10. Note the division on the thimble that coincides with the index line. Count these as pennies.
11. Add the quarters with the pennies. This represents the last two digits.
12. The dollars represent the first digit—place a decimal point in front of that number.
13. Use transparencies to reinforce how to read.
14. Have students measure various thickness of sheet metal.
15. Move the demonstration to the lathe & turn a .25 x .250 offset if time permits.
16. Review and answer questions.

VII. Assessment
After several practice sessions and problems in reading the micrometer, students will be required to apply their knowledge, skills and values. Students will be assessed with a quiz of micrometer problems and with a project that will require them to fabricate mating parts to precise sizes.

VIII. Special Safety & Care
1. Do not drop or spin the micrometer.
2. Keep the micrometer clean.
3. Do not force the micrometer faces together.
4. Use the micrometer only for what is was designed for. It is not a toy or a clamp!

IX. Integration
Social Studies & Design
a. Math & Science: Using the micrometer reinforces students’ abilities to comprehend small sizes and dimensions. Reinforces the notion of a 3D world (width, depth, thickness). This is also a nice application of understanding how to add decimals.

b. Social Studies

X. Implications
Interchangeable manufacturing, by means of which parts can be made in widely separated localities and then brought together for assembly, where the parts will all fit together properly, is an essential element of mass production. Without interchangeable manufacturing, modern industry could not exist, and without effective size control by designer and producer, interchangeable manufacturing could not be achieved.

XI. New Terms
1. Division—line on the micrometer scale
2. “Mike”—measure with a micrometer.
3. Faces—Surfaces which the gauge the thickness of the objects.
4. Thimble
5. Sleeve
6. Interchangeable parts
7. Accuracy
8. Tolerance
9. Fit

XII. Questions
1. What type of measuring tool does the micrometer most resemble?
2. To what degree of accuracy can a micrometer measure?
3. Name another precision measuring tool:

XIII. Summary
The lesson will introduce the students to one type of precision measuring instrument. The applications and techniques of using the micrometer will be addressed. Time will be taken to allow the students to read the micrometer. The demonstration will be moved to the lathe if time permits so that students can see a practical use of the micrometer. Subject matter will be reviewed and questions will be answered. Practice time will be provided. A follow-up lesson and review will be given, emphasizing the social implications of precision measurement.
Instructional Objectives

While not all goals and objectives can be or ought to be planed ahead, lesson plans are likely to be much more effective when teachers value the notion of stating instructional objectives in specific terms. Additionally, objectives are likely to be much more effective if teachers conceptualize what students might and ought to know, feel and do at the end of a lesson rather than the beginning. Objectives are intentions and hopes—students may actually do and feel exactly the opposite of what a teacher intended. But, if you decide in advance what you want your students to know, feel or do, or how you want them to act or behave, you can develop lessons that lead to intended results. Your assessment techniques ought to help you to determine if the results were achieved, and the nature of both intended and unintended consequences and results.

Knowledge does not exist independent of feelings or physical skills. Our emotions and skills cannot be separated from our capacity to learn and to act thoughtfully. With this in mind, all of our lessons touch the whole student; our practices are enactive, embodied or experienced. What we say, what we do and demonstrate, and the projects we assign, the classroom policies we develop and the tone we set effect cognition, emotion and action. There are always intended and unintended effects. We nevertheless ought to try to maximize intended effects while minimizing unintended effects. We ought to be cognizant of intended as well as unintended effects. These assertions will be explained in more details in the next two chapters.

In the micrometer lesson plan, the goal and objectives are listed in section #2. The goal of the first demonstration that a teacher would give with this plan is stated as follows: "The overall goal is to acquaint the students with the micrometer." This is the general goal and provides direction for the teacher. Goals are general and typically communicate the overall intent of the lesson. The goal is quite often communicated to the students. "Today is the first day of our orientation to precision measuring tools and I'm going to introduce the micrometer…" Objectives, on the other hand, provide specific intentions in three instructional domains (Affective or caring and feeling, Cognitive or knowing and Psychomotor or doing). Objectives refer to what the students will eventually know, do or feel. The objectives in the Micrometer lesson plan are stated as follows:

"The students will demonstrate the ability to:

1. Identify two reasons for using the micrometer in metalworking and machining.
2. Properly adjust a micrometer and read measurements that are accurate to three decimal places (thousandths on an inch).
3. Handle and properly care for the tool and appreciate the tool as a precision instrument."

Objectives ought to be more or less formulated in assessable or demonstrable terms. In other words, the objectives provide direction for you to assess whether or not your students are learning what you intended. For the sake of brevity and clarity, we list only 3-4 objectives per lesson plan.
Objective #1 deals with knowing. Objective #2 deals with doing. Objective #3 deals with feeling. We state objectives that derive from our basic philosophy of educating the head, heart, hand and feet. For each lesson plan, we ought to cover all three instructional domains with clear objectives. Remember, goals are what the teacher will be doing during the demonstration. Objectives are what the students ought to be doing, feeling or knowing at some point in time after the demonstration and after they had a chance to practice.

Instructional objectives help us to effectively plan for intended effects and keep us tuned into a wide range of aspects of human experience. Instructional objectives, for better or worse, have been divided into the three domains listed earlier. Note that a spiritual domain is uncommon in instructional practice, but ought to be considered with certain demonstrations and lessons. When established in the 1950s, 1960s and 1970s, the Cognitive, Affective and Psychomotor domains focused on specific behavioral objectives—what students did, knew or felt had to be observable and measurable. We have receded from these militant criteria, but we still plan with specific objectives derived from these three domains. In the best scenarios of teaching, we have shifted from militant analyses and one best way of thinking, feeling and acting to pluralism—the recognition of a range of expressions of cognition, emotion and action. We will elaborate on this in the next two chapters.

The cognitive domain (Table 1.1) refers to the recall or recognition of knowledge and intellectual abilities and skills. The affective domain (Table 1.2) refers to changes in appreciations, attitudes, emotions, interests and values. The psychomotor domain refers to the development of manipulative, sensory and motor skills (Table 1.3).

Cognitive Domain (Bloom’s Taxonomy, 1956)

Knowing

Knowledge- the remembering of learned material. This involves the recall of a range of material, from specific facts to complete theories, in an appropriate form.

Comprehension- the ability to grasp meanings and understand. This may be demonstrated by translating one form to another (words to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects).

Application- the ability to use knowledge in new and concrete situations. This may involve the application of concepts, laws, methods, procedures, principles and theories.

Analysis- the ability to break down knowledge into component parts so that its original structure may be understood. This may includes the identification of parts, analysis of the relationships between parts, and the recognition of organizational principles involved.
**Synthesis**- the ability to combine parts to form a new, original entity. This may involve the production of a unique communication (theme or speech), a plan of operations (intervention or management structure), or set of concrete relations (invention).

**Evaluation**- the ability to judge the value of knowledge, material or designs. The judgments are to be based on definite criteria. These may be internal criteria (organization) or external criteria (ethics, relevance).

**Table 1.1. Cognitive Domain**

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Recognize, identify, notice, distinguish, aware, detect, locate, select, compare, adjust, listen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>identify, describe, compute, associate, position, sort, acknowledge, express, respond, select, convert</td>
</tr>
<tr>
<td>Application</td>
<td>change, demonstrate, discover, modify, operate, predict, prepare, solve</td>
</tr>
<tr>
<td>Analysis</td>
<td>diagram, discriminate, distinguishing, infer, outline, relate, separate</td>
</tr>
<tr>
<td>Synthesis</td>
<td>categorise, combine, create, devise, design, generate, plan, reconstruct, rearrange, revise, explain</td>
</tr>
<tr>
<td>Evaluation</td>
<td>appraise, control, compare, criticise, justify, interpret, discriminate, contrast</td>
</tr>
</tbody>
</table>

**Affective Domain (Krathwohl, Bloom and Masia, 1964)**

**Feeling**

**Receiving**- attention to particular phenomena or stimuli (activities, textbook, music, etc.). Attention ranges from simple awareness to selective attention.

**Responding**- active participation that involves attention (receiving) and reaction. Acquiescence in responding, willing attitude, and display of satisfaction or dissatisfaction. Interest is exhibited.

**Valuing**- worth or value attached to objects, people or processes. Ranges from acceptance of value to complex levels of emotional commitment and responsibility toward values. Valuing is based on the internalization of a set of specific values and the actualization of these values in overt behavior. Behavior and emotions are consistent with values.
Organization - convergence of different values, resolution of value conflicts, and internally consistent value system. Emphasis on comparing, relating and synthesizing values. Individual is able to articulate how emotions and values are conceptualized and organized into value systems. Characterization - individual has articulated a value system that has informed actions and emotions for periods sufficient to the development of a lifestyle. Behavior is consistent, value-driven, pervasive and predictable. Emotional patterns are mature and reflective. Individual is in touch with feelings.

Table 1.2. Affective Domain

<table>
<thead>
<tr>
<th>Receiving</th>
<th>Responding</th>
<th>Valuing</th>
<th>Organization</th>
<th>Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving - attention to particular phenomena or stimuli (activities, textbook, music, etc.). Attention ranges from simple awareness to selective attention.</td>
<td>Responding - active participation that involves attention (receiving) and reaction. Acquiescence in responding, willing attitude, and display of satisfaction or dissatisfaction. Interest and emotion is exhibited.</td>
<td>Valuing - worth or value attached to objects, people or processes. Ranges from acceptance of value to complex levels of emotional commitment and responsibility toward values. Valuing is based on the internalisation of a set of specific values and the actualisation of these values in overt behaviour. Behaviour and emotions are consistent with values.</td>
<td>Organization - convergence of different values, resolution of value conflicts, and internally consistent value system. Emphasis on comparing, relating and synthesising values. Individual is able to articulate how emotions and values are conceptualised and organised into value systems.</td>
<td>Characterization - individual has articulated a value system that has informed actions and emotions for periods sufficient to the development of a lifestyle. Behavior is consistent, value-driven, pervasive and predictable. Emotional patterns are mature and reflective. Individual is in touch with feelings.</td>
</tr>
<tr>
<td>ask, attend, choose, reply, recieve, recoginise</td>
<td>behave, comply, cooperate, examine, obey, respond, observe, appreciate</td>
<td>accept, balance, believe, defend, devote, influence, prefer, express, seek, value</td>
<td>codify, commit, discriminate, favour, judge, order, organise, weigh, systematise, exhibit</td>
<td>internalize, verify, live according to</td>
</tr>
</tbody>
</table>

Psychomotor Domain (Hauenstein, 1972)

Doing

Observing - the act of receiving and recognizing certain particular stimuli or phenomena (watching a demonstration, listening). Generally passive activity but with the senses responsive to stimuli. Involves the sensory reception of stimuli. Awareness of objects and relationships. Infers recognition and awareness. Tends to build sensory awareness.

Imitating - the act of interpreting, translating and responding to repeat or stimulate an act in accordance with stimuli or phenomena (repeating word pronunciation, assuming a physical position, using a tool as shown). Dependent on the situation in which it was first encountered. Individual can display the sensory and motor actions necessary to repeat and act. Guided response
through imitation and trial and error performance. Infers comprehension and responsiveness or basic interest. Tends to build skill conformity.

**Manipulating** - the act of valuing and applying knowledge to perform an action in a situation analogous or similar to that which it was originally imitated. Application of knowledge to similar situations (solving a new problem, trying out a new solution). Individual shows coordination of sensory and motor skills. Infers application and valuing. Tends to build skill recognition.

**Performing** - the act of analyzing, synthesizing and organizing actions to act rationally and functionally. Meeting situations with confidence and performing in a variety of situations dissimilar to those of manipulation. Intellect, emotions and skills are developed to the point of ownership. Analyzing actions into parts to make new relationships consistent with values. Automatic and habitual phase of motor skills; applies sensory and motor skills as a matter of habit and intent. Infers analysis, synthesis and the organization of values. Builds skill independence.

**Perfecting** - the act of evaluating and behaving with a high degree of sensory and motor skills, sensitivity, expertise and artistry. Highly independent activity seeking to creatively apply knowledge and skills. Understanding and control of knowledge, emotions and skills to achieve sophisticated levels of being. Internalization of knowledge is reflected in character and lifestyles. Judgments and decisions are consistent with values and knowledge. Infers evaluation and characterization. Tends to exhibit high level capabilities.

**Table 1.3. Psychomotor Domain**

<table>
<thead>
<tr>
<th>Observing</th>
<th>Manipulating</th>
<th>Perfecting</th>
</tr>
</thead>
<tbody>
<tr>
<td>- the act of receiving and recognizing certain particular stimuli or phenomena (watching a demonstration, listening). Generally passive activity but with the senses responsive to stimuli. Involves the sensory reception of stimuli. Awareness of objects and relationships. Infers recognition and awareness. Tends to build sensory awareness.</td>
<td>- the act of valuing and applying knowledge to perform an action in a situation analogous or similar to that which it was originally imitated. Application of knowledge to similar situations (solving a new problem, trying out a new solution). Individual shows coordination of sensory and motor skills. Infers application and valuing. Tends to build skill recognition.</td>
<td>- the act of evaluating and behaving with a high degree of sensory and motor skills, sensitivity, expertise and artistry. Highly independent activity seeking to creatively apply knowledge and skills. Understanding and control of knowledge, emotions and skills to achieve sophisticated levels of being. Internalization of knowledge is reflected in character and lifestyles. Judgments and decisions are consistent with values and knowledge. Infers evaluation and characterisation. Tends to exhibit high level capabilities.</td>
</tr>
<tr>
<td>distinguish, hear, see, smell, taste, touch</td>
<td>simulate, duplicate, copy, determine, repeat, reproduce, emulate, model, match, approximate, adapt, practice, manipulate, mix</td>
<td>coordinate, integrate, regulate, design, devise, develop, originate, invent, formulate, automate</td>
</tr>
<tr>
<td>Imitating</td>
<td>Performing</td>
<td></td>
</tr>
</tbody>
</table>
Functional Relationships Between Affective, Cognitive and Psychomotor Development

Humans do not merely act but act in accordance with their emotions and intellect. The psychomotor vector will fluctuate toward the affective or cognitive axis in relation to the forces associated with the learner’s emotional and cognitive development. We do not develop in a balance of emotions, knowledge and physical skills. Some of us will attain high levels of physical skills but low levels of emotional development. Similarly, others will develop high levels of knowledge and emotional sensitivity but will attain a low level of physical dexterity. The challenge for teachers is to attend to whole development and help students attain a balance of cognitive, emotional and psychomotor development (Fig. 1.4).

Figure 1.4. Domain Vectors
Projection and Reflective Practice

The intent of this chapter was to explain the fundamental issues of communicating and organizing for instruction. We concluded that effective instruction requires effective communication and organization. Teachers organize themselves through lesson plans and instructional objectives. The affective, cognitive and psychomotor domains help us to create instructional objectives and maintain a balanced view of the educational process. The following two chapters address knowledge, feelings and skills and their relations to the three domains.

This chapter is incomplete until you participate by designing a demonstration, creating a lesson plan and delivering the demonstration before a peer audience and video camera. This is called microteaching. Using lesson plans developed in your course, you ought to prepare and deliver two-three demonstrations similar to those you will be delivering in your laboratories and workshops in the schools. In this way, you will learn how to present the content you developed. Through the benefits of peer and instructor feedback following the microteaching sessions, you can assess your presentation skills, use of teaching aids and multimedia production, voice and articulation, questioning and feedback style. You will receive the benefits of practice in providing and receiving feedback and critique, and with the benefits of videotapes, you can effectively reflect on your strengths and challenges, and hone in on areas for potential improvement. Reflection on the process of demonstrating provides a context in which to think about your practice in ways that you may not have previously considered. Microteaching allows you to integrate theory with practice, technical applications with environmental and social implications, and technical skills with considerations of gender, racial and special needs.

Microteaching sessions consist of the preparation and delivery of a 5-12 minute lesson that meets specific criteria. For example, the first microteaching activity will require you to conduct a 6 minute demonstration of an application, tool, material or process that will eventually be carried out in a design or technology lab or shop. Choose topics that are appropriate for labs or workshops in schools. Your demonstration will be videotaped so that your teaching can be analyzed in a small group session afterwards. In the small group session you will meet with 3-6 of your peers and will receive feedback on your teaching and provide feedback to the other group members on theirs. You will also prepare a brief (1/2 page) written reflection on your lesson along with an assessment of several aspects of your teaching that you need to work on in the future. In subsequent microteaching sessions you will repeat this process, adding your new video footage and your analysis to that which was completed earlier. You and your instructors will be expecting to see continued growth through the term as well as progress on aspects of your teaching that were identified as requiring more work. The intention of the microteaching sessions is to help you develop artful and logical approaches to demonstrating and presenting in the classrooms, labs and
workshops. This will also provide a tangible way of understanding the importance of instructional organization and planning.

1. Microteaching Exercise: Choose a material, technique, tool, instrument, machine or process to demonstrate a lesson in design and technology. Create the lesson plan, and prepare to deliver an introduction and overview, relevance of the activity, process and conclusion. You will have to do the entire lesson within the allotted time frame. Use overheads, chalkboard, computer, handouts etc. A lesson plan and at least two overhead transparencies, or a power point slide show, are required for each lesson. Adhere to the presentation time indicated and prepare for 2-3 minutes of peer feedback. A clear, cogent, professional demonstration is the goal. Each lesson will be videotaped.

Possible Microteaching Sessions:

1. Microteaching session (5-6 Minute Demonstration of how to use an apparatus, application, tool, or process) • How to use the tool or How to execute a command or series of commands.

2. Microteaching session (6-8 Minute Demonstration w/Presentation of an ecological or social dimension of apparatus, application, tool, machine, or process) • What and why about a specific technology?

3. Microteaching session (8-10 Minute Demonstration of how to reconfigure, repair or use a device, machine, peripheral or power tool w/ emphasis on safety) • How and why to safely do this.

4. Microteaching session (6-8 Minute Demonstration of a mathematical or scientific concept dealing with an apparatus, application, tool, machine or process (integration) • Explain the principles through which this works or operates.

5. Microteaching session (8-10 Minute Demonstration w/Presentation of a design issue related to of apparatus, application, tool, machine, or process) • What are the uses of this application, material or technology in design? How? Why?

6. Microteaching session (7-8 Minute Demonstration w/Presentation of an ethical dimension of apparatus, application, tool, machine or process) • What are the ethical dilemmas and responses to this issue? Why?

Criteria for instructor feedback:

Art and Logic of the lesson: Introduction, presentation, substance, conclusion.

Presentation: Organization, speech, clarity, enthusiasm, engagement with topic.