

CHAPTER III

THE LIFE SCIENCE COURSE AND THE DESIGN OF LEARNING CONTRACTS

The school system developed the life science curriculum around Virginia's Standards of Learning (SOL). They designated 14 life science Standards of Learning. Students take the Virginia SOL Assessment Test for Science in grade 8. Fifty of the 60 questions come from the SOL for grade 6, grade 7, and grade 8. The reporting categories on the SOL Assessment Test for Science 8 include: Scientific Investigation (11 items, grades 6-7-8); Force, Motion, Energy, and Matter (18 items, grades 6 & 8); Life Systems (7 items, grades 6 & 7); Ecosystems (8 items, grades 6 & 7); and Earth and Space Systems (6 items, grades 6 & 7). The state of Virginia does not exclude any SOL from the Science 8 SOL Assessment Test. Ten additional questions are added as Field Test Items; however, these questions do not factor in the computation of students' scores on the test. Four of the five reporting categories include the grade 7, life science SOL.

The seventh-grade, life science course consisted of six major themes. Their basis came from the Virginia Standards of Learning. By expanding each of the six themes in the learning contract, I, as the teacher-researcher, used a variety of activities to provide for the needs of the mixed-ability level students. One activity involved the students making a collage of living versus non-living organisms using cutouts from magazines. Another activity directed the students to make models of cells using edible shapes. For genetics, the students raised mice in the classroom and logged coloration of offspring using Punnet squares. They made daily observations of their teams' habitat that included fish, turtles, mice, gerbils, lizards, albino frogs or a guinea pig.

The themes for the six learning contracts centered around (1) exploring life, (2) the living cell: structure, function, and processes; (3) cell reproduction, genetics, and changes in living things; (4) classification of living things; (5) the animal kingdom: invertebrates and vertebrates; and (6) ecosystems. These six themes were used in the Science 7 course outline for life science (see Exhibit A).

I used the learning contract previously developed by the teacher I replaced in January 1997 for my case study. The learning contract contained the format I used to create learning contracts for the fourth, fifth, and sixth grading periods in 1997.

Exhibit A
Life Science Course Outline
SCIENCE 7

FIRST SIX WEEKS

EXPLORING LIFE

LIVING THINGS

WHAT IS SCIENCE?

SAFETY IN THE SCIENCE LAB

SCIENTIFIC MEASUREMENT

SECOND SIX WEEKS

THE LIVING CELL

STRUCTURE

FUNCTION

PROCESSES

THIRD SIX WEEKS

CELL REPRODUCTION

GENETICS

CHANGES IN LIVING THINGS

FOURTH SIX WEEKS

CLASSIFICATION OF LIVING THINGS

VIRUSES AND MONERANS

PROTISTS AND FUNGI

SIMPLE AND VASCULAR PLANTS

FIFTH SIX WEEKS

ANIMALS

INVERTEBRATES

VERTEBRATES

SIXTH SIX WEEKS

ECOLOGY

At the start of the new school year in September 1997, I used the original learning contract and later revised and updated the learning activities as needed. Chapter 5 discusses the changes and modifications to the learning contract in greater detail. In this chapter, I discuss the three components of a learning contract.

The Learning Contract Components

On the first day of the new grading period, each student received a learning contract. The learning contract consisted of (a) a letter to students and parents, (b) a Student Progress Sheet, and (c) a list of the life science course objectives with descriptions of the required and additional activities for a grading period of six-weeks (see Figure 1).

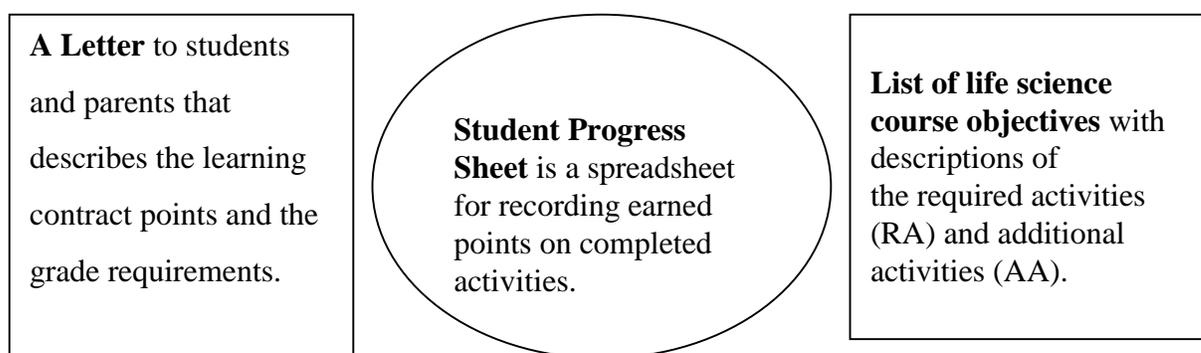


Figure 1. Learning contract components.

I reproduced the three components of the learning contract on colored paper for the students, and they kept them in section 1 of their three-ring, science notebook. The learning contract documented the learning activities for an entire grading period, the points the students earned for each activity, and a record of the contracted grade points.

A Letter to Students and Parents

The letter to the students and parents began with the grading period theme and the life science textbook chapter or chapters. The body of the letter contained six points, which repeated in the same sequence for each grading period (see Exhibit B).

Exhibit B
Learning Contract:
Letter to Students and Parents

SCIENCE 7

NAME _____

DATE _____

CHAPTER 1
EXPLORING LIFE

(Point 1) The following is an agreement between the student and teacher through which the student can choose and earn his or her own grade.

(Point 2) Points can be earned by completing required activities; tests on an activity, objective, and/or chapter /unit test; and completing additional activities. The total number of points earned on all of the above plus an evaluation of the student's work style and a completed student progress sheet will determine the final grade.

(Point 3) All required activities (RA) should be done in order as they are assigned. The student at his/her own pace according to the chosen grade can do Additional Activities (AA). However, some AA must be turned in each week. Each activity should appear neat and be complete BEFORE it is turned in for credit.

(Point 4) All activities should be kept in the student's loose-leaf (3-ring binder) notebook before and after the teacher has graded them. DO NOT THROW AWAY ANY OF THE ACTIVITIES. They may be needed at the end of the six weeks for determining the final grade.

(Point 5) The student should keep a careful record of points earned on the Student Progress Sheet.

(Point 6) Whenever a student is absent, it is the responsibility of the student to make up work missed.

(exhibit continues)

Exhibit B (continued)
Learning Contract:
Letter to Students and Parents

If any student has a problem with this or any assignment, it is strongly recommended that the student discuss the problem with the teacher immediately.

SUGGESTED GRADE REQUIREMENTS

D = 350 – 384 Total Points

C = 385 – 434 Total Points

B = 435 – 469 Total Points

A = 470 – 500 Total Points + Complete all RA, Pass Tests (Average test scores))

AA# 7,12,20,30,35

At least 150 points in AA

A+ = 550 + Total Points + Complete all RA, At Least a “C” on Tests (Average test scores)

A.A.# 7,12,20,22,30,31,35

At least 200 points in AA

THE GRADE I WISH TO SIGN FOR IS _____

SIGNED _____ Student

_____ Parent

_____ Teacher

Point 1 defined the learning contract as “an agreement between the student and the teacher through which the student can choose and earn his or her own grade.”

Point 2 summarized information relating how points could be earned by completing activities, and how grades would be determined. It mentioned that students held the responsibility of recording the activity points earned on a student progress sheet (see Exhibit C). The students understood their work style would be evaluated as part of the final grade.

Point 3 stressed the order for completing the required activities (RA) and additional activities (AA). The students were reminded that some additional activities had to be turned in each week. All assignments needed to be complete and neat.

Point 4 reminded the students about keeping their completed, graded activities, both required and additional, in a three-ring, science notebook. I also cautioned the students not to throw away any activity until directed by the teacher. This point provided an important safeguard for the student in the event the teacher missed an activity grade in her grade book. The student had the proof in his or her notebook, and the teacher could correct the student’s grade. The students used the completed activities as study guides for tests and quizzes.

Point 5 directed the student to record the total points earned for the activities on the Student Progress Sheet, which I collected at the end of each grading period.

Point 6 reminded to the students about their responsibility to make up all work when absent from class, and also, to talk with the teacher before leaving class if they anticipated any difficulty with an assignment.

The next group of items on the Letter to Students and Parents contained the Suggested Grade Requirements or total points required for each letter grade. I calculated the points by taking the lowest percentage for each letter grade, i.e. A = 94 to 100, and multiplying it by the total number of possible points. For example, 93.5 per cent of 500 total points was 470 points. The point range for an A would be 470 to 500, a B’s point range would be 435 to 469, C’s point range would be 385 to 434, and a D’s point range would be 350 to 384. The possibility of an A+ grade also existed if the total points equaled 550 or more.

I called these grade points Suggested Grade Requirements because in the event of a student not completing any of the activities, adjustments had to be made in the grade points.

Exhibit C
Learning Contract:
Student Progress Sheet

STUDENT PROGRESS SHEET

NAME: _____

FIRST SIX-WEEKS

DATE: _____

Required Activities			Additional Activities					
R.A.#	Value	Earned	A.A.#	Value	Earned	A.A.#	Value	Earned
Ch. 1 1	5		1	20		19	10	
2	10		2	10		20	10	
3	15		3	10		21	15	
4	15		4	15		22	15	
5	15		5	15		23	10	
6	20		6	10		24	10	
7	10		7	20		25	10	
TOTAL	90		8	10		26	20	
8	10		9	10		27	20	
9	10		10	10		28	20	
10	10		11	10		29	10	
11	10		12	10		30	10	
12	20		13	15		31	10	
TOTAL	150		14	10		32	15	
13	20		15	10		33	20	
14	20		16	10		34	15	
15	20		17	10		35		
16	20		18	15				
17	20							

(exhibit continues)

Required Activities			Additional Activities			Required Activities			Additional Activities		
R.A.#	Value	Earned	A.A.#	Value	Earned	R.A.#	Value	Earned	R.A.#	Value	Earned
18	15										
19	20										
20	5					A.A. Total = 150					
21	10										
TOTAL	300										
TEST	50										
SUMMARY OF POINTS EARNED											
R.A.	350		A REQUIREMENTS COMPLETE								
A.A.	150		A+ REQUIREMENTS COMPLETE								
TOTAL	500										
			FINAL GRADE								

A number of reasons required the point adjustments, including bad weather, late openings or early school closings, the need for students to repeat an activity, or the need to spend more time on an activity.

In addition to the grade points per letter grade, the students had to complete two further requirements for the A and the A+ grade: (1) for an A, the students must complete and pass all required activities (RA), all tests, and complete a minimum of 150 additional activity (AA) points, including those designated as A required; (2) for an A+, the student must pass all tests with an average of a C, complete 200 points in additional activities, and do those additional activities designed as A+ and A required.

Students who contracted for an A or an A+ must have met the grade requirements or they would not make the grade. The Letter to Students and Parents listed the A and A+ additional activities by number for the grading period.

The bottom of the Letter to Students and Parents provided a place for the students to write in their contracted grade, sign their names, and then take it home for the parents to sign. Because of the nature of the learning contract being a written agreement between the student and the teacher, I signed off on each of them.

The Student Progress Sheet

In order to show the point value for each activity in the learning contract, I created the Student Progress Sheet (see Exhibit C) in the form of a spreadsheet. I divided these into required activities (RA) and additional activities (AA) for each chapter. The students recorded their total points earned for each activity when it was returned from the teacher. I designed the Student Progress Sheet as a spreadsheet so that the students could see which assignments I designated as required activities (RA) and which I allowed as additional activities (AA). The students used the grade point information for A and A+ from the Letter to Students and Parents to circle the additional activities' numbers needed to comply with the A and A+ requirements. This spreadsheet showed the students which additional activities needed to be completed for the grading period. For example, the students would circle the number 7, if it was an A-required activity, and add a “ + “ in front of the number if it was required for an A+. I helped the students with this step, as a way to reinforce the additional activities needed for the contracted grade.

The spreadsheet organized the information into columns for each type of activity, required and additional. Column 1 stated the textbook chapter number and then listed in sequence the required activity number starting with the number one. Column 2 listed the point value for each required activity, and Column 3 I left blank so that the student could write in his or her points earned on the required activity. I used the next set of columns for the additional activities (AA). I divided the columns into sets of three, with the same pattern as the required activity columns, namely, additional activity number, point value, and earned points per activity. The bottom of this form included an area for the summary of points earned for the grading period. At the end of the grading period, I collected the completed Student Progress Sheet.

The Learning Contract with Life Science Course Objectives

The third component of the learning contract (see Exhibit D) detailed a list of the learning activities for the seventh-grade, life science student for a grading period of six-weeks. The first page began with the theme for the learning contract, chapter title and number, followed by the chapter objectives. The chapter objectives, found in the textbook at the beginning of each chapter section, corresponded to the life science curriculum objectives and the Virginia Standards of Learning. Under each chapter objective, I listed each of the learning activities used to teach the life science concept. These learning activities were divided into two types, required activities (RA) and additional activities (AA).

Required Activities

Required activities (see Exhibit E) were the learning activities, which matched the life science course objectives with the Standards of Learning (SOL), for the seventh-grade, life science curriculum. I assigned them to the students in a particular sequence. At my discretion, examples of required activities included a set of questions from the end of a chapter section or a lab exercise. I assigned the required activities as either class work or as homework. I numbered the required activities for identification purposes, for example, RA 1, which corresponded to Required Activity 1. It could easily be retrieved from the student's science notebook.

I described the required activities by kind of activity, i.e. study guide, video, filmstrip, new science words, and lab investigations. When appropriate, I stated page numbers or noted special instructions. Before doing any additional activities, I expected all students to finish the required activities.

Exhibit D

Learning Contract for the First Grading Period:

Life Science Course Objectives

CHAPTER 1

EXPLORING LIFE

OBJECTIVES: EXPLAIN WHAT BIOLOGISTS ARE, AND HOW THEY LEARN ABOUT LIVING THINGS.

REQUIRED ACTIVITIES (RA)

- _____ 1. View filmstrip: What Is Biology?
- _____ 2. VIEW *LASERVISION: What Is Life? Complete worksheet.
(* Laser disc series with reading booklets per topic and worksheets for reading level differentiation.)

ADDITIONAL ACTIVITIES (AA)

- _____ 1. Branches of Life Science: Enrichment
- _____ 2. The Work of Biologists (MacMillan)
- _____ 3. Working as a Life Scientist Crossword (MacMillan)
- _____ 4. Thinking Like a Scientist (MacMillan)
- _____ 5. The History of Biology
- _____ 6. Branches of Biology
- _____ 7. Investigation: On Your Own: Visiting the Environment

OBJECTIVE: APPLY SAFETY PROCEDURES IN THE LABORATORY

REQUIRED ACTIVITIES (RA)

- _____ 3. View filmstrip: Safety in the Science Lab: Parts 1 AND 2.
COMPLETE WORKSHEET.
Study Safety Rules page 672 and Safety Symbols page 673.
SIGN SAFETY CONTRACT
- _____ 4. View filmstrip: Laboratory Apparatus. Complete worksheet.
Inventory Lab Station (exhibit continues)

ADDITIONAL ACTIVITIES (AA)

- _____ 8. Tools of Life Science #1 (MacMillan)
- _____ 9. Tools of Life Science #2 (MacMillan)
- _____ 10. Tools of a Life Scientist (MacMillan)

OBJECTIVE: 1-1 LIVING THINGS PAGE 6

REQUIRED ACTIVITIES (RA)

- _____ 5. Find Out: page 6
- _____ 6. New Words page 6: Copy and Define
Read pages 6 - 9. Do Section Review page 9.
- _____ 7. Complete Study Guide: Living Things

ADDITIONAL ACTIVITIES (AA)

- _____ 11. Reinforcement: Living Things
- _____ 12. Enrichment: Living Things
- _____ 13. IN YOUR JOURNAL, page 8
- _____ 14. Skill Builder, page 9

OBJECTIVES: 1-2 WHERE DOES LIFE COME FROM? PAGE 10

REQUIRED ACTIVITIES (RA)

- _____ 8. Read pages 10 - 12. Do Section Review page 12.
- _____ 9. Complete Study Guide: Where Does Life Come From?

ADDITIONAL ACTIVITIES (AA)

- _____ 15. Reinforcement: Where Does Life Come From?
- _____ 16. Enrichment: Where Does Life Come From? Redi's Experiment.
- _____ 17. Skill Builder, page 12
- _____ 18. Research the lives of John Needham, Francesco Redi,
Lazzaro Spallanzani, and Louis Pasteur. Write a short report on each.

OBJECTIVES: 1-3 WHAT IS SCIENCE? PAGE 13

REQUIRED ACTIVITIES (RA)

(exhibit continues)

- _____ 10. New Science Words page 13: Copy and Define.
Read pages 13 - 21. Do Section Review, Page 21, and
Problem Solving Page 16.
- _____ 11. Study Guide: What Is Science?
- _____ 12. Read Pages 12 - 17 in the Addison-Wesley book.
View Filmstrip: Linear Measurement.
Investigation: Metric Measurement: Length
- _____ 13. View Filmstrip: The Triple Beam Balance.
Investigation: Metric Measurement: Mass
- _____ 14. View Filmstrip: Measuring Volume.
Investigation: Volume and Temperature.
- _____ 15. Investigation: Measuring Liquid Volume with a Graduated Cylinder
- _____ 16. Lab 1: The Scientific Method
- _____ 17. Lab 2: Using the Scientific Method
- _____ 18. Mini Lab, page 15
- _____ 19. Investigation: Determining Densities.

ADDITIONAL ACTIVITIES (AA)

- _____ 19. Reinforcement: What Is Science?
- _____ 20. Enrichment: What Is Science? The Case of the Polluted Stream
- _____ 21. Science and Reading: In Your Journal, page 19.
- _____ 22. Technology: Created a new use for Velcro, draw a picture of the product,
and make an ad to sell it.
- _____ 23. Skill Builder, page 21
- _____ 24. Practicing Measurement Skills
- _____ 25. Little Millie Metric
- _____ 26. That's Incredible
- _____ 27. Organizing Information
- _____ 28. The Scientific Method Applied: A Challenge

OBJECTIVES: 1-4 THE IMPACT OF SCIENCE ON YOUR LIFE PAGE 22

REQUIRED ACTIVITIES (RA)

- _____ 20. New Science Words page 22: Copy and Define
Read pages 22 & 23. Do Section Review page 23.
- _____ 21. Complete Study Guide: The Impact of Science on Your Life

ADDITIONAL ACTIVITIES (AA)

- _____ 29. Reinforcement: The Impact of Science on Your Life
- _____ 30. Enrichment: The Impact of Science on Your Life “Times Have Changed”
- _____ 31. You Decide: Science and Society, page 23
- _____ 32. Flex Your Brain: Topic: The Effect of Technology on Our Lives
- _____ 33. Experiment, page 24
- _____ 34. Chapter Review
- _____ 35. DEVISE YOUR OWN ACTIVITY (TEACHER APPROVAL NEEDED)

Exhibit E
Sample Required Activity (RA)

R.A. # 4 Name _____
Chapter 1 Date _____

Filmstrip "Laboratory Apparatus"

1. Laboratory apparatus may be grouped according to _____.
2. Laboratory balances are used to measure _____.
3. The meter stick and metric rule are used to measure _____.
4. Graduated cylinders are used to measure liquid _____.
5. The Bunsen burner is often used as a _____ source.
6. The thermometer is used to measure _____.
7. The thermometer scale is calibrated in degrees _____.
8. The test tube rack is used to support _____.
9. Small amounts of liquids or solids can be heated in a _____.
10. The capacity of glassware is shown in _____.
11. Beakers are used to prepare _____.
12. The wire gauze protects the glassware from the open _____.
13. Flasks are often used for the storage of _____.
14. Safety glasses or goggles should be worn when _____ confined liquids.
15. Over-heating can be controlled with a water _____.

WORD BANK:

Celsius	volume	milliliters
temperature	bath	flame
heat	solutions	solutions
use	test tube	heating
mass	test tubes	length

Additional Activities

In order to reinforce, enrich, expand, and differentiate among the science curriculum topics, I used the additional activities (see Exhibit F). The additional activities included crossword puzzles, computer projects, library research, worksheets, concept modeling, and projects. The additional activities' worksheets and crossword puzzles came from the ancillary materials accompanying the science textbook and the reference textbooks. I made up the computer projects and modeling activities from the science concepts being studied. The students completed additional activities after the required activities. I assigned all of the required activities; however, I designed the additional activities so that the students could select among several.

I listed additional activities with a special notation regarding the reference textbook to be used to complete the assignment, for example, Tools of Science # 1 (MacMillian). The reference textbook could be found enclosed in parentheses. I made reference textbooks available to the students in the classroom, or they could be checked out for overnight use. The reference textbooks were earlier editions of life science textbooks.

I grouped the additional activities with the required activities for a particular course objective. The additional activity's name came from the title of the worksheet, e.g., Tools of Science #1. I assigned additional activities on a weekly basis, for example, AA #6 through AA #12 were due on Monday.

The students chose which additional activities they wanted to complete from the numbers assigned for the week; however, the extra additional activities required for a grade of A or A+ were also due. For example, AA # 7 had to be completed by a student contracting for an A or A+. If the students who contracted for an A or A+ did not complete AA #7, they were not eligible to earn the A or A+ grade. I did not accept late work. All additional activities were due on Monday during class time.

More often than not, on Mondays, the students checked additional activities and picked up the new additional activities for the next week. The students called it "AA day." If they had already finished their required activities, the students could work on their additional activities on other days of the week.

Exhibit F

Sample Additional Activity (AA)

A.A. # 7

NAME _____

CHAPTER 1

DATE _____

INVESTIGATION: ON YOUR OWN

PURPOSE: TO OBSERVE THE ENVIRONMENT AROUND WHERE YOU LIVE.

MATERIALS: PENCIL AND PAPER

PROCEDURE: Walk outside and take a careful look at the environment around where you live. List as many kinds of organisms as you can see. Include any evidence you find that a living thing has been there recently—bird droppings, spider webs, or footprints, for example. Try to identify or describe each kind of living thing you observe and record how many of each kind you notice. You may see evidence of interactions occurring among different living things—for example, birds eating seeds or insects. Record your observations.

RESULTS: ON CHART

- ANALYSIS:
1. What kind of organism seems to be most common in the area?
 2. Did you observe interactions occurring among organisms? If so, give examples.
 3. What kind of organism appears to have the most effect on other organisms?

So that the points earned could be recorded on the Student Progress Sheet, I also numbered the additional activities, for example, AA #1. The student could plan how to earn the 150 AA points needed for the grading period by looking at the total possible points for each activity listed on the Student Progress Sheet, for example, AA #7, 20 possible points. A student who contracted for an A+ needed 200 AA points.

The Relationship Among the Learning Contract Components

I designed the learning contract so that the students could understand the assignments from the learning activities' descriptions. A blank line lay in front of each activity so that the student could either check off or date the assignment as it was assigned. From the menu of additional activities, the students chose which activities they would complete to earn their additional activity points. The required and additional activity information was formatted with the same numbers as the Student Progress Sheet for a grading period.

Students used the Letter to Students and Parents to identify the additional activities needed for an A or A+ grade. The Letter to Students and Parents served as the student's copy of the contracted letter grade and the total points needed for the learning contract grade.

The Student Progress Sheet listed the total points for a required or an additional activity. The students recorded the number of earned points for each activity on their Student Progress Sheets. I required all students to complete the Student Progress Sheet.

The Evaluation and Grading Practices for the Learning Contract

The final grade for a grading period took into account the sum of the required and additional activities' earned points, completion of the Student Progress Sheet, an evaluation of a student's work style, and completion of the extra additional activities for those students contracting for an A or A+.

Required Activities

During class, the students and I checked and corrected the required activities as a group activity. They used a red pen to either check if correct or make a correction. If the students made a correction, then this action reduced the points deducted. For example, if an assignment totaled 15 points and the student made two corrections, then the number of corrections divided by two was subtracted from the total number of points. Most required activities had a one point per item value. If a student failed to self-correct his or her assignment, then the student had to deduct the

full value from the total possible points, e.g. two incorrect answers deducted two points. The same assignment would have had only one point deducted from the total possible points if the student had corrected the mistakes.

On a designated area of their paper, the students recorded their points earned over the total number of points possible in fraction form, e.g. 14/15, and then placed their corrected papers in their group's folder. I recorded the students' earned points in my grade book. Then I returned the assignments to the students, and they recorded their earned points on the Student Progress Sheet. Classroom protocol called for the daily checking, grading, and collecting of required assignments.

Additional Activities

Each Monday, I assigned additional activities by number, e.g., AA #6 through AA #12. On the following Monday, the students checked these additional activities. The process of correcting and assigning points for the additional activities remained the same as the required activities except the student self-checked the activity, not the teacher. A more detailed explanation about checking the additional activities follows in Chapter 4, Orientation.

Student's Work Style

In an attempt to match learning activities with the learning styles of the students, I evaluated the students' work style. As the classroom teacher, I performed the evaluation of the students' work style mentioned in the Letter to Students and Parents informally with the students as an ongoing process throughout the school term.