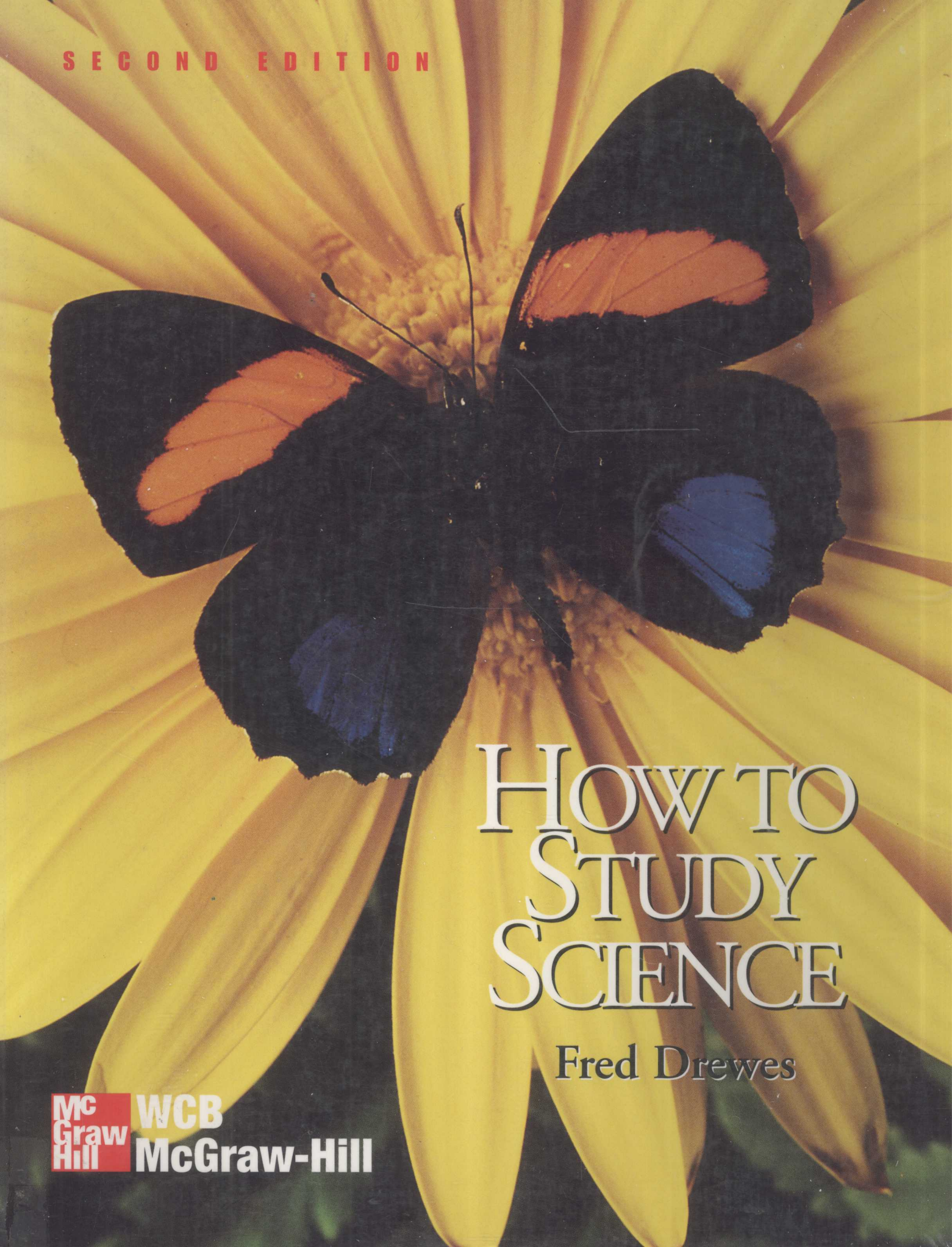
SECOND EDITION



How to Study Science

Fred Drewes

McGraw Hill WCB McGraw-Hill

How to Study Science

Fred Drewes
Suffolk County Community College

WCB McGraw-Hill

Boston, Massachusetts Burr Ridge, Illinois Dubuque, Iowa
Madison, Wisconsin New York, New York San Francisco, California St. Louis, Missouri

During the past few years, students have provided feedback to me about the content and format of this book. Their information helped guide me in this revision. I dedicate this book to the students who shared their efforts with me in the past and to the students who continue to take responsibility to improve their study skills to attain their collegiate goals.

WCB/McGraw-Hill

A Division of The McGraw-Hill Companies

Cover: Digital Stock, Flowers

The credits section for this book begins on page 122 and is considered an extension of the copyright page.

Library of Congress Catalog Card Number: 96–84293

ISBN 0–697–15905–1

Printed in the United States of America

10 9 8 7 6 5 4 3 2

P R E F A C E

To learn science, you must first want to learn it. A teacher can lead you to the subject matter, but cannot make you learn! Successful students have learned how to learn.

If you are uneasy about learning science, *How to Study Science*, second edition, will help you. However, you must incorporate good study skills into your academic routine and behavior. These skills must become second nature to you; you shouldn't have to think about learning to learn. The guide's helpfulness will depend upon your attitude, academic background, and present level of study skills.

Chapters 1 and 2 discuss the study of science and the natures of science courses and college instructors. Becoming familiar with the nature and structure of science courses will help you adapt to the challenge of these courses. This awareness will enable you to determine and control your academic behavior.

Chapter 3 talks about the process of learning and introduces study skills to be used in and out of class. The checklist in this chapter provides a handy inventory of things you can do to help yourself learn.

Chapters 4 and 5 give you guidance to in-class skills. Self-discipline and self-direction are important parts of your study. You must also have good listening skills. In addition, you must be able to take notes and convert them into a learning tool.

Chapters 6 through 12 discuss time management, study sessions, use of a textbook, terms and symbols, figures and their uses, and assignments and reports. All are important topics and these chapters provide details relating study skills to them.

Chapters 13 through 15 discuss writing essays, solving math problems, taking tests, and analyzing results. Written work you complete will be a measure of your ability to apply information you have learned. Chapter 15 suggests that you analyze results to identify the types of errors you make. This information should help guide your adoption and development of new study skills that will improve your learning and retention of information.

Each chapter has a written exercise to emphasize and reinforce the information and study skills discussed in the chapter. The guide's helpfulness will be increased if you complete these exercises. Compare your answers with those given in Appendix B. In a sense, the saying "No pain, no gain" is true.

This guide can be used in several ways. Individual students may use this book to enhance their study skills, or instructors may use it as a text or supplement for orientation classes, college seminars, or science courses. I believe the whole book should be reviewed prior to or within the first few weeks of the semester. Specific chapters should be referred to later as a need arises. For instance, early in the semester you should know that the book contains information about lab reports, graphs, and writing essays. Later, as you get involved in doing these things, you can refer to specific content in the book that will help you complete the task. For example, it is important to know about preparation for tests from the beginning, but specific test-taking skills might be studied the week before the test.

At Suffolk County Community College I use this book in two ways. First, I teach a noncredit "How to Study Biology" mini-course. This mini-course is offered the week before classes begin to all students who have registered for introductory biology courses. Using the workshop format, three hours per day for three days, I discuss information in the book and provide practice using the skills. Thus, students who choose to enroll in the noncredit mini-course begin to learn how to learn before the semester begins.

Second, I also recommend the book to students in my own biology classes to help improve their study skills. I incorporate suggestions for studying into the course and refer to *How to Study Science*. My hope is that students will develop and use these skills to learn biology.

I'd like to thank students who have been kind enough to provide feedback on the content value of this book. Thanks also go to Michael W. Orick, Schoolcraft College; John Morelli, Rochester Institute of Technology; Judy Dacus, Frederick Community College for their helpful reviews and critiques.

I hope you will find this book helpful. I would appreciate any feedback you care to give. Thanks.

Fred Drewes
Suffolk County Community College

CONTENTS

*These elements appear in every chapter.

C H A P T E R

1

The Study of Science

Objectives

When you have read this chapter, you will be able to answer these questions:

1. What is science?
2. How do scientists use the scientific method?
3. What is the connection between science and technology?
4. Why should I study science?
5. Am I ready to study science?
6. What does my attitude have to do with studying science?
7. What is the reward for studying science?

The sun shines. Clouds appear, and rain falls. Water soaks into the ground or runs off into rivers. Rock is eroded, and sediments are moved. Plants absorb water, carbon dioxide, and light. Animals consume the plants and scurry about claiming territory. All organisms struggle to survive.

What causes the sun to shine? Why does rain fall? What is water? Rock? A plant? An animal? A human being? Where did they all come from? Why do things work the way they do? One question leads to another; that is the nature of science.

What Is Science?

Science is the discipline that studies the quantitative as well as the qualitative nature of the world. Scientists attempt to answer what, when, why, where, and how questions; they try to understand and describe the universe.

To seek answers to questions, the **scientific method** blends creative thinking, critical thinking, and problem-solving techniques. First, scientists make **observations.** These then lead to the statement of a **problem** or the asking of a **question.** Scientists formulate **hypothetical** answers to the questions that have been asked about their **observations. Experiments** are then designed and conducted to test the hypothetical answers. The experimenters establish **procedures** to gather quantitative and qualitative **data.** This data is **analyzed,** and a **conclusion** is drawn that supports, modifies, or refutes the hypothetical answer. After repeated experiments lead to the same conclusions, **theories** are formulated. These theories can then be used to explain past observations and to predict answers to new questions.

Scientists and students of science find science fascinating, exciting, and fulfilling. When they discover something new or solve a befuddling problem, they may shout "Beautiful!" "Great!" or "Hot damn!" They may even fly some high fives.

Science and its quantification of the "stuff" of the universe started about 500 years ago. In the past 100 years, an explosion of scientific inquiry has taken place. Most recently, computers—developed from discoveries made by scientists—are being used to investigate the details of the universe even faster and further away. The inquiry is taking us from the infinitely detailed code of life's all-important hereditary molecule (DNA) to the vastness of space.

Scientific knowledge is neutral; it is neither good nor bad. How we use that knowledge can have desirable or undesirable results. Bacteria and viruses can be grown to produce antibiotics or vaccines. They also can be grown to create biological weapons. Chemists create new and useful molecules, but some molecules turn out to be toxic. Physicists explore the mechanisms of matter and motion, and engineers put this information to use for both farm and war machinery.

Technicians use scientific information to make all manner of tools, machines, and buildings—the things we call modern **technology.** Technology is not only an important part of our day-to-day life, it also helps scientists extend their knowledge and understanding (figure 1.1). Thus, we depend on both science and technology to maintain our modern lifestyle.

Why Study Science?

Since we humans are so dependent on science and technology, we should have some basic knowledge of the concepts and content of science. In addition, we should be able to use scientific information and the scientific method to make decisions about how to conduct our lives.

Figure 1.1 The sciences of molecular genetics and medical physiology blend with the technology of gene transfer to enable doctors to give gene therapy.

The welfare of any modern, technological country depends on an informed and active citizenry. Knowledge and communication of science are vital to national issues such as abortion, fetal tissue research, and the future use of genetic code information. Energy use, the production of pollutants, and our desire for greater material wealth are set to converge and create global environmental problems. How can we conduct our lives to resolve or manage these problems? What new legislation should be supported or opposed?

Your Study of Science

When we are young, we ask all sorts of questions: What? When? Why? Where? How? Later on, many people stop asking questions; they seemingly stop "wanting to know." But to learn science, you must be ready to ask questions and seek answers.

The learning process applies to all aspects of life, not just school. For example, as a hobby, many children memorize fantastic amounts of data about players from baseball cards. As they mature, some of those youngsters go on to study the strategy of the game. Those individuals have progressed from memorizing to thinking abstractly about concepts—and they have enjoyed doing it! The hobbyist's learning is *self-directed* and *self-disciplined.* Motivation comes from within the person. If this effort could be bottled and sold, it would make millions.

To be successful in your study of science, you must be able to do the following:

1. Identify and locate information to be learned.
2. Organize the information so it can be learned efficiently and effectively.
3. Interpret the spoken, written, and symbolic language of science.
4. Use and apply the information you have learned.

When you study science, you will **memorize** concrete bits of information and learn to **comprehend** complex relationships. This combination of memorizing and comprehension will lead to **understanding.** If you can motivate yourself to learn the material in your science course, you will have it made.

Some students have the skills necessary to do well. Other students have not developed, or have forgotten, the study skills they need to succeed. Still other students lack the self-confidence to study science; they have "science anxiety."

Overcoming Science Anxiety

Some students become so anxious about studying science or taking a test that "their minds go blank" or "they can't think straight." Others feel the course required by the curriculum will make or break their college careers. If you are extremely anxious about a science course, there are at least three things you can do.

The first is to visit a counselor on campus to help you deal with your real but inhibiting anxiety. Many colleges have counselors who have specialized in anxiety and stress management. Visiting them could help.

The second thing to do is to concentrate on *learning the skills* and *taking the time* necessary to study science. Do not dwell on the reasons why you can't study, can't learn, or can't take tests. This negative "whirlpool" can consume excessive time and energy. Practice and use the study methods recommended in this book. Begin to prepare for tests on the first day of class. Realize that if you do this conscientiously, you should feel confident about your ability to pass the course. If you learn from the first test, as suggested in chapter 15, you should do better with each passing week and each succeeding test.

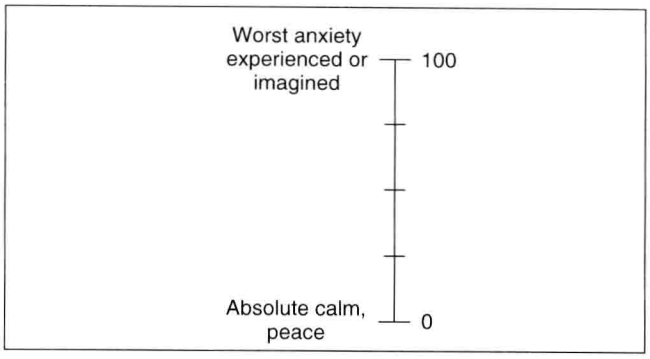
A third way to help overcome science anxiety is to seek out or form a **supportive study group.** Find other people who want to succeed in their courses. Studying together does work because it gives you the opportunity to teach each other. It also can be fun.

From time to time, you might need a "crutch" to help reduce your level of anxiety. In 1966, Joseph Wolpe devised the Subjective Unit of Disturbance Scale (SUDS) to help people gauge and reduce their anxiety. Here's how it works:

Using the Subjective Unit of Disturbance Scale (SUDS)

Think of two experiences or states of mind that yield two extremely different levels of anxiety. The first is an anxiety-free state, a scene that yields a peaceful frame of mind. Sitting by a shaded, quiet brook or watching a butterfly peacefully feeding on nectar are examples of this mindset. Register this as "0" on the SUDS scale. Next, think of the most anxious experience or scene that you can imagine . . . for example, a dark alley with a charging, snarling

mad dog racing at you. This "worst of worst" experience should be "100" on the SUDS:



From this point on, you can evaluate your anxiety level on your SUDS meter during class, while studying for tests, or just before tests. Are you closer to 0 or 100? Once you do this, you can take measures to reduce your level of anxiety. Think of the brook or the butterfly. Imagine the flowing water or the flittering flight of the butterfly. Learn to think less-anxious thoughts, and use your SUDS meter to gauge your anxiety. If it is too high, then take steps to reduce it. Motivate yourself to act positively. This might help reduce your science anxiety enough to give you the confidence you need.

There is a risk involved in studying science or any other subject. A *positive self-image* and feeling of *self-worth* will make you feel confident that the risks are really relatively small. This is true only if you learn how to learn, study, and be active in learning.

Meeting the Prerequisites

The college catalog lists the types of courses you must have as prerequisites before studying a science course, but more fundamental prerequisites must also be considered. For example, you need to have a clear **personal goal** and the motivation to become **actively involved** in learning. You must also be willing to make the *effort* to study six (6) to twelve (12) hours a week. How much time you spend studying depends upon your goals, commitment, job requirements, social life, and health. Add to these the requirements of being able to read at the 11th grade level, having good study skills, and possessing good writing skills. With these prerequisites plus an understanding of elementary algebra, you will be prepared to take an introductory science course. In addition, students studying in allied health or science major courses need intermediate algebra, college algebra, or calculus (figure 1.2).

As you begin a science course, you should evaluate yourself to see if you have the foundation to succeed in the course. If your analysis indicates that you have the prerequisites, you can feel confident about taking the course. On the other hand, if your analysis indicates various deficiencies, you must either strengthen your prerequisites before taking the course or cope with the difficulties and frustrations you will experience. A college degree is worth achieving. The study of science is one of the basic requirements for such a degree. You can study science successfully and earn your degree if you have proper prerequisites.

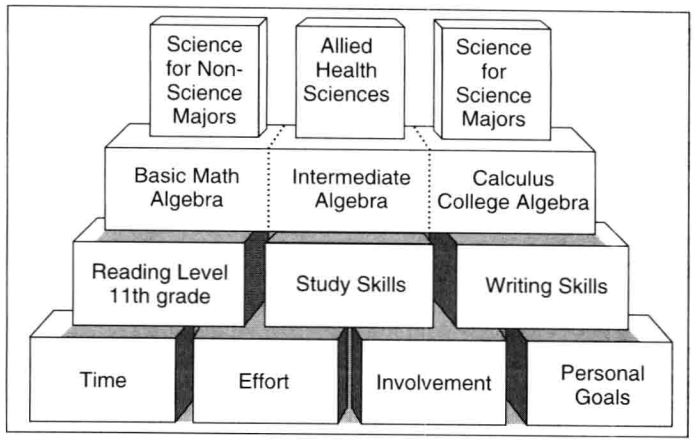


Figure 1.2 Seven "blocks" and an understanding of mathematics are the prerequisites needed to learn science.

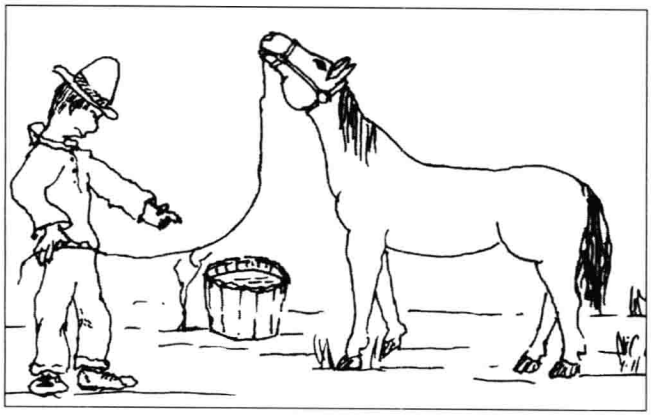


Figure 1.3 "You can lead a horse to water but you can't make him drink it." This saying and cartoon relate to you, the subject, and your instructor.

If you think you need help in learning the content of a science course, this book is designed for you. The recommendations are intended to be practical and valuable. They have been gleaned from personal experience, observing and interacting with successful and unsuccessful college students, and reviewing other study skill guides.

Successful students work hard, concentrate on the task at hand, and have an organized system of study skills and a strong foundation of basic skills in reading, writing, and mathematics. With regular practice and application of these study skills, you should succeed too!

College instructors assume you are in college to learn. They will lead you to the information, but they don't feel it is their task to get you to learn (figure 1.3).

The Rewards of Studying

A high grade, a high class standing, a scholarship, recognition, satisfaction of a natural curiosity, and a need to feel competent blend together in a complex way to be your reward for completing a science course. If you are highly motivated, then studying and learning will occur and rewards will be gained. If you are poorly motivated, the amount of studying and learning will be scanty, and rewards will not materialize. In fact, frustration will replace satisfaction.

You probably do not view the study of a college science course as a hobby. After all, college science courses are requirements. Because courses are requirements, some of the joys a hobbyist experiences while learning might be absent. Nevertheless, try to cultivate an "I can" attitude and an interest in learning. Introductory science courses are challenging, and it is gratifying to do well in them. The study skills recommended in this book will help you.

Review

1. The study of science attempts to define or describe various parts of the universe.
2. The scientific method is an organized system of study to answer questions or solve problems.
3. Humans apply scientific information to develop modern technology.
4. Citizens of technological countries should have an understanding of science and the scientific method.
5. Students of science must be able to ask questions and define problems. They then must be able to devise ways to answer the questions or solve the problems.
6. A person's attitude and academic background influence the way in which they learn and how well they succeed.
7. Learning science can be a rewarding experience.

Exercise 1

Name _____

Date _____

The Study of Science

1a. Climate for Learning—Self Evaluation
Your ability to succeed in college science courses is related to the climate in which you are trying to learn. Evaluate your "Climate for Learning" by rating yourself in response to the following statements. Use a scale of 1 (low) to 10 (high) for each statement. Record your evaluation in the spaces provided.

Self-Evaluation

_____ 1. I have a positive attitude toward learning in general.

_____ 2. I have a positive attitude toward learning science.

_____ 3. I have a home or dorm environment that makes studying comfortable and possible.

_____ 4. I have the support and encouragement of my family and peers.

_____ 5. I have the motivation necessary to learn science.

_____ 6. I have 6–12 hours per week available to study science.

_____ 7. I can manage my time to complete the things I must do.

_____ 8. I have good note-taking skills.

_____ 9. I have the skill to read and comprehend scientific information.

_____10. I have good observational and problem-solving skills.

_____11. I have the competency to read, write, and do mathematics at college level.

_____12. I feel good about myself and have confidence in my abilities.

_____13. I have the ability to concentrate on a topic for long periods of time.

_____14. I have the self-discipline to stick to the task at hand and to not be side-tracked by distractions.

1b. Improving Your Climate for Learning
If you rated yourself from 1 to 6 on any of the statements in section 1a, those areas need attention. Select three conditions you think you can change and record two actions you can take to improve your climate for learning.

1. Condition:
_____
_____
Action
a. _____
b. _____

2. Condition:
_____
_____
Action
a. _____
b. _____

3. Condition:
_____
Action
a. _____
b. _____

2. What do you think of the statement, "Scientific knowledge is neutral"?
_____
_____
_____
_____

3. Define and give examples of qualitative and quantitative data. (Use your dictionary if you have trouble defining these terms.)

4. In figure 1.3, what do you think the horse, the bucket, and the cowboy represent?

5. What is the attitude of the cowboy in figure 1.3? What data in the figure supports your view?

6. Compose an essay using the following terms: observation, problem, hypothesis, experiment, procedure, data, analysis, conclusion.

7. How does the discussion of the scientific method in your textbook compare to the brief statement in this chapter? (See table 13.1 Characteristics of Essay Tests)

8. What is SUDS? Practice imagining the scale suggested by Joseph Wolpe.

C H A P T E R

2

Science Classes and Instructors

Objectives

When you have read this chapter, you will be able to answer these questions:

1. What are the components of most science courses?
2. How might lecture information be organized?
3. What are the different teaching styles of instructors, and how can I adapt my learning style to each?
4. What is a course syllabus, and how should I use it?
5. Other than class time, is there anything else to help me learn the information?
6. Should I ask questions, and does class participation count?

Your life experience might not give you a clue as to what a science course is about. Thus, you may think taking a science course is riskier than taking other college courses. Part of the challenge is not knowing the organization of a science course or understanding the style or expectations of the instructors.

How Are Science Courses Organized?

In most colleges, science is taught in a traditional way. Introductory science courses are made up of lecture, laboratory, and in some cases, recitation classes (figure 2.1). Two or three lectures will meet for a total of two and a half to three hours each week. A laboratory period is either a two- or three-hour block of time. A recitation meets for about an hour. The lecture class size may vary from 20 to several hundred students. Laboratory classes also vary in size but generally have one instructor for 15 to 25 students.

Lecture

The bulk of the course content is presented during the lecture by instructors. Most instructors write key ideas, concepts, or brief outlines on the board. The main body of the lecture discusses the relationships between these recorded points. *Notes* must be taken on the *discussion* as well as on what is recorded on the *board*. Instructors also use a variety of visual aids. Because many book publishers provide transparencies as teaching aids, transparencies are probably the most frequently used visual aid. Be sure to record the figure number and make notes on the information described in the transparency. This is a challenging skill to learn, and hints for note-taking are discussed in chapter 5.

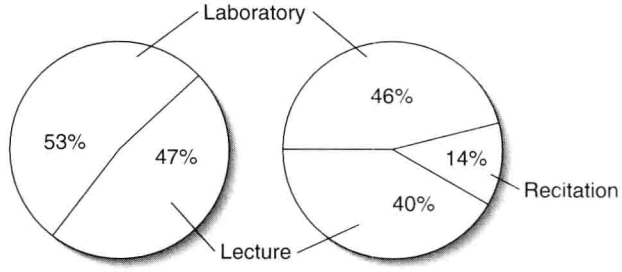


Figure 2.1 A science course. (a) Pie graph indicates that lecture occupies 47% and laboratory 53% of total course time. (b) If the course includes the three types of classes, recitation occupies 14%, lecture 40%, and laboratory 46% of course time.

Instructors organize their lectures in a number of ways. It will help you listen, take notes, and learn if you recognize the patterns your instructor uses. The following patterns have been organized in outline form. (Creating an **outline** is an important study skill. Note the numbering and indentations of the outline.)

Types of Lecture Organization[1]

A. Chronological (in time)
   1. Sequence in which subject was seen or discussed
      Example: Study of the atom
   2. Sequence in which the subject should be seen or discussed

[1]Adapted from *Study Smarts* by Judi Kesselman-Turkel and Franklynn Peterson (Contemporary Books, Inc. 1981).

Example: A laboratory experiment or the solution to a problem

3. From cause to effect
   Example: Radiation causing mutations or cancer

B. Spatial
   1. What is next to what
      Example: Different strata of rock in the Grand Canyon
   2. What is connected to what
      Example: Description of the digestive system

C. From general to specific
   1. Theoretical to practical
      Example: F = md, Work of pulley systems
   2. General topic to examples
      Example: Function and nature of enzymes or catalysts to discussion of pepsin or platinum

D. From least to most (or most to least)
   1. Small to large
      Example: Atom to biosphere
   2. Weak to strong
      Example: Chemical bonding
   3. Simple to complex
      Example: Discussion of tissues or the structure of atoms
   4. Least controversial to more controversial
      Example: Discussion of origin of the universe

Laboratory

Laboratories are meant to provide hands-on experience with the process of science. The information in the lab might or might not parallel that in the lecture, and the laboratory instructors might or might not be the same as the lecturer. Graduate students are frequently hired to teach laboratories. Some laboratory instructors might just sit at the desk and answer questions, assuming that you are doing the work and understanding the material. Other instructors move about to check on your progress and participation. It is up to you to take the initiative to become involved in the lab work. Don't be afraid to call upon instructors for help. It is their job to answer your questions. However, it is a bit embarrassing to ask questions if you have not properly prepared for the class (see chapter 7, Preview for Laboratory).

You will use laboratory manuals to guide your lab study. Don't sit back and watch your lab partners do all the work. If you do, you will find they will learn the material more easily than you will. Sometimes students with different styles of study and work have trouble working in the same laboratory group. This in turn could interfere with learning. If this problem arises for you, try to resolve it before it interferes with your learning.

It is important to take notes on what is covered in the laboratory class. If the instructor adds or clarifies information before you begin work on the lab, take notes on what is said!

Laboratory Books and Reports

Some science courses might require you to record procedures and data in bound lab notebooks and to write laboratory reports (see chapter 12). The actual requirements vary from college to college. You should be sure to know what your instructor's requirements are and adhere to them. Careful and organized record-keeping is part of the laboratory exercise. These requirements are reviewed during the first laboratory period. If the requirements are not clear, ask questions. Clarifying what is expected is not stupid; it is smart. The following are things to keep in mind:

- Observations and data should be recorded neatly.
- Graphs, tables, and diagrams should be clearly labeled with captions and units.
- All calculations must be shown.
- Incorrect data or calculations should be crossed out with one line. Don't tear out pages or blot out work.
- Written work (analysis and conclusions) should be concise.
- Hand in work on time; don't let work pile up.

Recitation

A recitation class is devoted to problem-solving or clarifying information from lecture and lab. Instructors will give assignments one week and review them the next. Students might be asked to demonstrate how they solved the assigned problems. Some instructors give quizzes on lecture or laboratory information during recitation periods. These activities reinforce the content of the lecture and laboratory.

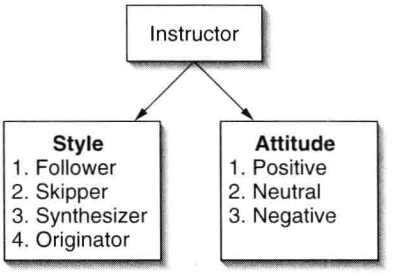


Figure 2.2 Instructors have different styles and attitudes.

Types of Instructors

Your instructor's style influences the way you listen, take notes, study, and learn. An instructor's style of teaching can be categorized into one of four groups (figure 2.2): the follower, the skipper, the synthesizer, or the originator. During the semester, your instructor might shift from one style to another.

Here are definitions of the four instructor "styles" and suggestions for ways you as a student can adapt to them:

1. **Follower** Follows the content of a textbook chapter-by-chapter, page-by-page, example-by-example.
   a. Bring your book to class so you can check the sections of material covered. You should take notes on any additions or clarifications of text material.
   b. You will find it easy to preview material before attending lectures. Your textbook with the checked material and notes are your guides to the material to be studied and learned.
2. **Skipper** Follows the content of a textbook but skips around from one part of the book to another.
   a. The skipper's content might or might not be easy to trace in the textbook. It's important that you take notes to keep track of exactly what was covered and in what sequence.
   b. You will find it easy to preview material before attending lecture, because assigned readings are probably given. For study purposes, your lecture notes are as important as the text.
3. **Synthesizer** This lecture style draws on different parts of the textbook and on outside resources. All is synthesized into the lecturer's view of the science course. This view might introduce the same material as the text but in a completely different way.
   a. Lecture notes are very important because the topics cannot be quickly found in the text. Study of the notes and of similar information in the text helps solidify learning. Looking up key terms from lecture in the index of the textbook will help you locate information in your text corresponding to the lecture notes.
   b. This type of presentation will be difficult to preview unless the instructor indicates what areas will be covered in the lectures to come.
4. **Originator** This type of instructor presents information from a variety of sources, much of it originating from recent publications. Collections of readings might be important, rather than a single text. Independent study and research are expected.
   a. Note-taking is important as is study of assigned outside readings.
   b. If a textbook is recommended, you will probably use it as a reference.

Occasionally an instructor will assume the role of a **facilitator** in the learning process. The instructor helps students define the topics to be learned. Groups of students assume the responsibility of researching and mastering the topics. As this is accomplished, students then take on the role of teacher and teach each other and the entire class. This **collaborative learning** develops responsible academic and work attitudes and shifts educational responsibility to the learner (student). It is a nontraditional, but exciting, way of learning. However, instructors and students "born and raised" to traditional education are uncomfortable with this mode of learning.

All instructors also have a certain *attitude* about their jobs as teachers and about your job as a student. Some instructors display a very positive attitude toward teaching, an enthusiastic interest in the subject matter, and a sincere concern about whether or not you learn the subject. Other instructors are purely dispensers of information and seem to have a very neutral attitude toward their job, the subject matter, and you. Still other instructors are negative individuals; they are dissatisfied with their jobs and would rather be doing something else.

You, as a student, have a certain *learning style*. You also have a certain set of attitudes that influence your learning. Your own style of learning might mesh well with your instructor's style of teaching, but if it doesn't, you will have to take steps to cope with the situation. It is your job to learn the material; the college educational system leaves it up to you to comprehend the subject matter. Some instructors make the material seem relatively easy and interesting; other instructors are sources of great frustration.

Course Syllabus and Requirements

Most instructors hand out a course syllabus on the first day of class. As the instructor reviews the syllabus, have a pencil or pen in hand, follow the review, and take notes. Reread the syllabus as your first "homework" assignment. Compare the course outline in the syllabus to the table of contents in your textbook. Recite the topics you will study and reaffirm the requirements for the course. Place the syllabus in your notebook.

The syllabus generally includes the following:

1. Course objectives
2. Title of required textbook and manual
3. Statement of teaching approach
4. Course outline
5. Reading assignments
6. Grading method and values of tests, assignments, and other work
7. Attendance policy
8. Makeup procedures
9. Tutoring center information
10. Policy on course withdrawal

Questions and Participation

If you are an active learner, questions will come to mind as you listen in class or as you study. Don't stifle the question. Raise your hand and ask the question or write it down in the question column on the left-hand page of your notebook (see chapter 5). A questioning mind will help define what must be learned. If, for some reason, questions are not encouraged in lecture, be sure to record them in your notes and seek out the answers after class.

Participation in class may or may not be a factor in determining your grade. Just because you attend class does not mean you will pass the course. The course syllabus will give information about the role of class participation and attendance.

Grades

Your final grade will be based on an average of test scores and graded assignments. The amount of effort and study time, class participation, and extra projects may be, but seldom are, part of the final grade (see chapters 12 and 13).

You will find that instructors expect you to find out what you missed if you were absent. Your absence does not excuse you from having to learn the material. Exchange telephone numbers with a few classmates so you can call them if you must miss class.

Where to Get Help

Instructor's Office Hours

Instructors generally are required to hold office hours. If you have questions about the course content or requirements, make an appointment to see the instructor. Before the appointment, write down the difficulties or questions you have. This will demonstrate to the instructor that you've made an attempt to analyze your concerns. A prepared problems list will lead to an effective and efficient meeting.

Learning Centers

Most colleges have organized tutoring services to assist you. Find out if a learning center for the science course you are taking is available. Tutors are usually graduate or undergraduate students qualified to help guide your study. As with instructors, their level of skill will vary. Generate questions before you seek their help. The questions will be a valuable way to start a tutoring session. In addition, you or your study group might find the center a good place to study.

Books, Laboratory Manuals, Study Guides, and Computer Programs

A textbook is a primary source of information to complement the presentation of the instructor. Your job as a student is to use the information in the textbook to reinforce the content of the lectures. The laboratory manual will describe the specific exercises you will perform. This manual will contain the bulk of the information you will need to learn in the laboratories. Most publishers offer study guides to help learn the information in the textbook.

You should listen to your instructor's recommendation concerning the use of the study guides and other references or study aids. Some guides are computerized, and through interactive programs, lead you through the information to be learned. In some cases, supplemental materials are presented via computer and CD-ROM. The use of computers as teaching and learning tools varies tremendously.

Most textbooks, manuals, study guides, and computer programs contain more information than will be taught in the science course. An important study skill is learning how to identify the content you are expected to learn.

You will be presented with scientific information in a number of different ways. You are expected to learn the material and then demonstrate your comprehension of it. Your responses to tests and written reports result in a grade. You will develop certain feelings about the overall course of study. In the end, you will judge your overall level of satisfaction.

Review

1. Introductory science courses have lecture and laboratory classes each week. In addition to lecture and lab, some science courses also have a recitation class each week.
2. An instructor might be a follower, a skipper, a synthesizer, an originator, or any combination of these. How you take notes and how you study are influenced by the instructor's style.
3. Instructors have attitudes that influence their effectiveness as teachers. It is your job to comprehend course content regardless of the instructor's teaching style and attitude.
4. A course syllabus describes the course requirements and content.
5. The grades in the science course are based on your performance on various tests and graded assignments.
6. Use instructors and tutors to help you answer questions you can't resolve. Instructors and tutors are paid to help you.

Exercise 2

Name _____

Date _____

Science Classes and Instructors

1. List your concerns about taking a science course. Compare your list with that of one or two other students. Discuss the concerns.

_____

_____

_____

_____

2. Analyze the labels and arrows in the figure at the bottom of this page. Compose an essay using the content of the figure. Compare the essay you have written with the essays other students have written.

_____

_____

_____

_____

_____

_____

_____

_____

_____

3. What kind of graph appears in figure 2.1? Explain what the graph represents.

_____

_____

_____

_____

4. List the four styles of instructors you might encounter. Which of these styles do you think will match your style of learning?

a. _____ c. _____

b. _____ d. _____

5. If you think the style of your instructor will clash with your style of learning, what three actions will you take to learn the science material presented?

a. _____

b. _____

c. _____

6. This chapter discussed a number of ways instructors might organize their lectures.

a. In what format was "Types of Lecture Organization" presented in this chapter?

_____