Introduction

Great Science Adventures is a unique, highly effective program that is easy to use for teachers as well as students. This book contains 24 lessons. The concepts to be taught are clearly listed at the top of each lesson. Activities, questions, clear directions, and pictures are included to help facilitate learning. Each lesson will take one to three days to complete.

This program utilizes highly effective methods of learning. Students not only gain knowledge of basic science concepts, but also learn how to apply them.

Specially designed *3D Graphic Organizers* are included for use with the lessons. These organizers review the science concepts while adding to your students' understanding and retention of the subject matter.

This *Great Science Adventures* book is divided into four parts:

1) Following this *Introduction* you will find the *How to Use This Program* section. It contains all the information you need to make the program successful. The *How to Use This Program* section also contains instructions for Dinah Zike's *3D Graphic Organizers*. Please take the time to learn the terms and instructions for these learning manipulatives.

2) In the *Teacher's Section,* the numbered lessons include a list of the science concepts to be taught, simple to complex vocabulary words, and activities that reinforce the science concepts. Each activity includes a list of materials needed, directions, pictures, questions, written assignments, and other helpful information for the teacher.

   The *Teacher's Section* also includes enrichment activities, entitled *Experiences, Investigations, and Research.* Alternative assessment suggestions are found at the end of the *Teacher's Section.*

3) The *Lots of Science Library Books* are next. These books are numbered to correlate with the lessons. Each *Lots of Science Library Book* will cover all the concepts included in its corresponding lesson. You may read the *LSLB* books to your students, ask them to read the books on their own, or make the books available as research materials. Covers for the books are found at the beginning of the *LSLB* section. (Common Sense Press grants permission for you to photocopy the *Lots of Science Library Books* pages and covers for your students.)

4) *Graphics Pages,* also listed by lesson numbers, provide pictures and graphics that can be used with the activities. They can be duplicated and used on student–made manipulatives, or students may draw their own illustrations. The *Investigative Loop* at the front of this section may be photocopied, as well. (Common Sense Press grants permission for you to photocopy the *Graphics Pages* for your students.)

How to Use This Program

This program can be used in a single–level classroom, multilevel classroom, homeschool, co–op group, or science club. Everything you need for a complete space study is included in this book. Intermediate students will need access to basic reference materials.

Take the time to read the entire *How to Use this Program* section and become familiar with the sections of this book described in the *Introduction.*

Begin a lesson by reading the *Teacher Pages* for that lesson. Choose the vocabulary words for each student and the activities to complete. Collect the materials you need for these activities.

Introduce each lesson with its corresponding *Lots of Science Library Book* by reading it aloud or asking a student to read it. (The *Lots of Science Library Books* are located after the *Teacher's Section* in this book.)

Discuss the concepts presented in the *Lots of Science Library Book,* focusing on the ones listed in your *Teacher's Section.*

Follow the directions for the activities you have chosen.

How to Use the Multilevel Approach

The lessons in this book include basic content appropriate for grades K–8 at different mastery levels. For example, throughout the teaching process, a first grader will be exposed to a lot of information but would not be expected to retain all of it. In the same lesson, a sixth–grade student will learn all the steps of the process, be able to communicate them in writing, and be able to apply that information to different situations.

In the *Lots of Science Library Books,* the words written in larger type are for all students. The words in smaller type are for upper level students and include more scientific details about the basic content, as well as interesting facts for older learners.

In the activity sections, icons are used to designate the levels of specific writing assignments.

This icon ✎ indicates the Beginning level, which includes the nonreading or early reading student. This level applies mainly to kindergarten and first grade students.

This icon ✎✎ is used for the Primary level. It includes the reading student who is still working to be a fluent reader. This level is designed primarily for second and third graders.

This icon ✎✎✎ denotes the Intermediate level, or fluent reader. This level of activities will usually apply to fourth through eighth grade students.

If you are working with a student in seventh or eighth grade, we recommend using the assignments for the Intermediate level, plus at least one *Experiences, Investigations, and Research* activity per lesson.

No matter what grade level your students are working on, use a level of written work that is appropriate for their reading and writing abilities. It is good for students to review data they already know, learn new data and concepts, and be exposed to advanced information and processes.

Vocabulary Words

Each lesson lists vocabulary words that are used in the content of the lesson. Some of these words will be "too easy" for your students, some will be "too hard," and others will be "just right." The "too easy" words will be used automatically during independent writing assignments. Words that are "too hard" can be used during discussion times. Words that are "just right" can be studied by definition, usage, and spelling. Encourage your students to use these words in their own writing and speaking.

You can encourage beginning students to use their vocabulary words as you reinforce reading instruction and enhance discussions about the topic, and as words to be copied in cooperative, or teacher guided, writing.

Primary and Intermediate students can make a Vocabulary Book for new words. Instructions for making a Vocabulary Book are found on page 3. The Vocabulary Book will contain the word definitions and sentences composed by the student for each word. Students should also be expected to use their vocabulary words in discussions and independent writing assignments. A vocabulary word with an asterisk (*) next to it is designated for Intermediate students only.

Using 3D Graphic Organizers

The *3D Graphic Organizers* provide a format for students of all levels to conceptualize, analyze, review, and apply the concepts of the lesson. The *3D Graphic Organizers* take complicated information and break it down into visual parts so students can better understand the concepts. Most *3D Graphic Organizers* involve writing about the subject matter. Although the content for the levels will generally be the same, assignments and expectations for the levels will vary.

Beginning students may dictate or copy one or two "clue" words about the topic. These students will use the written clues to verbally communicate the science concept. The teacher should provide various ways for the students to restate the concept. This will reinforce the science concept and encourage the students in their reading and higher order thinking skills.

Primary students may write or copy one or two "clue" words and a sentence about the topic. The teacher should encourage students to use vocabulary words when writing these sentences. As students read their sentences and discuss them, they will reinforce the science concept, increasing their fluency in reading, and higher order thinking skills.

Intermediate students may write several sentences or a paragraph about the topic. These students are also encouraged to use reference materials to expand their knowledge of the subject. As tasks are completed, students enhance their abilities to locate information, read for content, compose sentences and paragraphs, and increase vocabulary. Encourage these students to use the vocabulary words in a context that indicates understanding of the words' meanings.

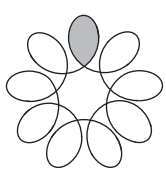
Illustrations for the *3D Graphic Organizers* are found on the *Graphics Pages* and are labeled by the lesson number and a letter, such as 5–A. Your students may use these graphics to draw their own pictures, or cut out and glue them directly on their work.

Several of the *3D Graphic Organizers* will be used over a series of lessons. For this reason, you will need a storage system for each student's *3D Graphic Organizers.* A pocket folder or a reclosable plastic bag works well. See page 1 for more information on storing materials.

Investigative Loop™

The *Investigative Loop* is used throughout *Great Science Adventures* to ensure that your labs are effective and practical. Labs give students a context for the application of their science lessons, so that they begin to take ownership of the concepts, increasing understanding as well as retention.

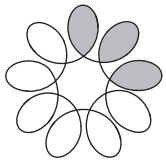
The *Investigative Loop* can be used in any lab. The steps are easy to follow, user friendly, and flexible.



Each *Investigative Loop* begins with a **Question or Concept.** If the lab is designed to answer a question, use a question in this phase. For example, the question could be: "How do Saturn and Earth compare in density?" Since the activity for this lab will show the density of two different objects, a question is the best way to begin this *Investigative Loop*.

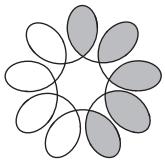
If the lab is designed to demonstrate a concept, use a concept statement in this phase, such as: "The Moon reflects the light of the Sun." The lab will demonstrate that fact to the students.

After the **Question or Concept** is formulated, the next phase of the *Investigative Loop* is Research and/or Predictions. Research gives students a foundation for the lab. Having researched the question or concept, students enter the lab with a basis for understanding what they observe. Predictions are best used when the first phase is a question. Predictions can be in the form of a statement, a diagram, or a sequence of events.



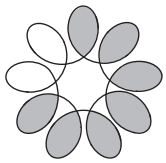
The **Procedure** for the lab follows. This is an explanation of how to set up the lab and any tasks involved in it. A list of materials for the lab may be included in this section or may precede the entire *Investigative Loop*.

Whether the lab is designed to answer a question or demonstrate a concept, the students' **Observations** are of prime importance. Tell the students what they are to focus upon in their observations. The Observation phase will continue until the lab ends.



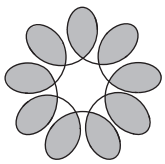
Once observations are made, students must **Record the Data**. Data may be recorded through diagrams or illustrations. Recording quantitative or qualitative observations of the lab is another important activity in this phase. Records may be kept daily for an extended lab or at the beginning and end for a short lab.

Conclusions and/or Applications are completed when the lab ends. Usually the data records will be reviewed before a conclusion can be drawn about the lab. Encourage the students to defend their conclusions by using the data records. Applications are made by using the conclusions to generalize to other situations or by stating how to use the information in daily life.



Next, **Communicate the Conclusions**. This phase is an opportunity for students to be creative. Conclusions can be communicated through a graph, story, report, video, mock radio show, etc. Students may also participate in a group presentation.

Questions that are asked as the activity proceeds are called **Spark Questions.** Questions that the lab sparks in the minds of the students are important to discuss when the lab ends. The lab itself will answer many of these questions, while others may lead to a new *Investigative Loop*. Assign someone to keep a list of all Spark Questions.



One lab naturally leads to another. This begins a new *Investigative Loop*. The phase called **New Loop** is a brainstorming time for narrowing the lab down to a new question or concept. When the new lab has been decided upon, the *Investigative Loop* begins again with a new Question or Concept.

Take the time to teach your students to make qualitative and quantitative observations. Qualitative observations involve recording the color, texture, shape, smell, size (such as small, medium, large), or any words that describe the qualities of an object. Quantitative observations involve using a standard unit of measurement to determine the length, width, weight, mass, or volume of an object.

All students will make a Lab Book, in the form of a Large Question and Answer Book, to record information about the *Investigative Loops*. Instructions are found on page 2. Your students will make a new Lab Book as needed to glue side–by–side to the previous one. Instructions can be found in the *Teacher's Section.*

Predictions, data, and conclusions about the *Investigative Loops* are written under the tabs of the Lab Book.

When you begin an *Investigative Loop*, ask your students to glue or draw the graphic of the experiment on the tab of the Lab Book. Each *Investigative Loop* is labeled with the lesson number and another number. These numbers are also found on the corresponding graphics.

During an *Investigative Loop*, beginning students should be encouraged to discuss their answers to all experiment questions. By discussing the topic, the students will not only learn the science concepts and procedures, but will be able to organize their thinking in a manner that will enhance their writing skills. This discussion time is very important for beginning students and should not be rushed.

After the discussion, work with the students to construct a sentence about the topic. Let them copy the sentence. Students can also write "clue" words to help them remember key points about the experiment and discuss it at a later time.

Primary students should be encouraged to verbalize their answers. By discussing the topic, students will learn the science concepts and procedures and learn to organize their thinking, increasing their ability to use higher–level thinking skills. After the discussion, students can complete the assignment using simple phrases or sentences. Encourage students to share the information they have learned with others, such as parents or friends. This will reinforce the content and skills covered in the lesson.

Even though Intermediate students can write the answers to the lab assignments, the discussion process is very important and should not be skipped. By discussing the experiments, students review the science concepts and procedures as well as organize their thinking for the writing assignments. This allows them to think and write at higher levels. These students should be encouraged to use their vocabulary words in their lab writing assignments.

Design Your Own Experiment

After an *Investigative Loop* is completed, intermediate students have the option to design their own experiments based on that lab. The following procedure should be used for those experiments.

Select a Topic based upon an experience in an *Investigative Loop*, science content, an observation, a high-interest topic, a controversial topic, or a current event.

Discuss the Topic as a class, in student groups, and with knowledgeable professionals.

Read and Research the Topic using the library, the Internet, and hands-on investigations and observations, when possible.

Select a Question that can be investigated and answered using easily obtained reference materials, specimens, and/or chemicals, and make sure that the question selected lends itself to scientific inquiry. Ask specific, focused questions instead of broad, unanswerable questions. Questions might ask "how" something responds, forms, influences, or behaves, or how it is similar or different to something else.

Predict the answer to your question, and be prepared to accept the fact that your prediction might be incorrect or only partially correct. Examine and record all evidence gathered during testing that both confirms and contradicts your prediction.

Design a Testing Procedure that gathers information that can be used to answer your question. Make sure your procedure results in empirical, or measurable, evidence. Don't forget to do the following:

Determine where and how the tests will take place – in a natural (field work) or controlled (lab) setting.

Collect and use tools to gather information and enhance observations. Make accurate measurements. Use calculators and computers when appropriate.

Plan how to document the test procedure and how to communicate and display resulting data.

Identify variables, or things that might prevent the experiment from being "fair." Before beginning, determine which variables have no effect, a slight effect, or a major effect on your experiment. Create a method for controlling these variables.

Conduct the Experiment carefully and record your findings.

Analyze the Question Again. Determine if the evidence obtained and the scientific explanations of the evidence are reasonable based upon what is known, what you have learned, and what scientists and specialists have reported.

Communicate Findings so that others can duplicate the experiment. Include all pertinent research, measurements, observations, controls, variables, graphs, tables, charts, and diagrams. Discuss observations and results with relevant people.

Reanalyze the Problem and if needed, redefine the problem and retest. Or, try to apply what was learned to similar problems and situations.

Ongoing Project: Timeline Book

One of the activities in Lesson 1 is to make an Accordion Book for the Timeline Book. This will be an ongoing project for your students. In each *Lots of Science Library Book,* there is information on Space events. In the Graphics Pages there are identical pictures of these events. Your students will use a copy of these graphics to cut out and glue to the appropriate page in the Timeline Book. After the picture is glued in place, ask your students to draw a line from the picture to the correct time on the line. Encourage students to complete independent research on other events for the Timeline Book.

Ongoing Projects: Problem Solving and Inquiry Scenarios

In the Graphic Pages, following the *Investigative Loop,* you will find the Problem Solving and Inquiry Scenarios. Photocopy this page for your students. Allow the students to work on one or more of these scenarios while completing this study of space. Although designed for intermediate students, the Problem Solving and Inquiry Scenarios are beneficial for all students' participation, if possible.

Experiences, Investigations, and Research

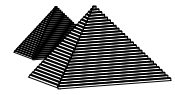
At the end of each lesson in the *Teacher's Section* is a category of activities entitled *Experiences, Investigations, and Research.* These activities expand upon concepts taught in the lesson, provide a foundation for further study of the content, or integrate the study with other disciplines. The following icons are used to identify the type of each activity.


Space

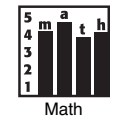

Hands On


Computer


Writing


History


Literature



Math

Research

Cumulative Project

At the end of the program we recommend that students compile a Cumulative Project using the activities they have completed during their course of study. It may include the Investigative Loops, Lab Record Cards, and the *3D Graphic Organizers* on display.

Please do not overlook the Cumulative Project, as it provides immeasurable benefits for your students. Students will review all the content as they create the project. Each student will organize the material in his or her own unique way, thus providing an opportunity for authentic assessment and reinforcing the context in which it was learned. This project creates a format where students can make sense of the whole study in a way that cannot be accomplished otherwise.