Appendix B

Definitions of Teacher Composites

- Teacher Preparation
  - Teacher Preparedness to Use Standards-Based Teaching Practices
  - Teacher Preparedness to Teach Students from Diverse Backgrounds
  - Teacher Preparedness to Use Calculators/Computers
  - Teacher Preparedness to Use the Internet
  - Teacher Content Preparedness: Science
  - Teacher Content Preparedness: Mathematics
- Instructional Control
  - Curriculum Control
  - Pedagogy Control
- Instructional Objectives
  - Nature of Science/Mathematics Objectives
  - Science Content Objectives
  - Basic Mathematics Skills Objectives
  - Mathematics Reasoning Objectives
- Teaching Practices
  - Use of Strategies to Develop Students' Abilities to Communicate Ideas
  - Use of Traditional Teaching Practices
  - Use of Laboratory Facilities
  - Use of Projects/Extended Investigations
  - Use of Computers
  - Use of Calculators/Computers for Developing Concepts and Skills
  - Use of Calculators/Computers for Investigations
  - Use of Informal Assessment
  - Use of Journals/Portfolios

Definitions of Teacher Composites

Composite definitions for the science and mathematics teacher questionnaire are presented below along with the item numbers from the respective questionnaires. Composites that are identical for the two subjects are presented in the same table; composites unique to a subject are presented in separate tables.

Teacher Preparation

These composites estimate the extent to which teachers feel prepared in both science and mathematics content and pedagogy.

Table B-1
Teacher Preparedness to Use Standards-Based Teaching Practices

	Science	Mathematics
Take students' prior understanding into account when planning curriculum and instruction.	Q3a	Q3a
Develop students' conceptual understanding of science/mathematics	Q3b	Q3b
Provide deeper coverage of fewer science/mathematics concepts	Q3c	Q3c
Make connections between science/mathematics and other disciplines	Q3d	Q3d
Lead a class of students using investigative strategies	Q3e	Q3e
Manage a class of students engaged in hands-on/project-based work	Q3f	Q3f
Have students work in cooperative learning groups	Q3g	Q3g
Listen/ask questions as students work in order to gauge their understanding	Q3h	Q3h
Use the textbook as a resource rather than the primary instructional tool	Q3i	Q3i
Teach groups that are heterogeneous in ability	Q3j	Q3j
Number of Items in Composite	**10**	**10**
Reliability (Cronbach's Coefficient Alpha)	**0.88**	**0.86**

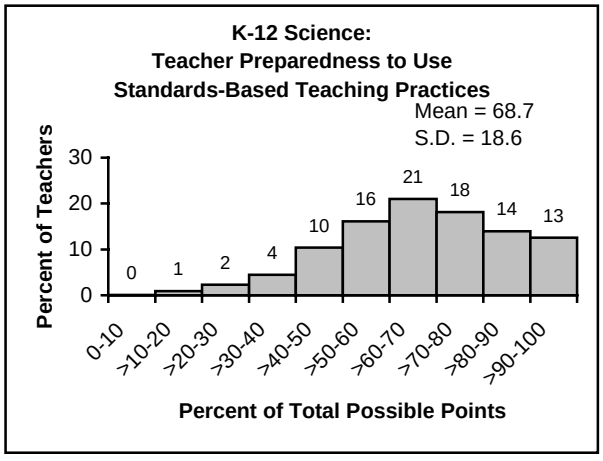


Figure B-1

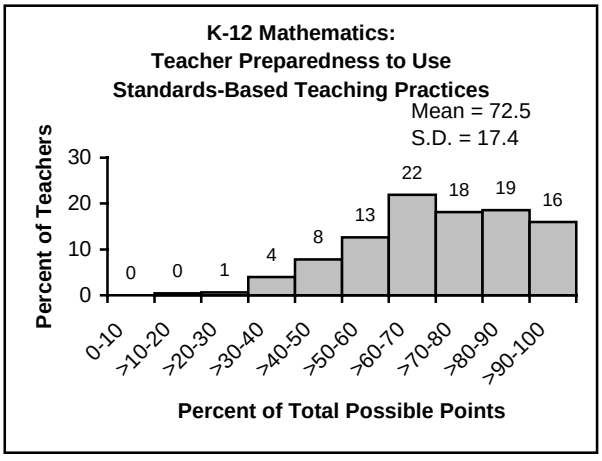
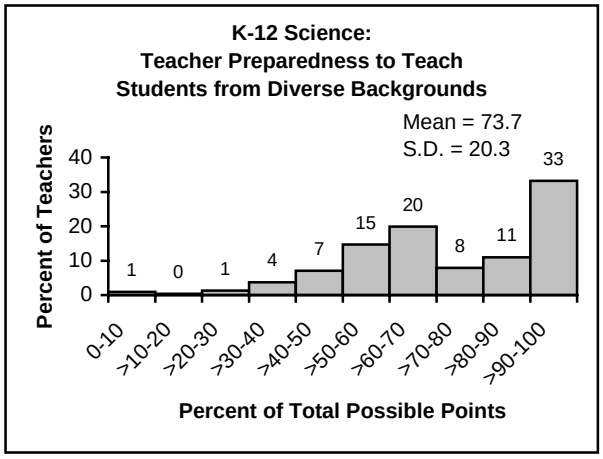


Figure B-2

Table B-2
Teacher Preparedness to Teach Students from Diverse Backgrounds

	Science	Mathematics
Recognize and respond to student cultural diversity	Q3l	Q3l
Encourage students' interest in science/mathematics	Q3m	Q3m
Encourage participation of females in science/mathematics	Q3n	Q3n
Encourage participation of minorities in science/mathematics	Q3o	Q3o
Number of Items in Composite	**4**	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.81**	**0.80**



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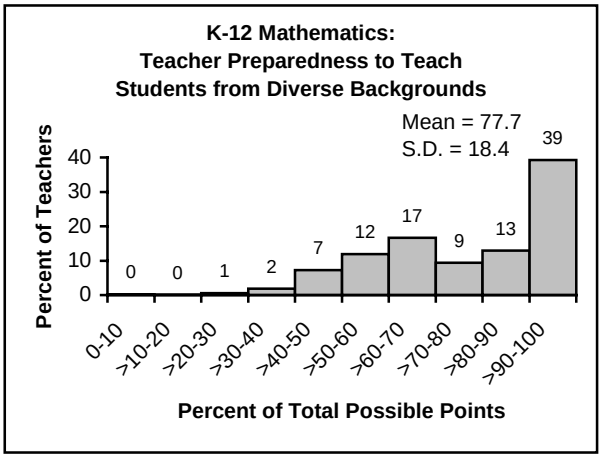


Figure B-4

Table B-3
Teacher Preparedness to Use Calculators/Computers

	Science	Mathematics
Use calculators/computers for drill and practice	Q3q	Q3q
Use calculators/computers for science/mathematics learning games	Q3r	Q3r
Use calculators/computers to collect and/or analyze data	Q3s	Q3s
Use computers to demonstrate scientific principles*	Q3t	
Use calculators/computers to demonstrate mathematics principles*		Q3t
Use computers for laboratory simulations*	Q3u	
Use computers for simulations and applications*		Q3u
Number of Items in Composite	**5**	**5**
Reliability (Cronbach's Coefficient Alpha)	**0.89**	**0.89**

* The mathematics and science versions of this question are considered equivalent, worded appropriately for that discipline.

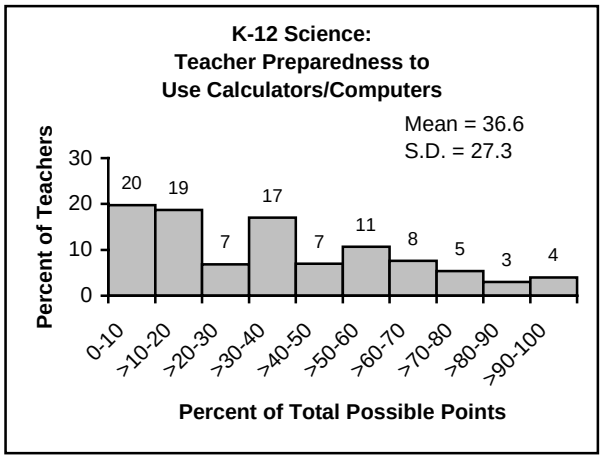


Figure B-5

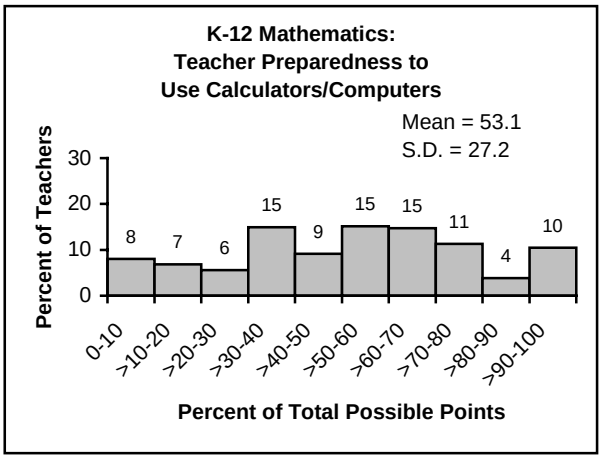
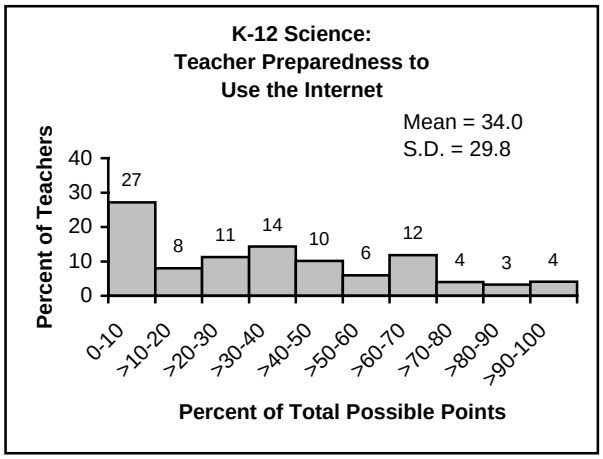


Figure B-6

Table B-4
Teacher Preparedness to Use the Internet

	Science	Mathematics
Use the Internet in your science/mathematics teaching for general reference	Q3v	Q3v
Use the Internet in your science/mathematics teaching for data acquisition	Q3w	Q3w
Use the Internet in your science/mathematics teaching for collaborative projects with classes/individuals in other schools	Q3x	Q3x
Number of Items in Composite	**3**	**3**
Reliability (Cronbach's Coefficient Alpha)	**0.86**	**0.90**



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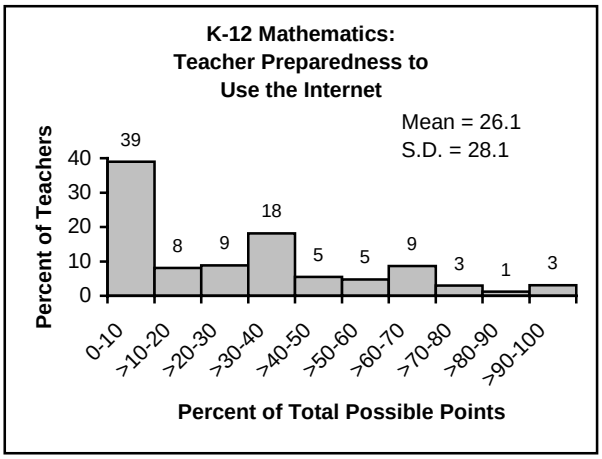
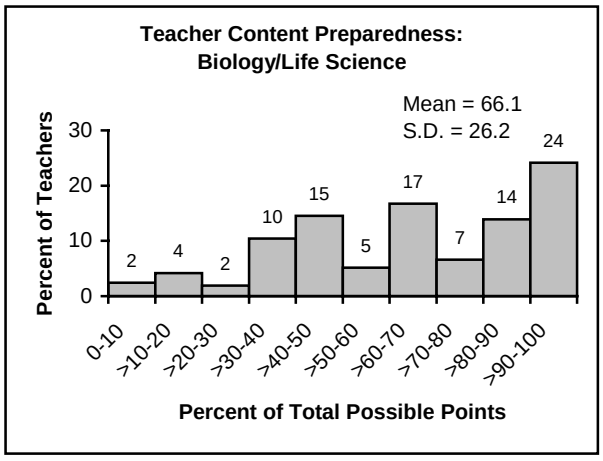


Figure B-8

Table B-5
Teacher Content Preparedness: Science*

	Biology/ Life Science	Chem-istry	Earth Science	Environ-mental Science	Integrated/ General Science	Physical Science	Physics
Earth's features and physical processes			Q15a1a	Q15a1a	Q15a1a	Q15a1a	
The solar system and the universe			Q15a1b		Q15a1b	Q15a1b	
Climate and weather			Q15a1c	Q15a1c	Q15a1c	Q15a1c	
Structure and function of human systems	Q15a2a				Q15a2a		
Plant biology	Q15a2b				Q15a2b		
Animal behavior	Q15a2c				Q15a2c		
Interactions of living things/ecology	Q15a2d			Q15a2d	Q15a2d		
Genetics and evolution	Q15a2e				Q15a2e		
Structure of matter and chemical bonding		Q15a3a			Q15a3a	Q15a3a	
Properties and states of matter		Q15a3b			Q15a3b	Q15a3b	
Chemical reactions		Q15a3c			Q15a3c	Q15a3c	
Energy and chemical change		Q15a3d			Q15a3d	Q15a3d	
Forces and motion					Q15a4a	Q15a4a	Q15a4a
Energy					Q15a4b	Q15a4b	Q15a4b
Light and sound					Q15a4c	Q15a4c	Q15a4c
Electricity and magnetism					Q15a4d	Q15a4d	Q15a4d
Modern physics (e.g., special relativity)					Q15a4e	Q15a4e	Q15a4e
Pollution, acid rain, global warming				Q15a5a	Q15a5a		
Population, food supply, and production				Q15a5b	Q15a5b		
Formulating hypothesis, drawing conclusions, making generalizations	Q15a6a	Q15a6a	Q15a6a	Q15a6a	Q15a6a	Q15a6a	Q15a6a
Experimental design	Q15a6b	Q15a6b	Q15a6b	Q15a6b	Q15a6b	Q15a6b	Q15a6b
Describing, graphing, and interpreting data	Q15a6c	Q15a6c	Q15a6c	Q15a6c	Q15a6c	Q15a6c	Q15a6c
Number of Items in Composite	**8**	**7**	**6**	**8**	**22**	**15**	**8**
Reliability (Cronbach's Coefficient Alpha)	**0.87**	**0.87**	**0.76**	**0.79**	**0.87**	**0.89**	**0.88**

* Questions comprising these composites were asked of only those teachers in non-self-contained settings.



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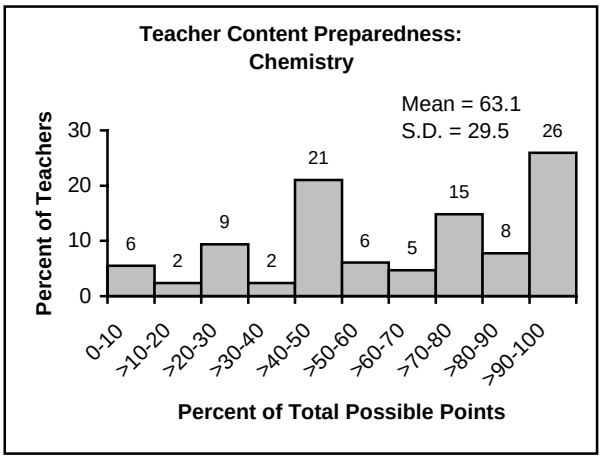

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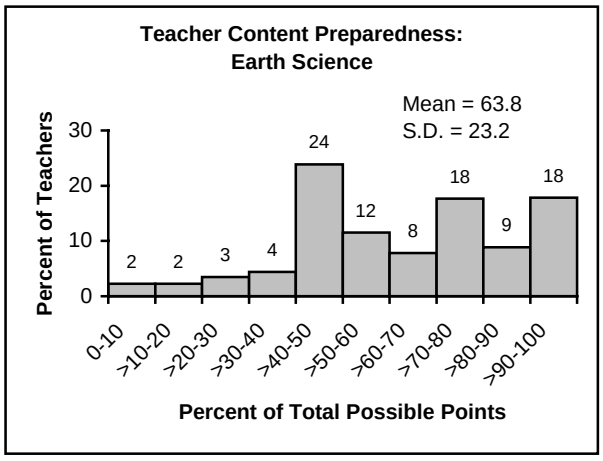

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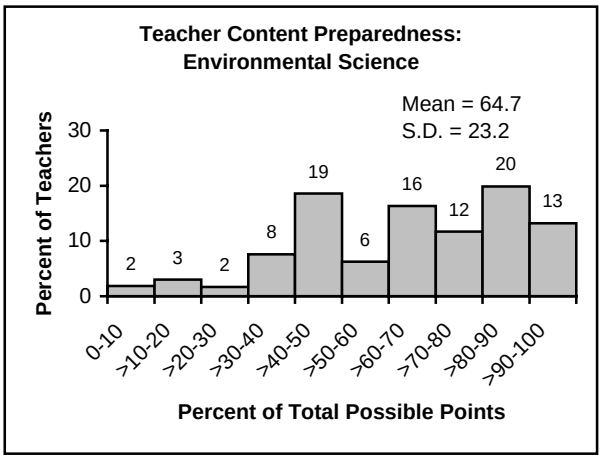

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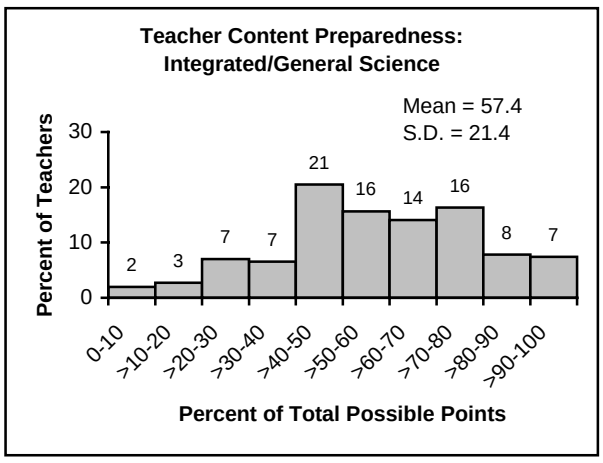


Figure B-13

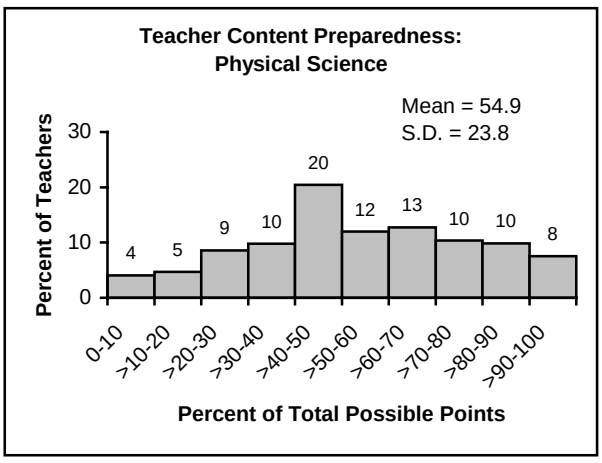


Figure B-14

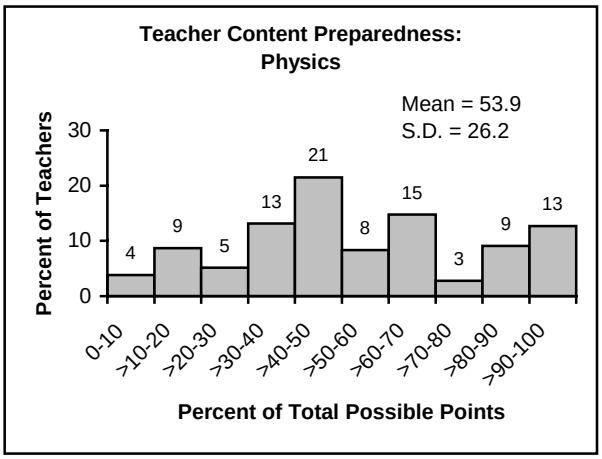

Teacher Content Preparedness:
Physics
Mean = 53.9
S.D. = 26.2
Percent of Teachers
30
20
10
0
4
9
5
13
21
8
15
3
9
13
0-10
>10-20
>20-30
>30-40
>40-50
>50-60
>60-70
>70-80
>80-90
>90-100
Percent of Total Possible Points

Figure B-15

Table B-6
Teacher Content Preparedness: Mathematics

	General Mathematics	Advanced Mathematics
Numeration and number theory	Q15aa	
Computation	Q15ab	
Estimation	Q15ac	
Measurement	Q15ad	
PrB-Algebra	Q15ae	
Algebra		Q15af
Patterns and relationships	Q15ag	
Geometry and spatial sense	Q15ah	
Functions (including trigonometric functions) and prB-calculus concepts		Q15ai
Data collection and analysis		Q15aj
Probability		Q15ak
Statistics (e.g., hypothesis tests, curve fitting and regression)		Q15al
Topics from discrete mathematics (e.g., combinatorics, graph theory, recursion)		Q15am
Mathematical structures (e.g., vector spaces, groups, rings, fields)		Q15an
Calculus		Q15ao
Technology (calculators, computers) in support of mathematics		Q15ap
Number of Items in Composite	**7**	**9**
Reliability (Cronbach's Coefficient Alpha)	**0.82**	**0.85**

* Questions comprising these composites were asked of only those teachers in non-self-contained settings.

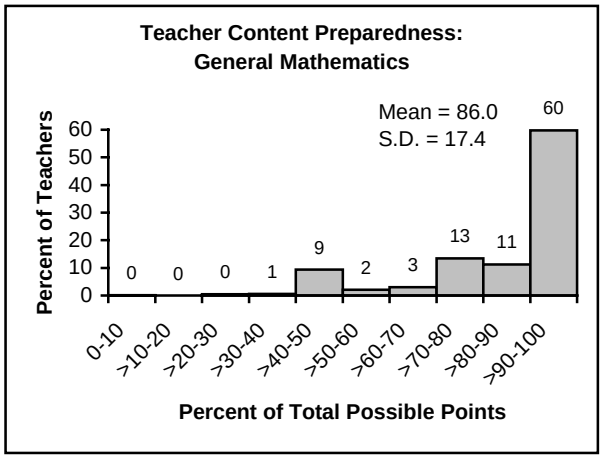


Figure B-16

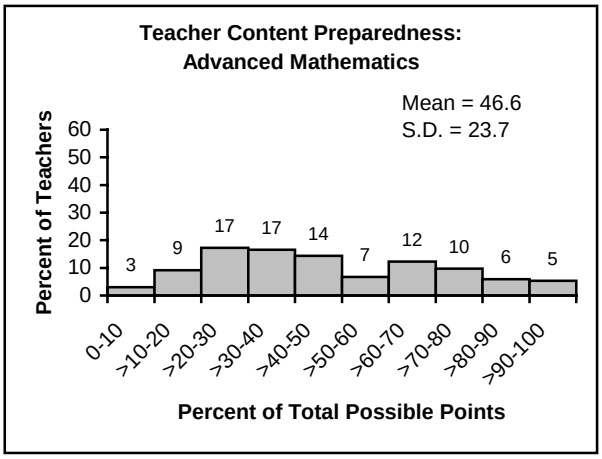


Figure B-17

Instructional Control

These composites estimate the level of control teachers perceive having over curriculum and pedagogy decisions for their classrooms.

Table B-7
Curriculum Control

	Science	Mathematics
Determining course goals and objectives	Q31a	Q31a
Selecting textbooks/instructional programs	Q31b	Q31b
Selecting other instructional materials	Q31c	Q31c
Selecting content, topics, and skills to be taught	Q31d	Q31d
Selecting the sequence in which topics are covered	Q31e	Q31e
Number of Items in Composite	**5**	**5**
Reliability (Cronbach's Coefficient Alpha)	**0.82**	**0.82**

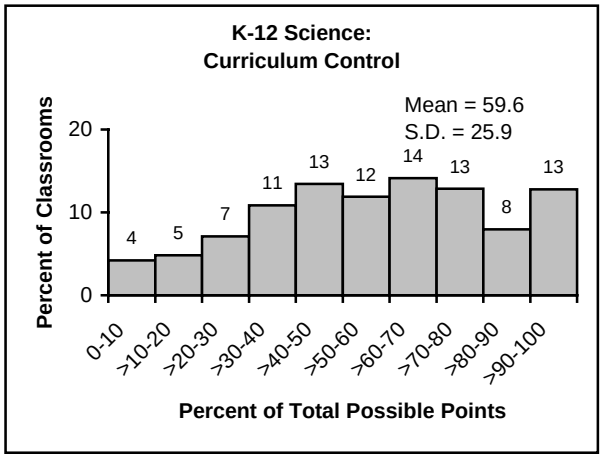


Figure B-18

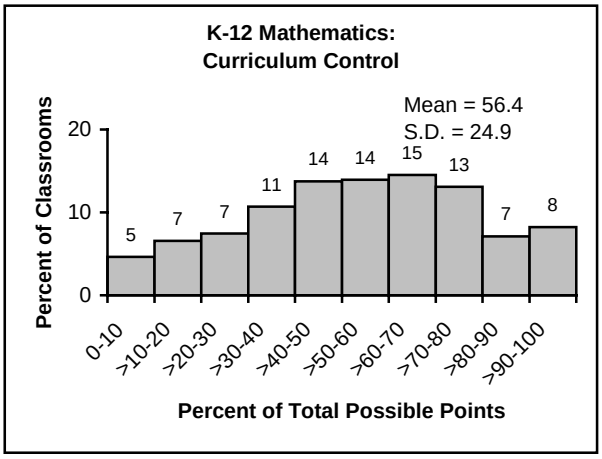


Figure B-19

Table B-8
Pedagogy Control

	Science	Mathematics
Selecting the pace for covering topics	Q31g	Q31g
Determining the amount of homework to be assigned	Q31h	Q31h
Choosing criteria for grading students	Q31I	Q31i
Choosing tests for classroom assessment	Q31j	Q31j
Number of Items in Composite	**4**	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.84**	**0.80**

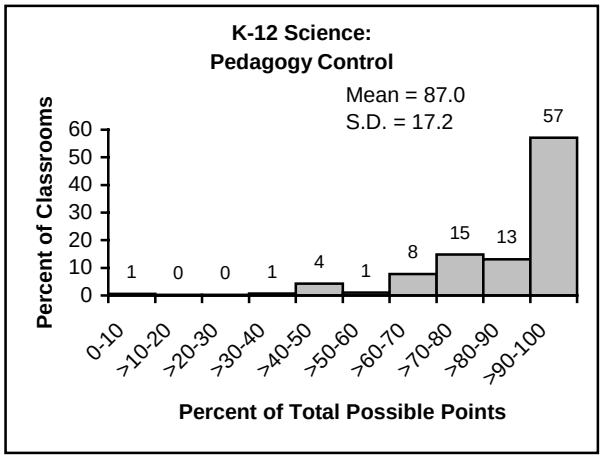


Figure B-20

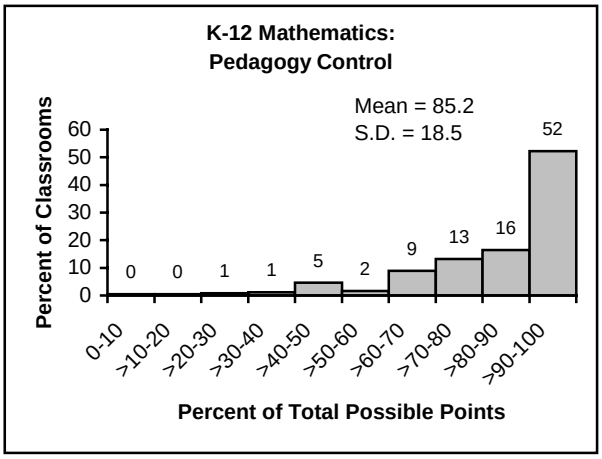


Figure B-21

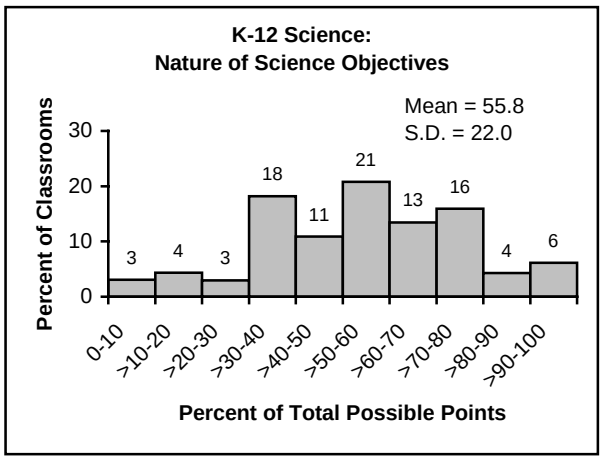
Instructional Objectives

These composites estimate the amount of emphasis teachers place on various objectives.

Table B-9
Nature of Science/Mathematics Objectives

	Science	Mathematics
Learn to evaluate arguments based on scientific evidence	Q23f	
Understand the logical structure of mathematics		Q23i
Learn about the history and nature of science/mathematics	Q23j	Q23j
Learn how to communicate ideas in science effectively*	Q23g	
Learn how to explain ideas in mathematics effectively*		Q23k
Learn about the applications of science in business and industry*	Q23h	
Learn how to apply mathematics in business and industry*		Q23l
Learn about the relationship between science, technology, and society	Q23I	
Number of Items in Composite	**5**	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.84**	**0.73**

* The mathematics and science versions of this question are considered equivalent, worded appropriately for that discipline.



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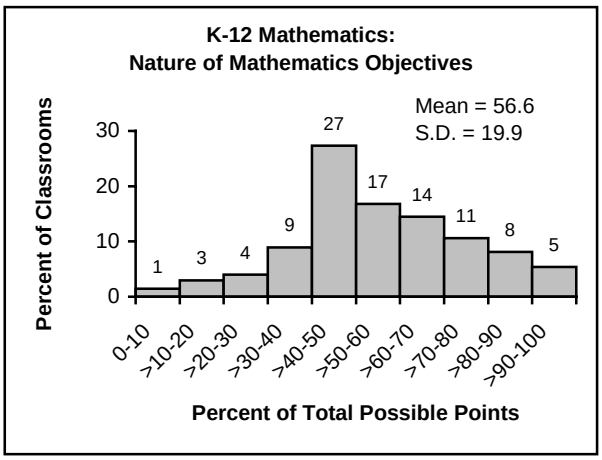

Figure B-23

Table B-10
Science Content Objectives

	Science
Learn basic science concepts	Q23b
Learn important terms and facts of science	Q23c
Learn science process/inquiry skills	Q23d
Prepare for further study in science	Q23e
Number of Items in Composite	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.60**

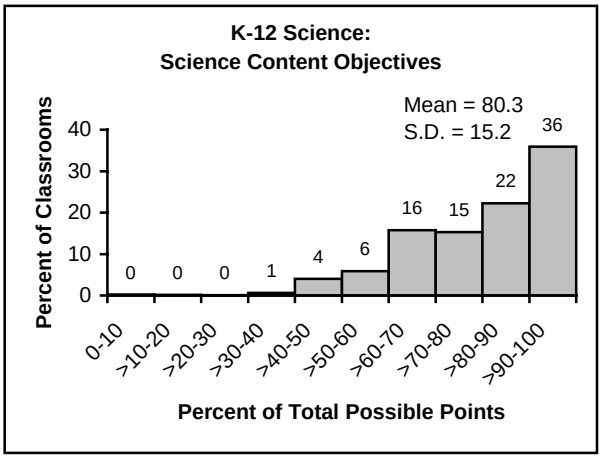

Figure B-24

Table B-11
Basic Mathematics Skills Objectives

	Mathematics
Develop students' computational skills	Q23d
Learn to perform computations with speed and accuracy	Q23m
Prepare for standardized tests	Q23n
Number of Items in Composite	**3**
Reliability (Cronbach's Coefficient Alpha)	**0.69**

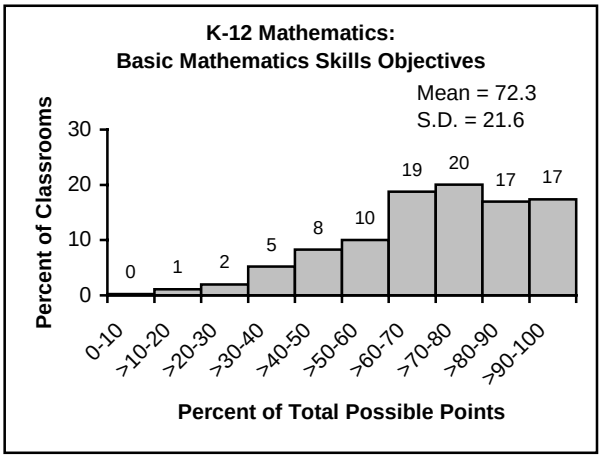

Figure B-25

Table B-12
Mathematics Reasoning Objectives

	Mathematics
Learn mathematical concepts	Q23b
Learn how to solve problems	Q23e
Learn to reason mathematically	Q23f
Learn how mathematics ideas connect with one another	Q23g
Number of Items in Composite	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.75**

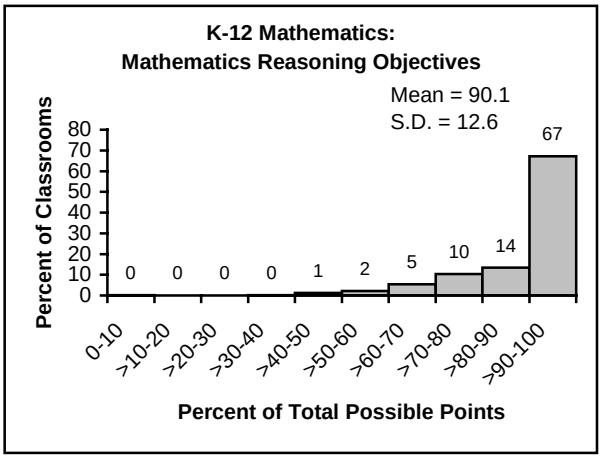

Figure B-26

Teaching Practices

These composites estimate the extent to which teachers use a variety of teaching practices and instructional technologies/facilities.

Table B-13
Use of Strategies to Develop Students' Abilities to Communicate Ideas

	Science	Mathematics
Pose open-ended questions	Q24b	Q24b
Engage the whole class in discussions	Q24c	
Require students to supply evidence to support their claims*	Q24d	
Require student to explain their reasoning when giving an answer*		Q24d
Ask students to explain concepts to one another	Q24e	Q24e
Ask students to consider alternative explanations *	Q24f	
Ask students to consider alternative methods for solutions*		Q24f
Ask students to use multiple representations (e.g., numeric, graphic, geometric, etc.)		Q24g
Help students see connections between science/mathematics and other disciplines	Q24h	Q24h
Number of Items in Composite	**6**	**6**
Reliability (Cronbach's Coefficient Alpha)	**0.79**	**0.77**

* The mathematics and science versions of this question are considered equivalent, worded appropriately for that discipline.

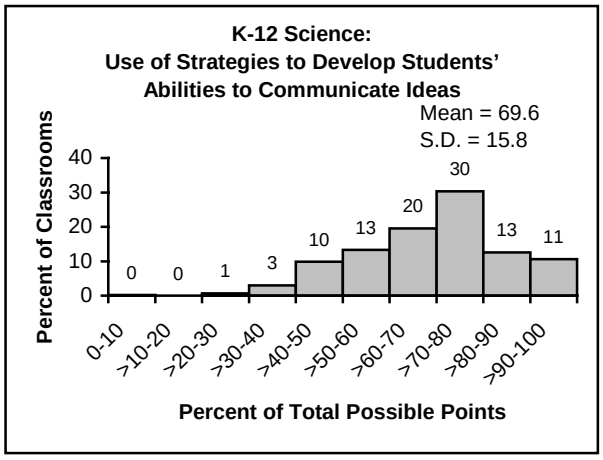

Figure B-27

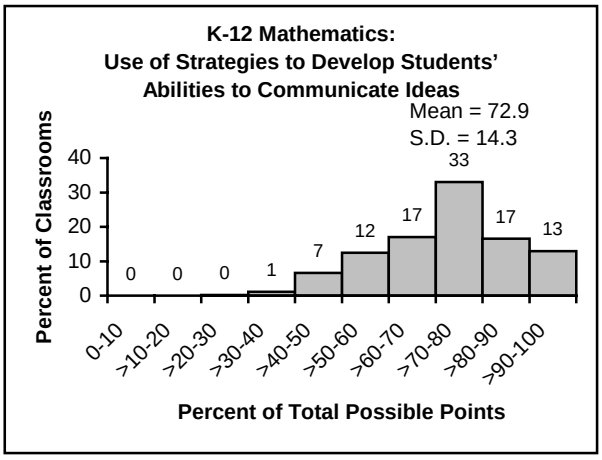

Figure B-28

Table B-14
Use of Traditional Teaching Practices

	Science	Mathematics
Introduce content through formal presentations	Q24a	Q24a
Assign science/mathematics homework	Q24I	Q24j
Listen and take notes during presentation by teacher	Q25a	Q25a
Read from a science/mathematics textbook in class	Q25d	Q25c
Practice routine computations/algorithms		Q25f
Review homework/worksheet assignments		Q25g
Answer textbook or worksheet questions	Q25j	Q25k
Review student homework	Q27f	Q27f
Give predominantly short-answer tests (e.g., multiple choice, true/false, fill in the blank)	Q27k	
Number of Items in Composite	**7**	**8**
Reliability (Cronbach's Coefficient Alpha)	**0.78**	**0.74**

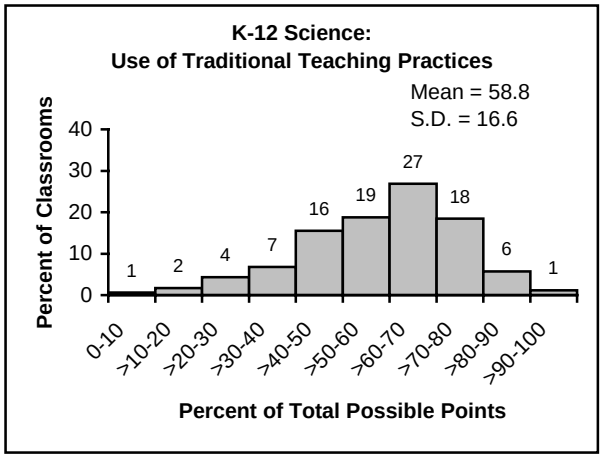

Figure B-29

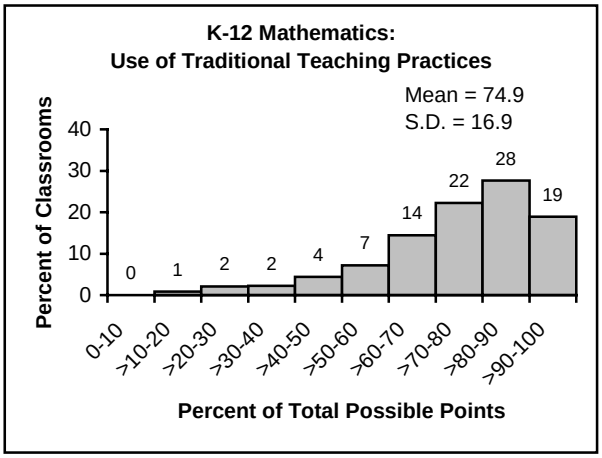

Figure B-30

Table B-15
Use of Laboratory Facilities

	Science
Use running water in labs/classrooms	Q28l3
Use electric outlets in labs/classrooms	Q28m3
Use gas for burners in labs/classrooms	Q28n3
Use hoods or air hoses in labs/classrooms	Q28o3
Number of Items in Composite	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.80**

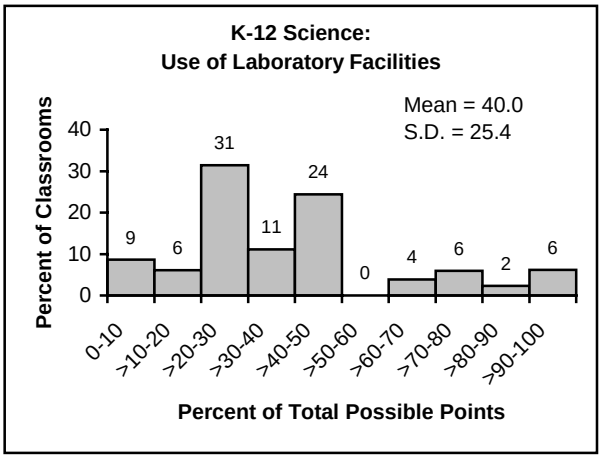

Figure B-31

Table B-16
Use of Projects/Extended Investigations

	Science
Design or implement their own investigation	Q25h
Participate in field work	Q25i
Prepare written science reports	Q25m
Make formal presentations to the rest of the class	Q25n
Work on extended science investigations or projects (a week or more in duration)	Q25o
Have students do long-term science projects	Q27i
Have students present their work to the class	Q27j
Grade student work on open-ended and/or laboratory tasks using defined criteria (e.g., a scoring rubric)	Q27m
Have students assess each other (peer evaluation)	Q27n
Number of Items in Composite	**9**
Reliability (Cronbach's Coefficient Alpha)	**0.85**

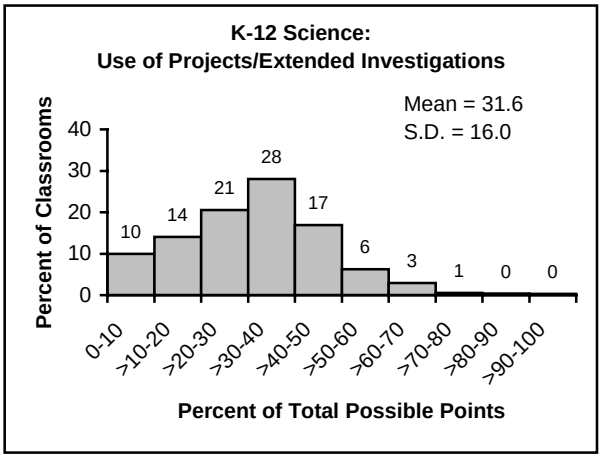

Figure B-32

Table B-17
Use of Computers

	Science
Use computers as a tool (e.g., spreadsheets, data analysis)	Q25p
Do drill and practice	Q26a
Demonstrate scientific principles	Q26b
Play science learning games	Q26c
Do laboratory simulations	Q26d
Collect data using sensors or probes	Q26e
Retrieve or exchange data	Q26f
Solve problems using simulations	Q26g
Take a test or quiz	Q26h
Number of Items in Composite	**9**
Reliability (Cronbach's Coefficient Alpha)	**0.91**

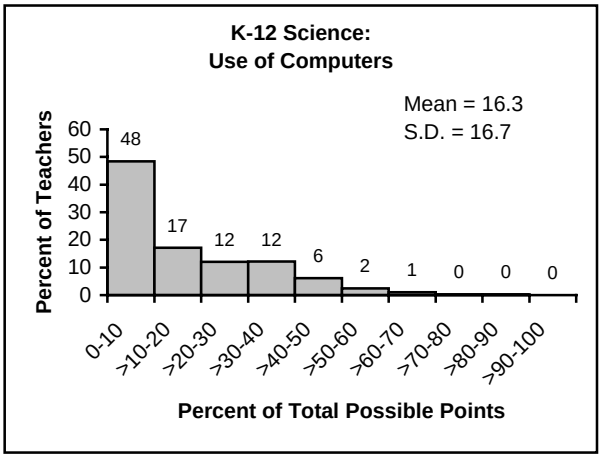

Figure B-33

Table B-18
Use of Calculators/Computers for Developing Concepts and Skills

	Mathematics
Use calculators or computers for learning or practicing skills	Q25p
Use calculators or computers to develop conceptual understanding	Q25q
Do drill and practice	Q26a
Demonstrate mathematics principles	Q26b
Take a test or quiz	Q26h
Use graphing calculators	Q28g3
Number of Items in Composite	**6**
Reliability (Cronbach's Coefficient Alpha)	**0.86**

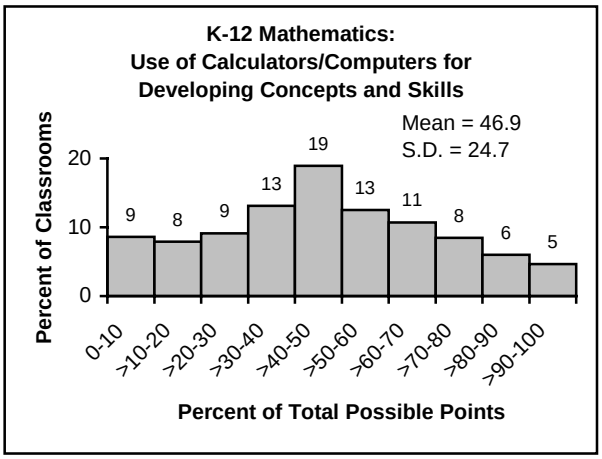

Figure B-34

Table B-19
Use of Calculators/Computers for Investigations

	Mathematics
Record, represent, and/or analyze data	Q25l
Use calculators or computers as a tool (e.g., spreadsheets, data analysis)	Q25r
Do simulations	Q26d
Collect data using sensors or probes	Q26e
Retrieve or exchange data	Q26f
Solve problems using simulations	Q26g
Number of Items in Composite	**6**
Reliability (Cronbach's Coefficient Alpha)	**0.85**

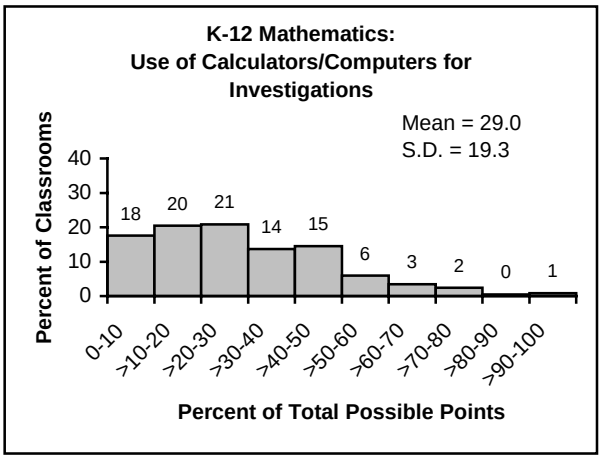

Figure B-35

Table B-20
Use of Informal Assessment

	Science	Mathematics
Observe students and ask questions as they work individually	Q27b	Q27b
Observe students and ask questions as they work in small groups	Q27c	Q27c
Ask students questions during large group discussions	Q27d	Q27d
Use assessments embedded in class activities to see if students are "getting it"	Q27e	Q27e
Number of Items in Composite	**4**	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.79**	**0.69**

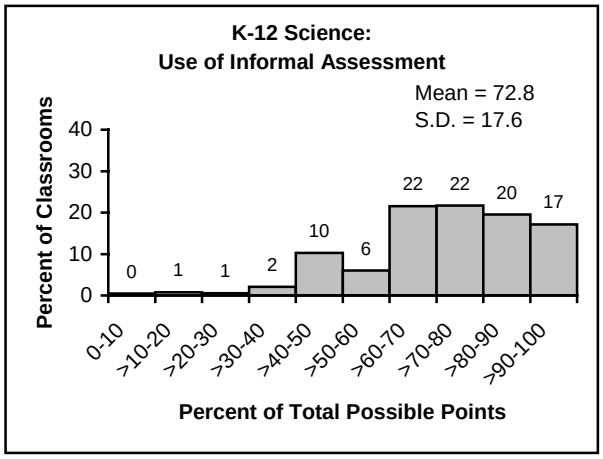

Figure B-36

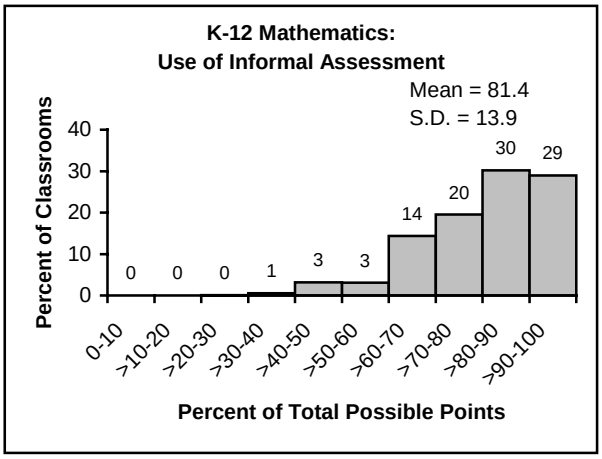

Figure B-37

Table B-21
Use of Journals/Portfolios

	Science	Mathematics
Read and comment on the reflections students have written, e.g., in their journals	Q24j	Q24k
Write reflections (e.g., in a journal)	Q25l	Q25m
Review student notebooks/journals	Q27g	Q27g
Review student portfolios	Q27h	Q27h
Number of Items in Composite	**4**	**4**
Reliability (Cronbach's Coefficient Alpha)	**0.82**	**0.83**

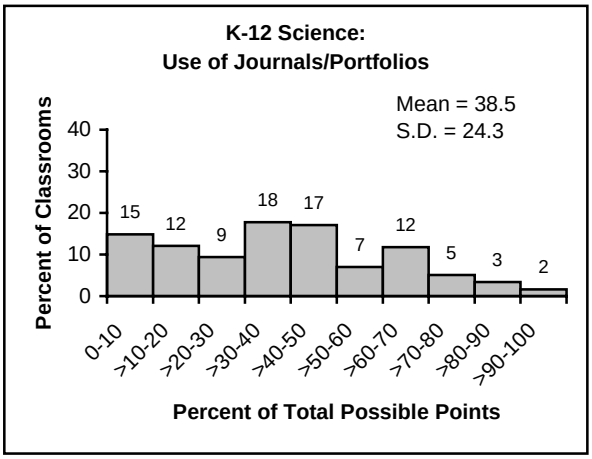

Figure B-38

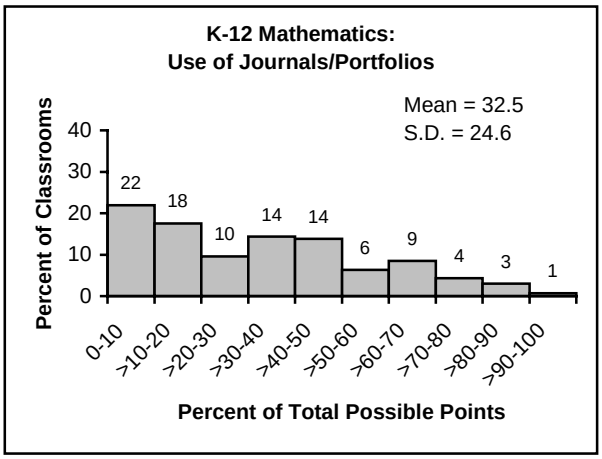

Figure B-39