

Numeracy

GRADE 6

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Numeracy in Grade 6

By Grade 6, students are expected to complete a variety of numeracy tasks based on their own research, as well as simulated tasks provided by their teachers. The following briefly describes typical Grade 6 numeracy tasks. For quick reference, these examples have been grouped according to purpose. In practice, a single numeracy task or problem may often address more than one purpose.

MONEY TASKS

- ◆ Find the most economical prices for school supplies.
- ◆ Choose something they would like to purchase and compare prices from three different sources.
- ◆ Compare prices of products expressed in different units (e.g., .69/g, \$3.90/kg, 0.32/100g, \$3.99/500g).

CHANCE TASKS

- ◆ Determine whether or not a coin-toss game is fair.
- ◆ Design games involving chance.

DATA ANALYSIS

- ◆ Record, display, and analyze data to draw conclusions about own lifestyle.
- ◆ Design and conduct surveys, display and analyze resulting data, and draw conclusions.
- ◆ Analyze television commercials for number, type, and target audience.
- ◆ Analyze graphs from magazines, newspapers, or web sites, and evaluate the appropriateness of the population sample used.

MEASUREMENT AND OTHER APPLICATIONS OF SHAPE AND SPACE

- ◆ Design a container for compact disks.
- ◆ Create a “personal” box: calculate the surface area, choose material, and determine the most economical way to use material to cover the box.
- ◆ Given a set of parameters, design the shortest fence to enclose a skateboard park.
- ◆ Estimate and measure volume and mass of various types of rocks as part of a science study; draw conclusions.

Wherever possible, students should demonstrate numeracy through real situations and problems that can be solved in a variety of ways. Students should be expected to explain their procedures and results, and to suggest other situations where similar methods might be useful. In most cases, these tasks will require an extended amount of time. Relatively short questions with one correct procedure and answer are not appropriate for performance assessment.

Quick Scale: Grade 6 Numeracy

This Quick Scale is a summary of the criteria described in detail in the Rating Scale that follows. These criteria may apply at any time of the year, depending when specific skills or concepts are introduced.

Aspect	Not Yet Within Expectations	Meets Expectations (Minimal Level)	Fully Meets Expectations	Exceeds Expectations
SNAPSHOT	<i>The student is unable to meet basic requirements of the task without close, ongoing assistance. Unable to provide a relevant extension.</i>	<i>The work satisfies most basic requirements of the task, but it is flawed or incomplete in some way. May produce a simple extension with help.</i>	<i>The work satisfies basic requirements. If asked, the student can produce a relevant extension or further illustration.</i>	<i>The work is complete, accurate, and efficient. The student may volunteer an extension, an application, or a further illustration.</i>
CONCEPTS AND APPLICATIONS* - recognizing mathematics - grade-specific concepts, skills - patterns, relationships	- unable to identify mathematical concepts or procedures needed - does not apply relevant mathematical concepts and skills appropriately; major errors or omissions - often unable to describe patterns or relationships	- identifies most mathematical concepts and procedures needed - applies most relevant mathematical concepts and skills appropriately; some errors or omissions - may need help to describe and use patterns and relationships	- identifies mathematical concepts and procedures needed - applies mathematical concepts and skills appropriately; may be inefficient, make minor errors or omissions - describes and uses basic patterns and relationships	- identifies mathematical concepts and procedures needed; may offer alternatives - applies mathematical concepts and skills accurately and efficiently; thorough - independently describes and uses patterns and relationships
STRATEGIES AND APPROACHES - procedures - estimates to verify solutions	- appears unsystematic and inefficient - results or solutions are often improbable	- generally follows instructions without adjusting or checking - may need reminding to verify results or solutions; estimates are generally logical	- follows logical steps; may be inefficient - makes logical, relatively accurate estimates to verify results or solutions	- structures the task efficiently; may find a shortcut - makes logical estimates to verify results or solutions
ACCURACY recording, calculations	often includes major errors in recording or calculations	may include some errors in recording or calculations; generally "close"	recording and calculations are generally accurate; may include minor errors	recording and calculations are accurate; may use mental math
REPRESENTATION AND COMMUNICATION - presenting work - constructing charts, diagrams, displays - explaining procedures, results	- work is often confusing, with key information omitted - often omits required charts, diagrams, or graphs, or makes major errors - explanations are incomplete or illogical	- most work is clear; may omit some needed information - creates required charts, diagrams, or graphs; some features may be inaccurate or incomplete - explanations may be incomplete or imprecise	- work is generally clear and easy to follow - uses required charts, diagrams, or graphs appropriately; may have minor errors or flaws - explains procedures and results logically in own words	- work is clear, detailed, and logically organized - uses required charts, diagrams, or graphs effectively and accurately - explains procedures and results clearly and logically; may include visuals

* You may want to list key curriculum concepts or skills for a particular task.

Rating Scale: Grade 6 Numeracy

These criteria may apply at any time of the year, depending when specific skills or concepts are introduced. *

Aspect	Not Yet Within Expectations	Meets Expectations (Minimal Level)
SNAPSHOT	<i>The student is unable to meet basic requirements of the task without close, ongoing assistance. The student is unable to provide a relevant extension.</i>	<i>The work satisfies most basic requirements, but it is flawed or incomplete. The student may produce an extension by making a minor variation in the original task. Often needs some help.</i>
CONCEPTS AND APPLICATIONS** - recognizing mathematics - grade-specific concepts, skills - patterns, relationships	- unable to identify mathematical concepts or procedures needed to solve a problem or complete a task - does not apply relevant mathematical concepts and skills appropriately; major errors or omissions - often unable to describe patterns or relationships	- identifies most mathematical concepts and procedures needed to solve a problem; may oversimplify or miss some aspects of the task - applies most relevant mathematical concepts and skills appropriately; some errors or omissions - describes and uses some patterns and relationships; may need some help
STRATEGIES AND APPROACHES - procedures - estimates to verify solutions	- appears unsystematic and inefficient - results or solutions are often improbable, suggesting that the student is unable to make logical estimates	- generally follows instructions without adjusting or checking procedures - may need reminding to use estimation to verify results or solutions; estimates are generally logical
ACCURACY recording, calculations	often includes major errors in recording or calculations	may include some errors in recording or calculations; generally answer or solution is "close"
REPRESENTATION AND COMMUNICATION - presenting work - constructing charts, diagrams, displays - explaining procedures, results	- work is often confusing, with key information omitted - often omits required charts, diagrams, or graphs, or makes major errors - explanation of procedures or results is incomplete or illogical; uses little or no mathematical language	- most work is clear, although some necessary information may be omitted - creates required charts, diagrams, or graphs, but some features may be inaccurate or incomplete (e.g., diagrams not to approximate scale; inappropriate intervals) - explanations of procedures and results may be incomplete or imprecise; uses little mathematical language

* Student performance that falls within the wide range of expectations for Grade 6 generally matches the Level 3 descriptions in Evaluating Mathematical Development Across Curriculum.

**Some of the curriculum concepts and skills students are expected to apply in completing numeracy tasks are specific to the type of task. The shaded charts below the Rating Scale show some of the concepts and skills most likely to apply in Grade 6.

MONEY TASKS

- percentage
- equality

CHANCE TASKS

- experimental and theoretical probability of single events
- identify relationships between number of faces and probability of a single event, using various polyhedrons and dice

	Fully Meets Expectations	Exceeds Expectations
	<i>The work satisfies basic requirements of the task. If asked, the student can produce a relevant extension or further illustration.</i>	<i>The work is complete, accurate, and efficient. The student may volunteer an extension, application, or further illustration of the same mathematical idea.</i>
	- identifies the mathematical concepts and procedures needed to solve a problem or complete a task - applies relevant mathematical concepts and skills appropriately; may be somewhat inefficient or make minor errors or omissions - describes and uses basic patterns and relationships (e.g., how surface area affects volume; comparison of two results); may need prompting	- identifies the mathematical concepts and procedures needed to solve a problem or complete a task; may offer alternative methods - applies relevant mathematical concepts and skills accurately and efficiently; thorough - independently describes and uses patterns and relationships (e.g., how surface area affects volume; comparison of two results)
	- structures the task into logical steps or stages; may be inefficient - makes logical and relatively accurate estimates to verify results or solutions	- structures the task efficiently; may find a shortcut for the procedure modelled or offer alternative ways to address the task - makes logical estimates to verify results or solutions
	recording and calculations are generally accurate; may be minor errors	recording and calculations are accurate; may use mental math
	- work is generally clear and easy to follow - uses required charts, diagrams, or graphs appropriately; these may have minor errors or flaws (e.g., missing units, title, or axis labels) - explains procedures and results logically in own words; uses some mathematical language	- work is clear, detailed, and logically organized - uses required charts, diagrams, or graphs effectively and accurately - explains procedures and results clearly and logically in own words; uses mathematical language; may include visuals

DATA ANALYSIS

- formulate questions
- identify appropriate data sources
- select data collection method
- choose population sample
- display data (including histograms, double-bar graphs, stem-and-leaf plots)
- interpret graphs; describe distributions
- analyze data to make comparisons and test predictions

MEASUREMENT

- perimeter
- area
- surface area
- volume
- measurement of angles

OTHER APPLICATIONS OF SHAPE AND SPACE

- create, analyze, and describe designs
- draw designs
- recognize and describe optical illusions
- sketch 3-D solids and skeletons

Sample 1: Lifestyle Data (Data Analysis)

CONTEXT

This task was a mathematics component within an integrated unit on “Healthy Lifestyles” for Personal Planning.

MATHEMATICAL CONCEPTS

- ◆ compare and order improper fractions and decimal fractions
- ◆ calculate with whole numbers, decimal fractions, and percentage
- ◆ display data by hand or by computer in a variety of ways
- ◆ read and interpret graphs
- ◆ describe the general distribution of data

PROCESS

Students were given written instructions to follow a five-step process, as summarized here.

Step 1

Use a chart provided to record the time spent (rounded to the nearest 15-minute interval) in a 24-hour period on each of the following activities:

- ◆ exercising
- ◆ sleeping
- ◆ watching TV
- ◆ other activities

Step 2

Use recorded data to:

- ◆ calculate the total amount of time in each category
- ◆ check that the total added up to 24 hours (If the total was not 24 hours, students discussed what they might have done wrong and solicited advice from other students.)

Step 3

Represent data by:

- ◆ constructing a 24-hour strip graph using the template provided and a different colour for each category of activity
- ◆ construct a circle graph with the same data

NOTE:

In order to help students construct a circle graph without using protractors, the teacher ironed basket coffee filters flat and had students figure out different ways of finding the centre (folding, using a compass). She then had the students tape the ends of their strip graphs together into circular bracelets. Students placed their bracelets on the circles so that each section was an equal distance from the centre of the circle and marked the boundaries of each category from the strip graphs onto the circle graphs.

Step 4

Suggest alternative methods of representing the information, choose the one most appropriate, explain the choice, and represent the information in this form as well.

Step 5

Respond to a series of questions designed to help interpret the data. (See student samples for the questions.)

NOTE:

In the following examples, students used colour coding in their charts and graphs. This is not always easy to see in the reproduction.

NOT YET WITHIN EXPECTATIONS

Teacher's Observations

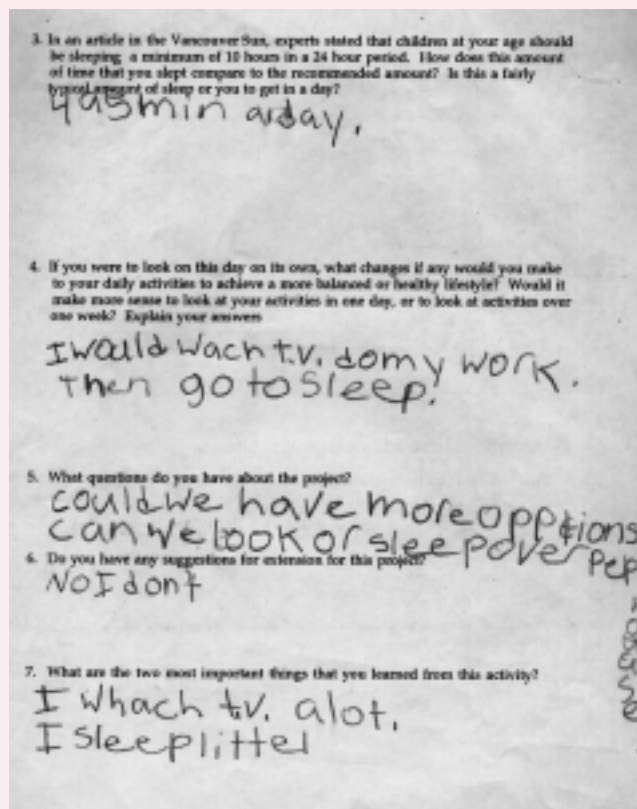
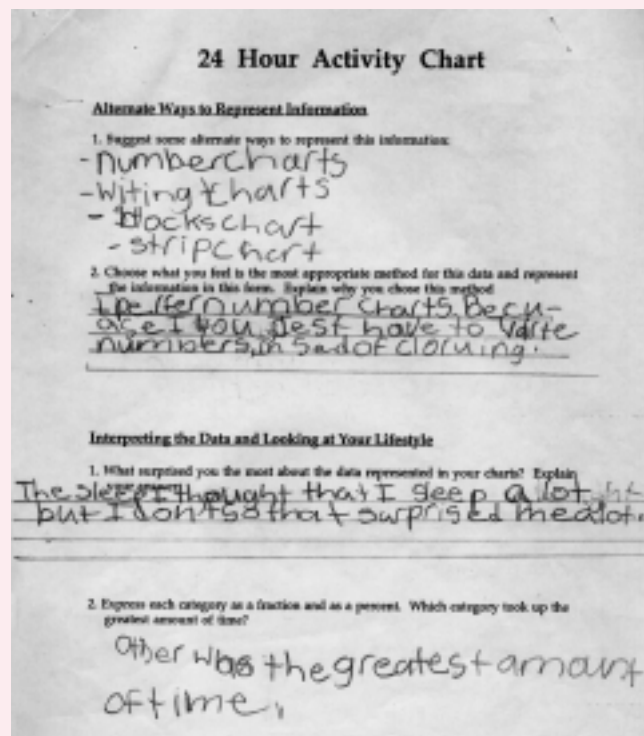
This student required ongoing assistance to record data, graph it, interpret it, and answer questions. She was unable to do the calculations involving fractions and percentage, or to represent the data in a way that had not been modelled in class.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ♦ unable to identify mathematical concepts or procedures needed
- ♦ appears unsystematic and inefficient
- ♦ key information omitted
- ♦ explanation of procedures and results is incomplete; uses little mathematical language

24 hour chart		
Exercise		
From	To	Explanation of Activity
10:32	10:45	Recess walking 13
12:00	12:45	Lunch football 45
3:30	4:20	walking from school 50
7:09	7:46	Dancing to music 37
		144 200 74
From	To	Explanation of Activity
3:00	4:00	Off the wall 30
4:30	5:30	classroom/home work 30
5:30	6:00	Alladen 30
6:00	6:30	Tom and Puber 30
6:30	7:00	Dinosaurs 30 230
Sleeping		
From	To	Explanation of Activity
9:45	7:30	Sleeping 10

Other		
From	To	Explanation of Activity
9:00	10:30	School work 90
10:45	12:00	School work 155
1:00	2:50	School work 150
4:00	5:58	Home work 158
		555



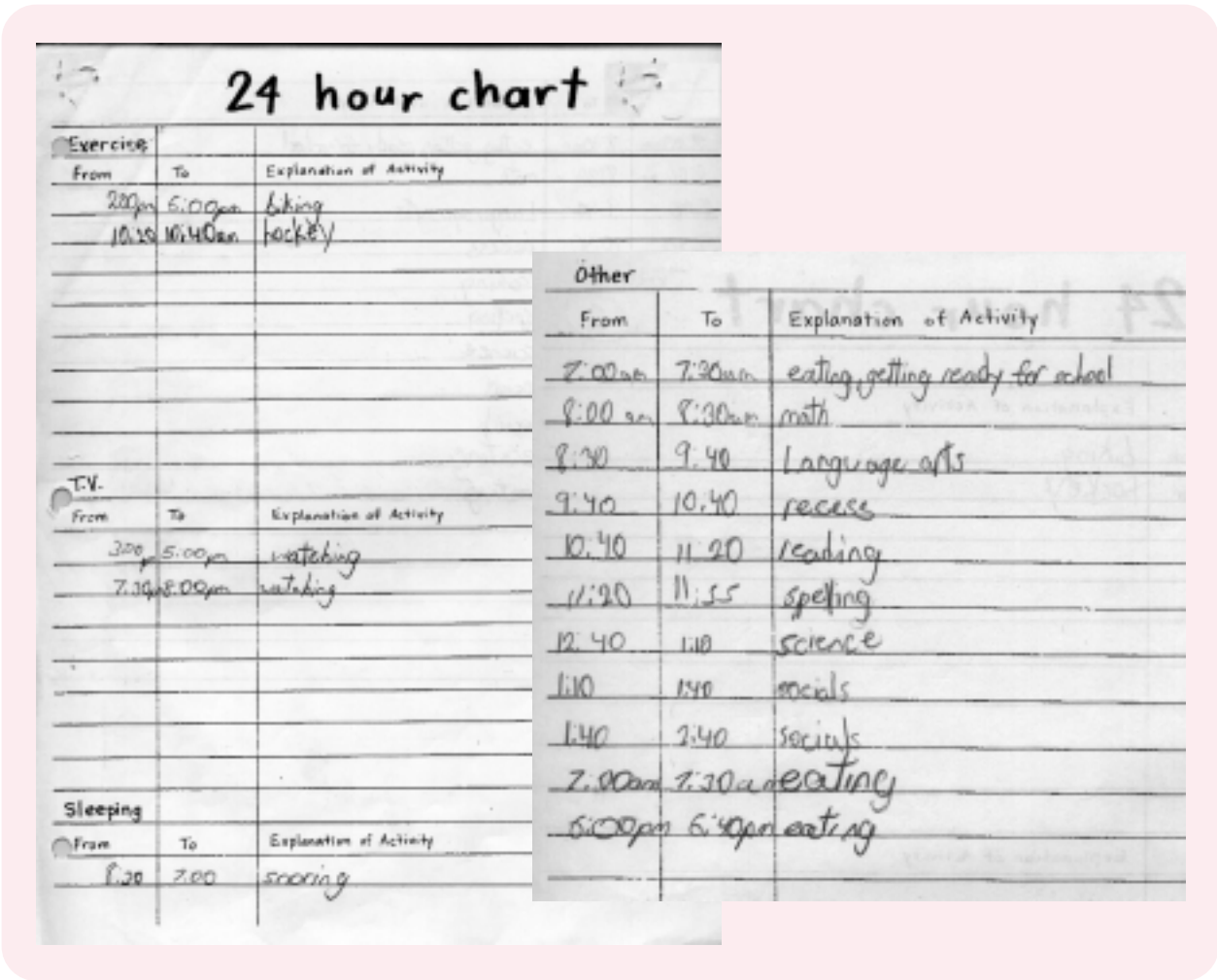
MEETS EXPECTATIONS (MINIMAL LEVEL)

Teacher's Observations

This student was able to interpret his results with some prompting. Some of the calculations of percentage are inaccurate. The circle graph is constructed carelessly, and he did not represent his data in an additional way.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- identifies most mathematical concepts and procedures needed
- describes and uses some patterns and relationships; needs some help
- some errors in calculations; the answer is “close”
- creates required graphs, but some features are inaccurate or incomplete
- explanations of procedures and results are incomplete; uses little mathematical language



Step 2

① exercise = 4 hours
sleep = 11 hours

television = 3 hours
other = 6 hours

② exercise 4 hours
TV 3 hours
sleep 11 hours
other 6 hours
24

③ The strategies I used were to use a watch and time everything I did.

Dad would tell them to reduce their paper

Step 3

Legend

② exercise = red
TV = blue
sleep = green
other = yellow



TV 3 hours



other 6 hours



exercise 4 hours

Hilroy

Step 4

- ① For a different way, I would make a bar graph to show the information or a tally graph.
- ② I would choose the tally graph.
- ③ I chose this method because it's a better way of showing the time.

Step 5

- ① I was surprised that my J.V. period was shorter because it seemed I watched a lot of J.V.
- ② The red is $\frac{4}{16}$ 25% The green took up the green is $\frac{10}{16}$ 60% most of the time.
The yellow is $\frac{3}{16}$ 16.5%
The blue is $\frac{1}{16}$ 12.5%
- ③ My sleep time compares pretty well, I slept for 11 hours.
Yes this is pretty typical.
My sleep changes from homework or the weekends.
- ④ I spent 4 hours exercising
- ⑤ I spent 3 hours watching J.V.
- ⑥ I would make sure that I got a lot more exercise because it's healthy for your body.

Teacher's Observations

	Not Yet	Meets	Fully	Exceeds
<i>SNAPSHOT</i>				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ identifies the mathematical concepts and procedures needed
- ◆ applies relevant mathematical concepts and skills appropriately
- ◆ describes and uses basic patterns and relationships (e.g., comparison of results)
- ◆ recording and calculations are generally accurate
- ◆ uses required graphs appropriately
- ◆ explains procedures and results logically in own words; uses some mathematical language

GRADE 6 NUMERACY

A TYPICAL THURSDAY

6:30 wake up
 6:30-6:40 eat breakfast (10 min) •
 6:40-6:45 brush teeth (5 min) •
 6:45-7:30 get ready for school (45 min) •
 7:30-7:35 Walking to Terri's (5 min) •
 7:35-8:30 Time @ Terri's (1 hour) •
 8:30-8:35 Walking from Terri's to school (5 min) •
 8:35-8:40 Waiting for the bell to ring (5 min) •
 8:40-2:30 School (6 hours) •
 2:30-2:35 Walking from school to Terri's (5 min) •
 2:35-2:40 Walking from Terri's (5 min) •
 2:40-3:30 Time @ Terri's (45 min) •
 3:30-3:35 Terri's house to my house (5 min) •
 3:35-4:00 Getting ready for Basketball (30 min) •
 4:00-6:00 Basketball Camp (2 hours) •
 6:00-6:30 Eat + Change Clothes (30 min) •
 6:30-8:00 C.C.D (1 hour 30 min) •
 8:00-8:15 Driving home (15 min) •
 8:15-8:30 Brushing my teeth + Washing Up. (15 min) •
 8:30-8:45 Changing into PJ's (15 min) •
 8:45-9:00 Getting into Bed + Saying Goodnight. (15 min) •
 9:00-6:30 Sleep. •

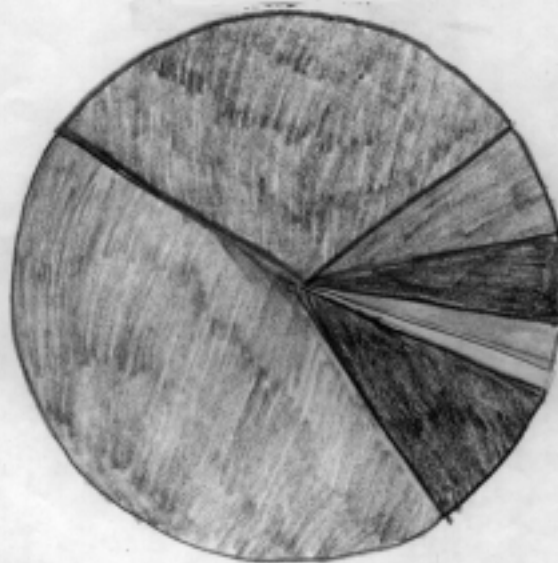
Exercise - • 1 hour 45 min.
 Washroom - • 20 min.
 Sleep - • 9 hours 30 min.
 Other - • 1 hour 40 min.
 Time @ Terri's - • 1 hour 45 min.
 Eating - • 40 min.
 School - • 6 hour

1455
 - 1400

 1055

P.S. - Terri is my baby-sitter

CIRCLE GRAPH



LEGEND

- Exercise - ●
- Washroom - ●
- Sleep - ●
- Other - ●
- Time @ Terri's - ●
- Eating - ●
- School - ●

ALTERNATE WAYS TO REPRESENT THIS INFORMATION :

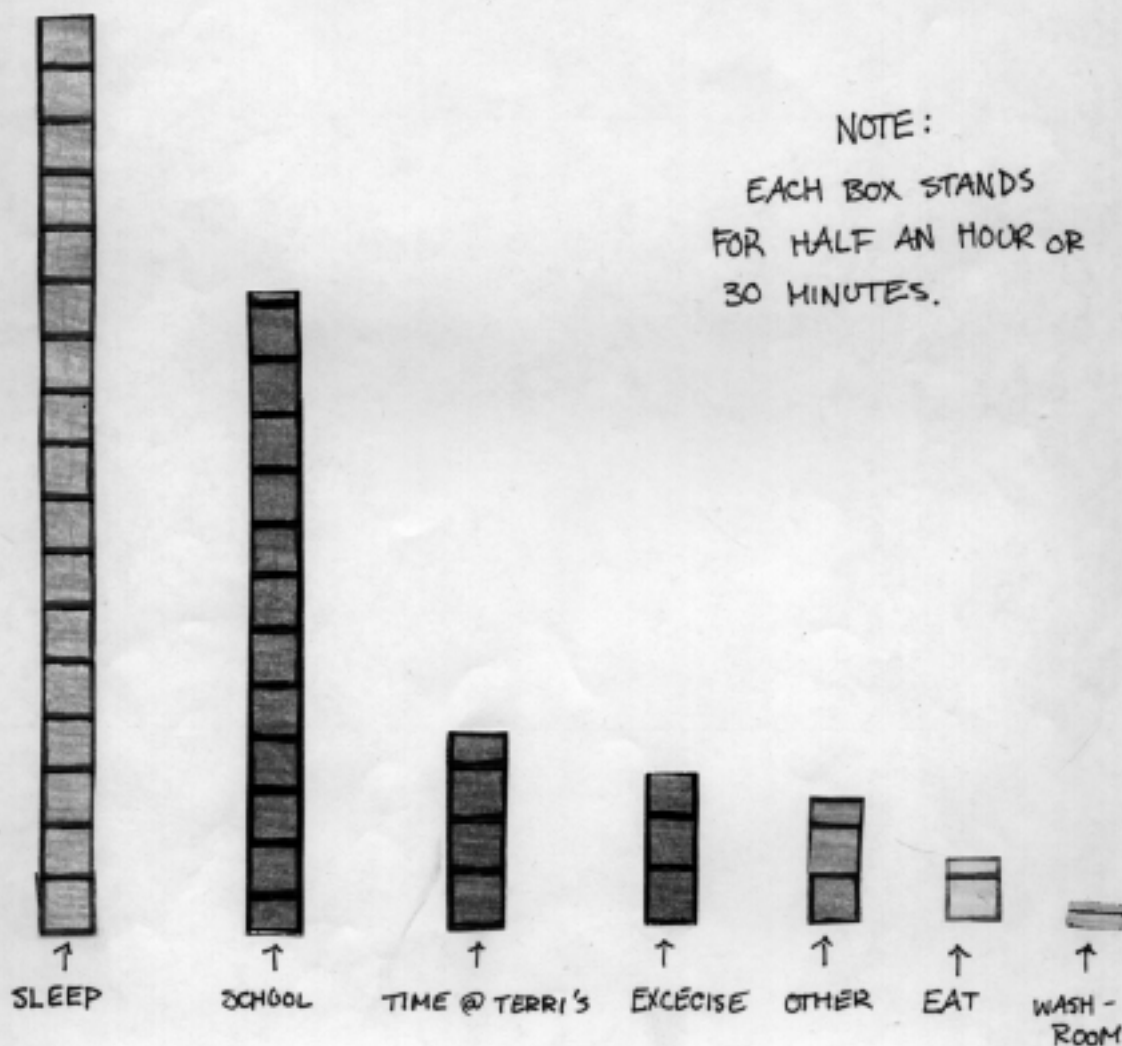
- THIS INFORMATION COULD BE SHOWN IN A BAR GRAPH 
- THIS INFORMATION COULD BE SHOWN IN A LINE GRAPH 
- THIS INFORMATION COULD BE SHOWN ON A CHART 
- THIS INFORMATION COULD BE SHOWN IN A PIE GRAPH 
- THIS INFORMATION COULD BE SHOWN IN A WRITE-UP 

CONCLUSION

I thought that this information was shown the best in a bar graph. I thought this because a bar graph is simple and easy to read.

STEP #4

BAR GRAPH



INTERPRETING THE DATA AND LOOKING AT YOUR LIFESTYLE

- 1) It surprised me that school and sleep took up so much time in my life. After that, exercise was what I did much more than anything else. The other category is made up of all other activities that I do, and I even exercise more than all of those things put together.

- 2) Sleep took up the most of my time. I slept from 9:00 pm - 6:30 am.
- 3) I sleep very close to ten hours a night. I sleep nine hours and thirty minutes every night. This is a fairly typical amount of sleep per day. This amount of sleep may change if I am ill and go to bed earlier, or if I have a late night. It may also change if I have a nap during the day.
- 4) I spend 1 and a half to 2 and a half hours exercising every day.
- 5) I don't spend any time watching T.V. during the day.
- 6) If I could change my day I would become more active, join a club or do more after school activities. I think that I should do more activities, and that I should exercise more.
- 7) If a person was wondering if they needed to make changes to their lifestyle it would only be fair to look at their activities in a week. After all, what if you caught them on a bad day when all they did was watch T.V.? You would think they were lazy. But if you got them on a day when they exercised did you would think they were a jock. That is why it is fair to look at a week not a day.
- 8) I don't have any.
- 9) No.
- 10)

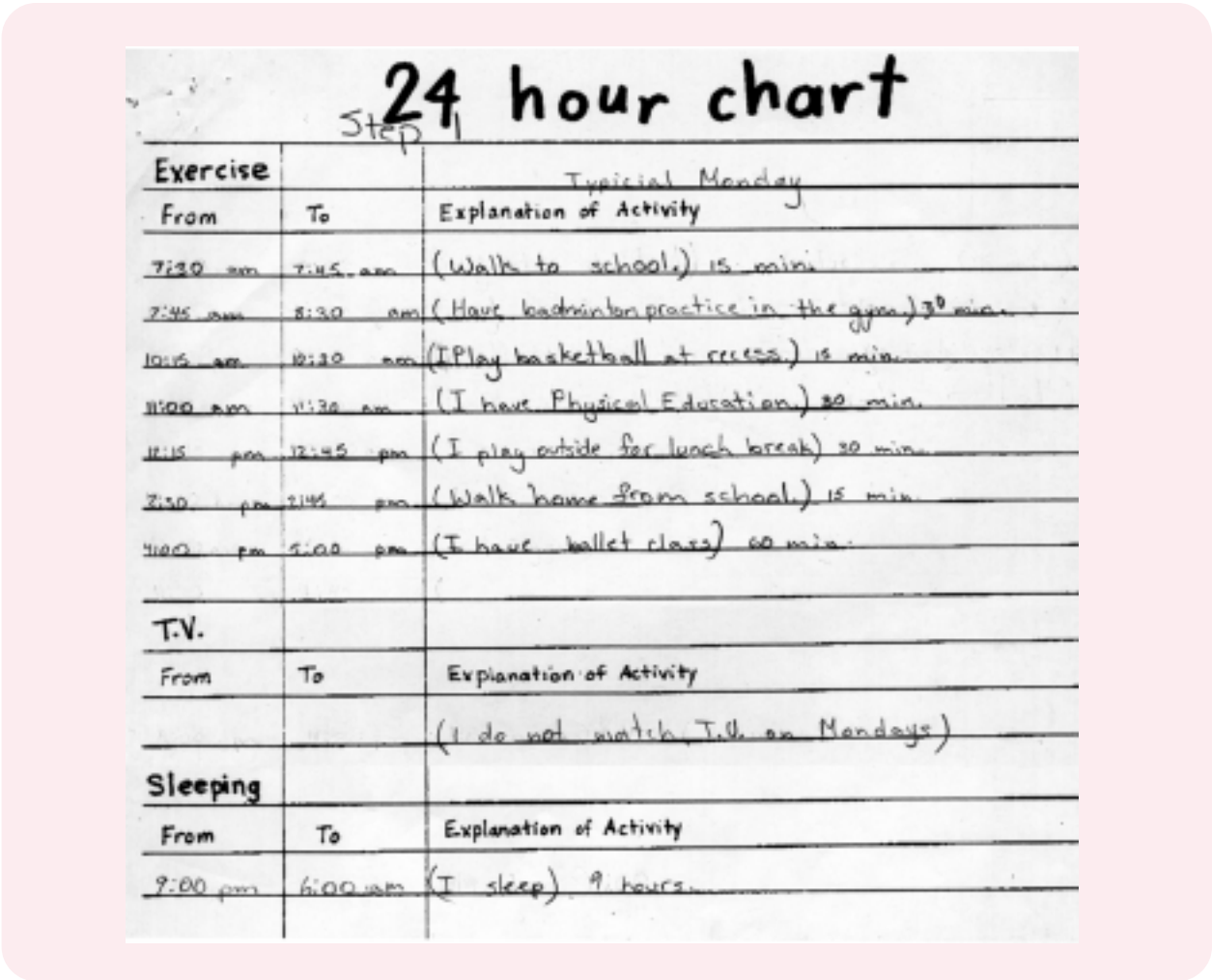
EXCEEDS EXPECTATIONS

Teacher's Observations

This student collected exceptionally detailed data and offered logical conclusions. All work is correct, accurate, detailed, and thorough.

- ◆ applies relevant mathematical concepts and skills accurately and efficiently; thorough
- ◆ independently describes and uses patterns and relationships involved (e.g., comparisons of results)
- ◆ structures the task efficiently
- ◆ recording and calculations are accurate
- ◆ uses required charts and graphs effectively and accurately
- ◆ explains procedures and results clearly and logically, in own words; uses mathematical language; includes visuals

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				



Other		
From	To	Explanation of Activity
6:00 am	6:15 am	(Get up-get dressed-make bed-do hair) 15 min.
6:30 am	6:45 am	(Pack my bag and my badminton) 15 min.
6:45 am	7:15 am	(I eat my breakfast) 30 min.
7:15 am	7:30 am	(Brush teeth, get shoes, coat, bag, racket) 15 min.
8:30 am	10:15 am	(I have normal school classes) 45 min.
10:30 am	11:00 am	(I have normal school classes) 30 min.
11:30 am	11:45 am	(I have silent reading) 15 min.
11:45 am	12:00 pm	(I have library sign out time) 15 min.
12:00 pm	12:15 pm	(I eat at school) 15 min.
12:45 pm	1:15 pm	(I have normal classes) 30 min.
1:15 pm	2:15 pm	(I have buddies in the primary wing) 45 min.
2:15 pm	2:30 pm	(I have C.B. reorganization) 15 min.
2:45 pm	3:00 pm	(I unload my bag and eat my snacks) 15 min.
3:00 pm	3:15 pm	(I get dressed and do my hair for ballet) 15 min.
3:15 pm	3:45 pm	(I go pick up ballet friend then drive to ballet studio) 15 min.
3:45 pm	4:00 pm	(I put on ballet shoes and take off street shoes) 15 min.
5:00 pm	5:15 pm	(I put on street clothes and take off ballet shoes) 15 min.
5:15 pm	5:45 pm	(I drop off ballet friend and drive home) 30 min.
5:45 pm	6:00 pm	(I do some homework) 15 min.
6:00 pm	6:30 pm	(I eat my dinner) 30 min.
6:30 pm	6:45 pm	(I finish my homework) 15 min.
6:45 pm	7:15 pm	(I do my violin practice) 30 min.
7:15 pm	7:45 pm	(I have bath) 30 min.
7:45 pm	8:00 pm	(I get my bed ready and get into P.J.'s) 15 min.
8:00 pm	8:45 pm	(I read my book) 45 min.
8:45 pm	9:00 pm	(I go to the bathroom and get into bed) 15 min.

Step 2

3) Strategies - The strategies I used were simple. Added each category by counting the number of numbers. (I know, it sounds confusing) For example in Exercise 1 have:

$$\begin{array}{rcl}
 15 & & \\
 45 & \left\{ & = 45 \times 1 = \\
 15 & & = 60 \times 1 = \\
 30 & & = 15 \times 3 = \\
 30 & & = 30 \times 2 = \\
 15 & & \uparrow \\
 60 & &
 \end{array}$$

Then I calculated each of these and divided them by 60.

$$45 \times 1 = 45 \div 60 = 45 \text{ min.}$$

$$60 \times 1 = 60 \div 60 = 1 \text{ hour.}$$

$$15 \times 3 = 45 \div 60 = 45 \text{ min.}$$

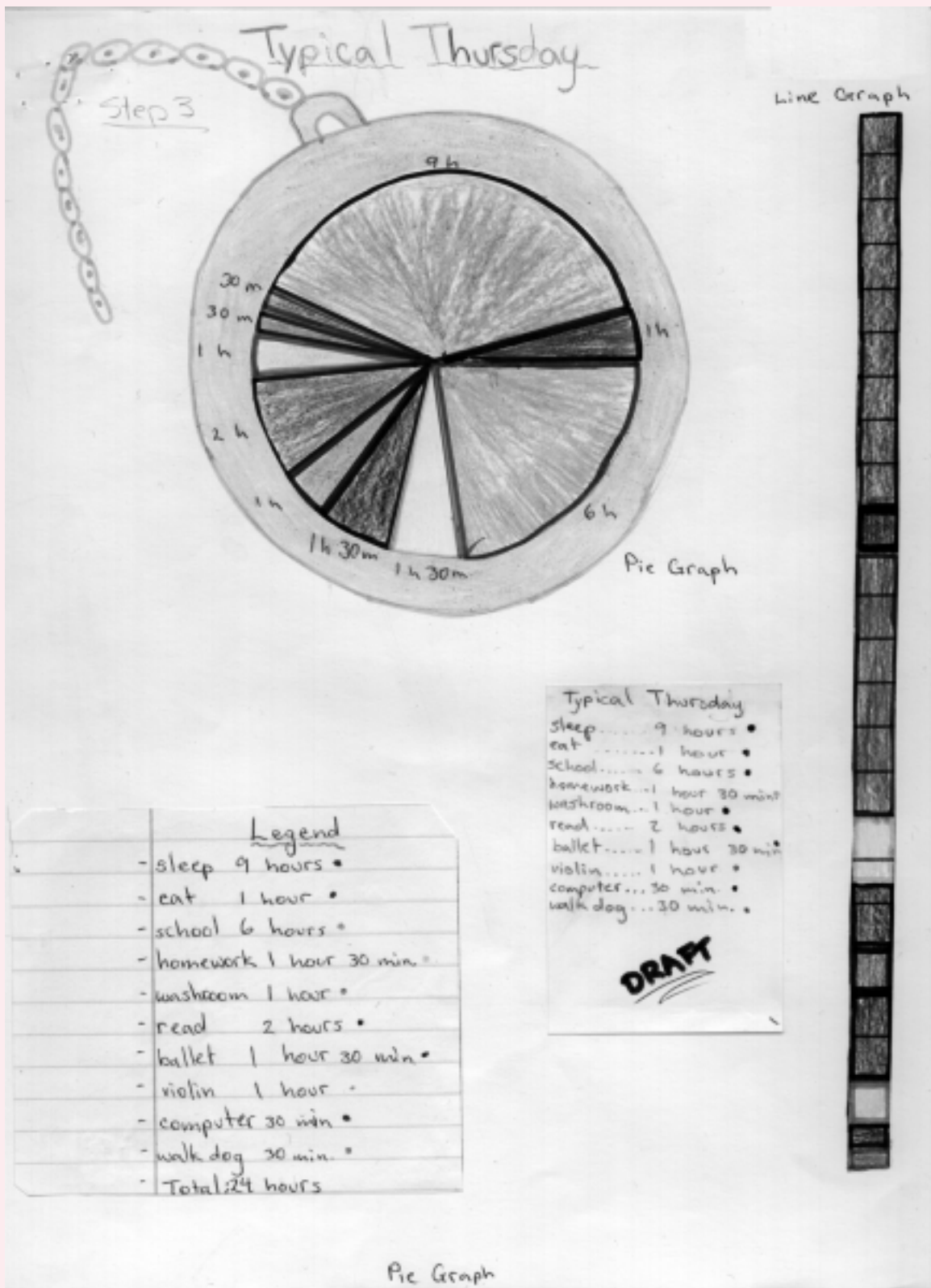
$$30 \times 2 = 60 \div 60 = 1 \text{ hour.}$$

Then I did a grand total and calculated each of the remaining min./hours.

$$\begin{array}{r}
 45 \text{ min} \\
 1 \text{ hour} \\
 45 \text{ min} \\
 + 1 \text{ hour} \\
 \hline
 3 \text{ h } 30 \text{ m}
 \end{array}$$

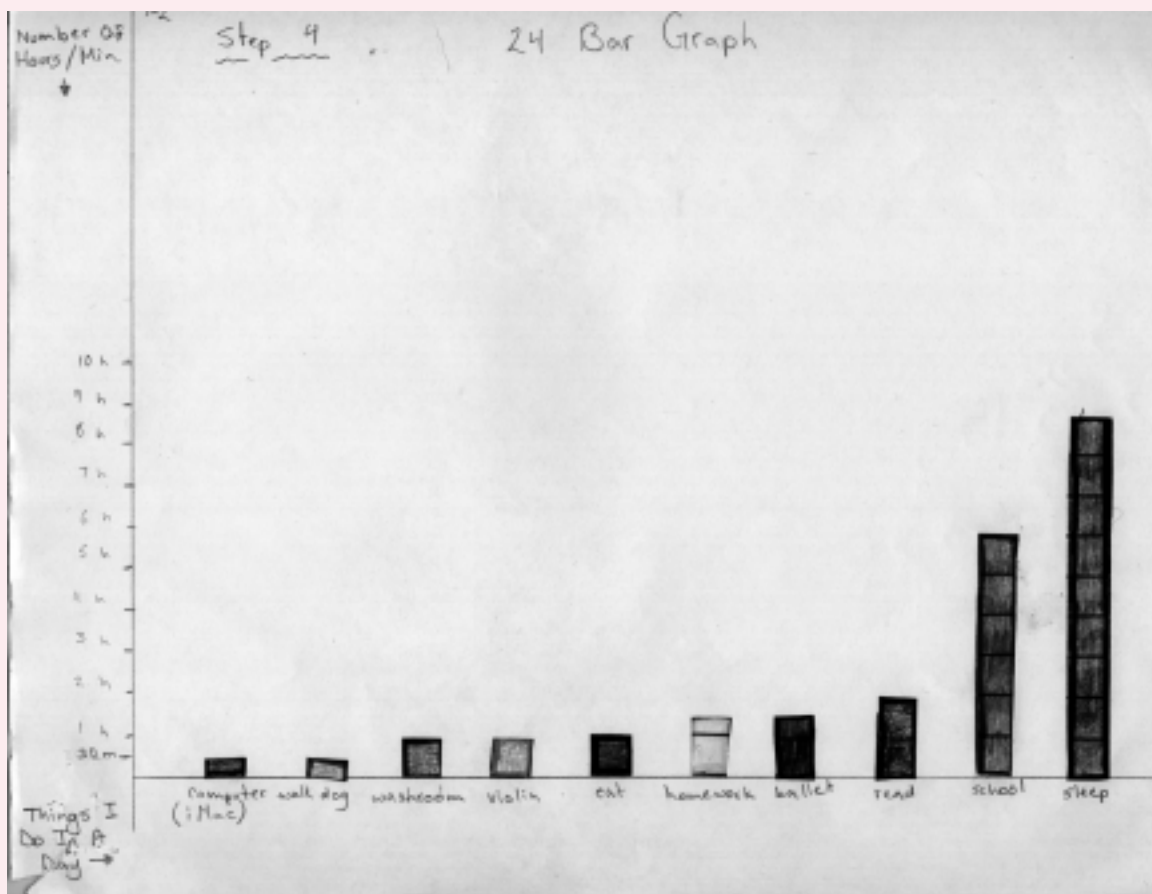
I followed this process throughout the other categories.

4a) The advise I would give someone would be that at whatever time you go to bed (the day before) you must go until then the next day.
example: I go to bed at 9:00 pm and finished my day at 9:00 pm.



Step 4

- 1) You could use a line graph, picto graph, bar graph.
- 2) Stapled on the back.
- 3) I chose to do this bar graph because I like the look of the organized and neat way that the data is displayed. It is easy to read and is to use.



Step 5

- 1) What I was surprised with the fact that after completing it I was pretty happy with myself. I realize that a few of my questions are incorrect, being myself, I know I am not a mathematician. (or a speller)

	Fraction	Percent
Exercise -	$\frac{3.30}{24}$	3.30%
T.V. -	0	0%
Sleeping -	$\frac{9}{24}$	9%
Other	$\frac{10.75}{24}$	10.75%

My OTHER Category took up the majority of my time.

- 2) I sleep 9 hours a day. (Yes I know my bedtime's early for a grade six, but I LOVE my bed. On school days, I got to bed at 9:00 and wake up at 7:00 (except on Mondays when I have to get up at 6:30 for badminton at 7:30.)

- 3) I spent 3 hours 30 min exercising during the day.

- 4) I do not watch T.V. on Monday.

- 5) I don't think that there is a need to change anything. I spend a healthy time exercising, a healthy time sleeping, (well, maybe a little too healthy of a time), but when it comes down to it I don't want to change anything.

- 6) I think it would be better to look at someone's activities in a week because someone could have more or less of something in a week.

8. I don't have any questions, except for the fact of why OUR CLASS had to do this.
9. No. I do however think you should explain what you want us to do a little more clearly.
10. Two important things I learnt from doing this was:
 - a) how to work together with someone
 - b) how to use logic on solving these problems.

Sample 2: Designing a Box to Hold CDs (Measurement)

CONTEXT

Students had previous instruction and practice in calculating surface area and volume using exploration, guess, and test techniques. The teacher reviewed these concepts, along with SI (metric) units and how to use measurement tools with precision.

MATHEMATICAL CONCEPTS

- ◆ calculations involving whole numbers and decimal fractions
- ◆ using SI units for length and capacity
- ◆ calculation of volume
- ◆ calculation of surface area
- ◆ describing patterns and relationships (i.e., how different dimensions affect volume)

PROCESS

Students were asked to:

- ◆ design one or more boxes to hold 12 CDs
- ◆ draw and label the dimensions of the box(es)
- ◆ calculate the volume of each box
- ◆ calculate the surface area for one box
- ◆ provide a written explanation of their thinking processes and how they went about designing their boxes
- ◆ explain how different dimensions affect the volume

NOT YET WITHIN EXPECTATIONS

Teacher's Observations

This student was able to measure a CD accurately, but unable to consistently use the correct SI units of measurement (i.e., sometimes recording length in cm, sometimes in cm^3). He was unable to complete the remaining parts of the task.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ does not apply relevant mathematical concepts and skills appropriately
- ◆ unable to describe patterns or relationships
- ◆ appears unsystematic and inefficient
- ◆ includes major errors in calculations
- ◆ omits required diagrams and makes major errors

Handwritten student work showing multiple calculations for volume and area, with various errors in units and calculations.

Top left: $H=12\text{ cm}$, $W=1\text{ cm}$, $L=14\text{ cm}$

① $12 \times 14 = 168$, $168 \times \frac{1}{12} = 14$, $14 \times 1 = 14$

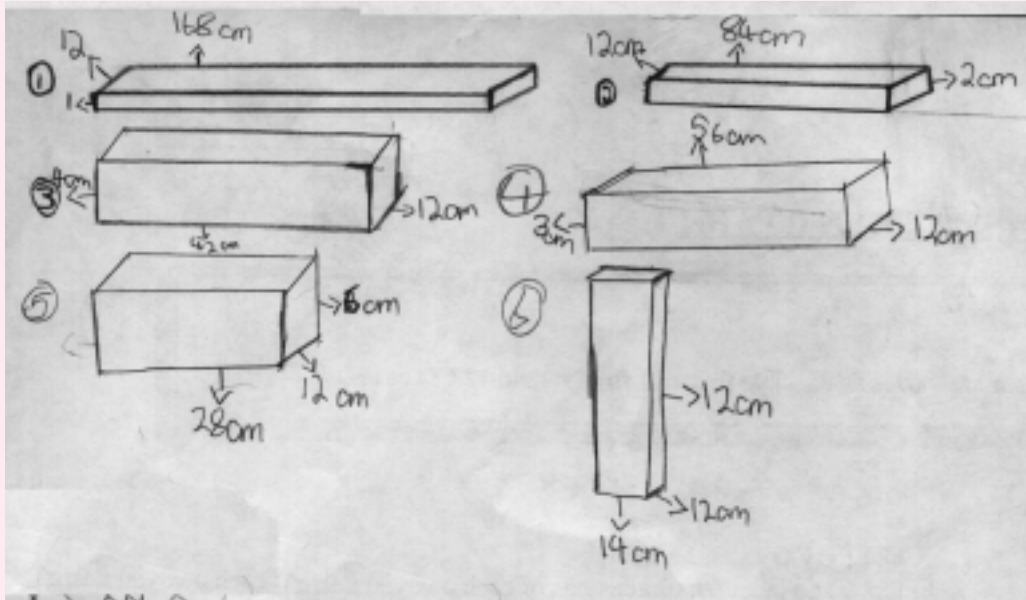
② $14 \times 6 = 84$, $84 \times \frac{1}{12} = 7$, $7 \times 2 = 14$

③ $42 \times \frac{1}{4} = 10.5$, $10.5 \times \frac{1}{12} = 0.875$, $0.875 \times 12 = 10.5$

④ $4 \times 14 = 56$, $56 \times \frac{1}{3} = 18.67$, $18.67 \times \frac{1}{12} = 1.56$

⑤ $28 \times \frac{1}{6} = 4.67$, $4.67 \times \frac{1}{12} = 0.39$, $0.39 \times 12 = 4.67$

⑥ $14 \times 1 = 14$, $14 \times \frac{1}{12} = 1.17$, $1.17 \times 12 = 14$



MEETS EXPECTATIONS (MINIMAL LEVEL)

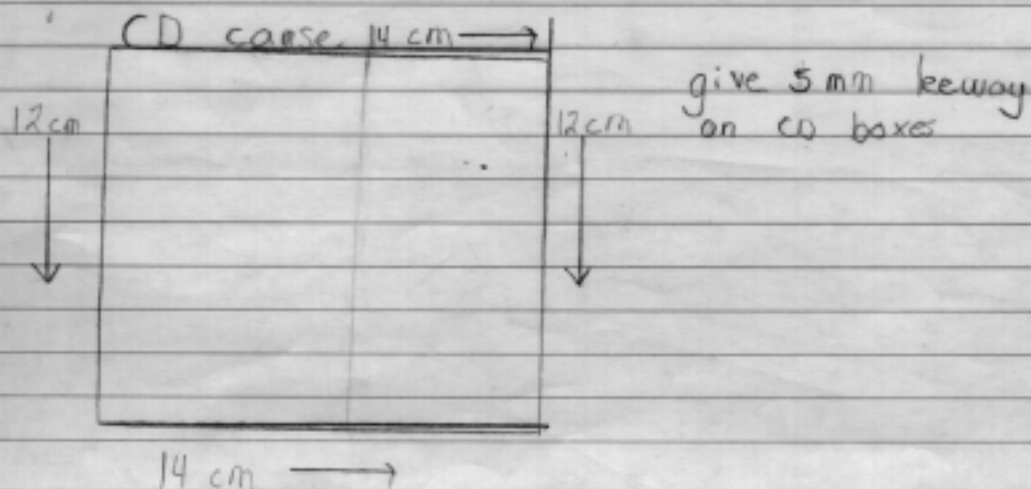
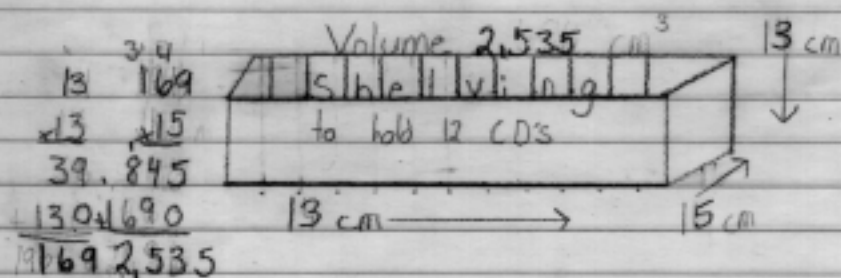
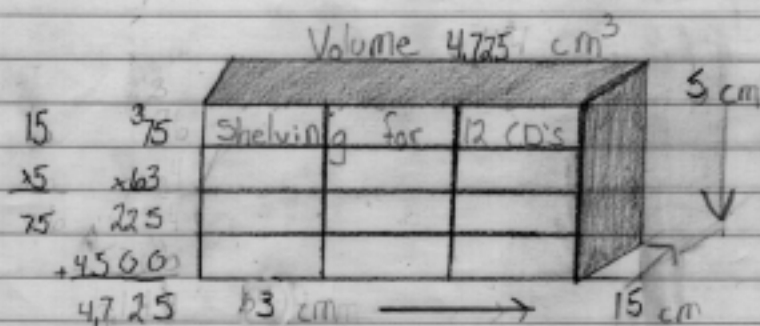
Teacher’s Observations

This student was able to complete the basic steps of the task. However, some calculations are missing (i.e., surface area) and diagrams are not to approximate scale. She was unable to give a clear explanation of how different dimensions affect volume.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ applies most relevant mathematical concepts and procedures needed; misses some aspects of the task
- ◆ follows instructions without adjusting or checking procedures
- ◆ includes some errors in recording and calculations; the answer or solution is “close”
- ◆ most work is clear, although some necessary information is omitted
- ◆ creates required diagrams (but not to approximate scale)

Different dimensions do effect the volume because I did so 2 very different designs. And how you space them out and how you put them in also changes the volume.



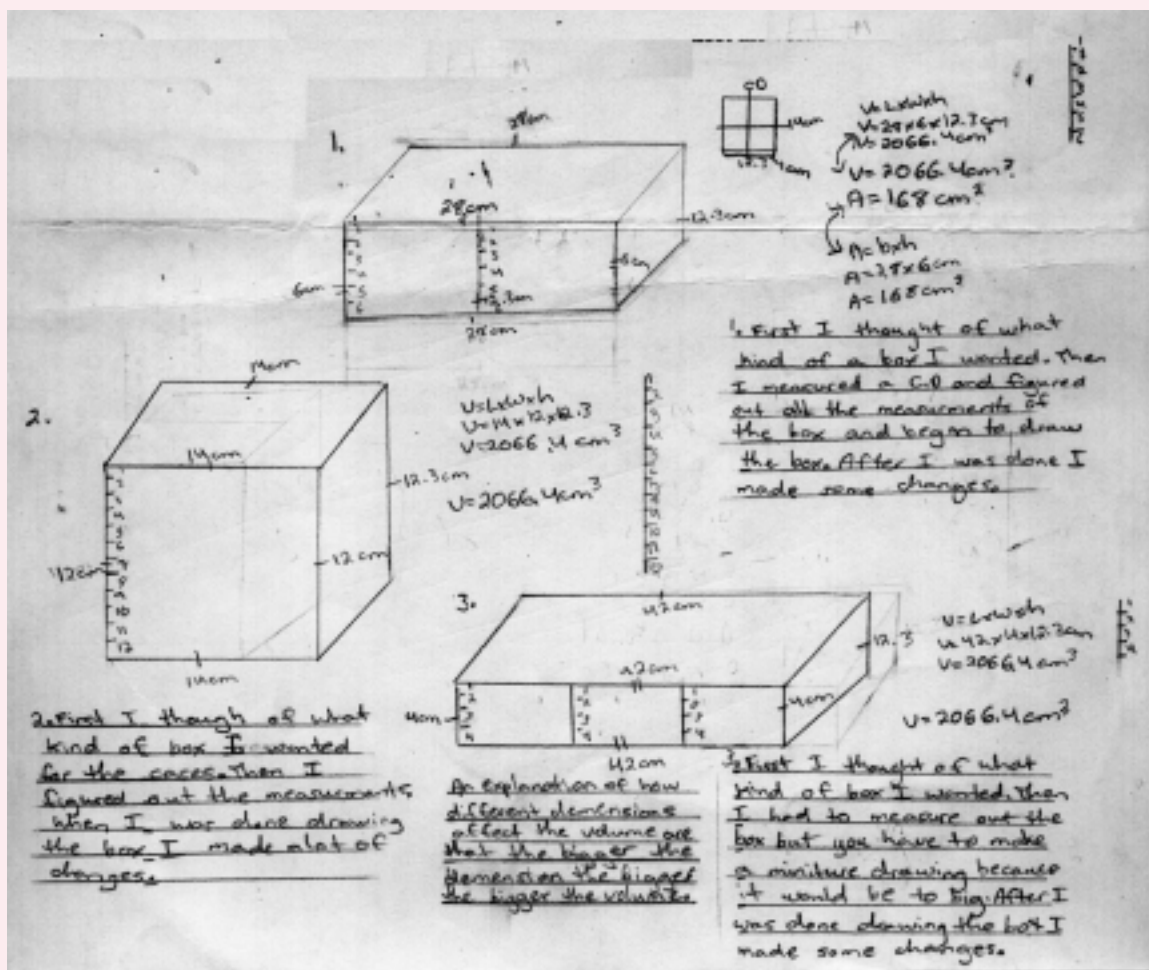
FULLY MEETS EXPECTATIONS

Teacher's Observations

This student designed three CD boxes, accurately calculating volume in each case. Diagrams are to approximate scale and clearly labelled using appropriate units. Her explanation of the effect of different dimensions on volume demonstrates a good spatial understanding.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ applies relevant mathematical concepts and skills appropriately
- ◆ describes and uses basic patterns and relationships
- ◆ recording and calculations are generally accurate
- ◆ uses required diagrams appropriately
- ◆ explains procedures and results logically in own words; uses some mathematical language



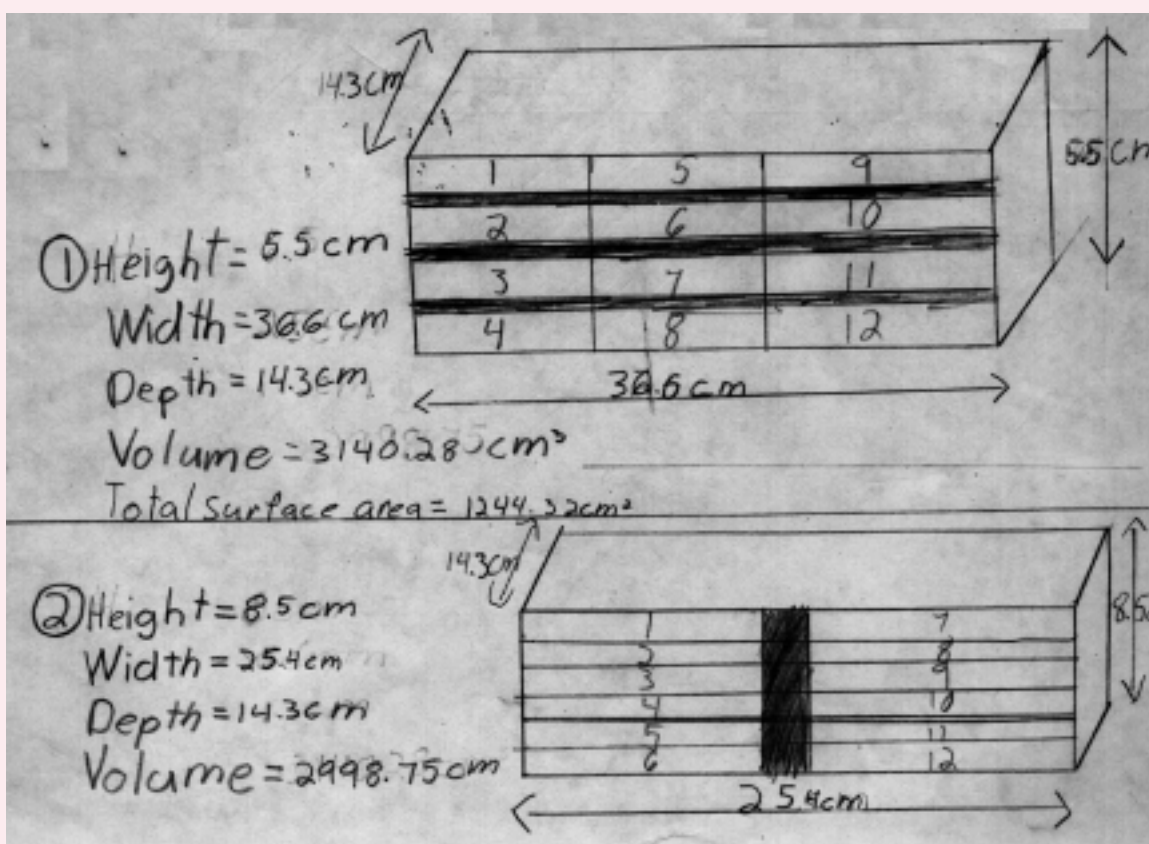
EXCEEDS EXPECTATIONS

Teacher's Observations

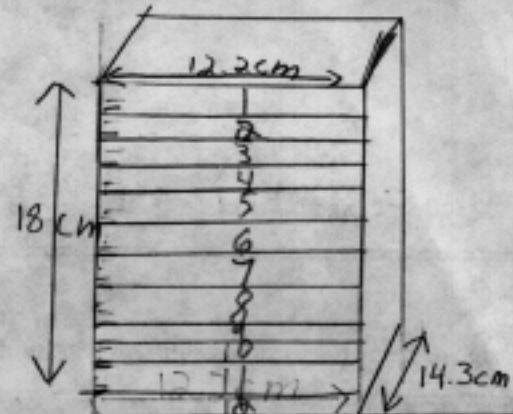
This student designed four CD boxes, accurately calculating volume in each case. The diagrams are to approximate scale and clearly labelled, using appropriate units. His explanation of his approach and the effect of the dividers and external dimensions on volume demonstrates an excellent spatial understanding.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

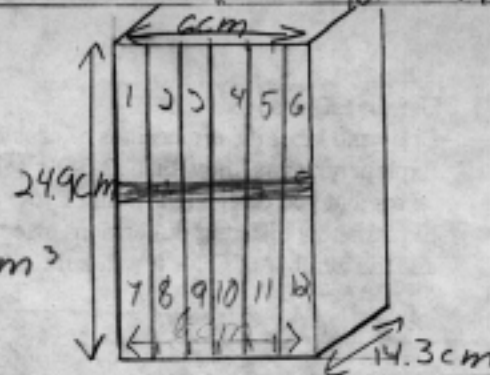
- ◆ applies relevant mathematical concepts and skills accurately and efficiently; thorough
- ◆ independently describes and uses patterns and relationships (e.g., how surface area affects volume; comparison of results)
- ◆ structures the task efficiently; offers alternative ways to address the task
- ◆ work is clear, detailed, and logically organized
- ◆ uses required diagrams effectively and accurately
- ◆ explains procedures and results clearly and logically in own words; uses mathematical language



③ Height = 18 cm
 Width = 12.2 cm
 Depth = 14.3 cm
 Volume = 3140.28 cm³



④ Height = 24.9 cm
 Width = 6 cm
 Depth = 14.3 cm
 Volume = 2136.42 cm³



Since I know the dimensions of a CD case (1cm height $\times$ 12.2cm width $\times$ 14.3cm depth), I was able to design four CD boxes.

The depth of one case is 14.3cm, so I automatically know the depth of the box will be 14.3cm. The height of one case is 1cm, so I stacked 4 cases on top of each other with 5mm dividers in between the cases. Then I put three piles of four together to get 12 CD's. To get the width, I multiplied 12.2×3 to get 36.6cm which is the width. There are no dividers in between the piles. That is how I designed box #1.

Once again, the depth is 14.3cm, which is the depth of one case. Instead of 3 stacks of 4 cases, I made 2 stacks of 6 cases once again with 5mm dividers in between the cases. For the width, I multiplied 12.2×2 and added 1cm for the divider between the two piles, which gave me 24.9cm. This is how I designed box #2.

All the boxes including this one have a depth of 14.3cm. All the boxes including this one have a depth of 14.3cm. The height is 18cm because I stacked them all in one pile with 5mm dividers in between the cases. The width 12.2cm because I only had one pile and that is the width of one case. This is how I designed box #3.

This box also has a width of 14.3cm. The height is 24.9cm because I stood the cases on end, 6 cases on the top and 6 on the bottom. I had a 5mm divider between the 6 cases on the top and 6 on the bottom. Since I stacked them on end, the width is 6cm with no dividers.

The dividers are what affect the volume. It also depends on your piles. How many there are and how high they are also affect the volume of the box.

