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ABSTRACT

This final report describes the outcomes of Project MAPS (Monitoring Authentic Problem Solving), a project that developed multimedia computer-managed assessment environments to overcome the barriers educators face in using problem-solving performance assessment (PSPA) with students with disabilities. MAPS software was developed for 6 alternate performance assessments at each grade: grades 2, 3, 4, 5, and 6, for a total of 30 multimedia performance assessments. The multimedia presentation includes CD, options for reviewing selected parts of the CD, options for selecting parts of the text view, and options for selecting parts of the text for the computer to read/reread aloud. Students represent their responses on the computer by moving items from a sticker gallery or by typing in answers. The interactive scoring system automatically scores the student's responses. A study in which 40 students with disabilities and 40 comparable, same-age students completed performance assessments with and without the MAPS multimedia system, found the MAPS system could provide support for students to show what they know on complex performance assessments. Also, results showed that students could be trained in the use of the software in large group sessions lasting no more than 45 minutes. Appendices include sample screens from the MAPS multimedia system. (CR)

FINAL REPORT

MONITORING AUTHENTIC PROBLEM SOLVING: MAPS FOR ENHANCING OUTCOMES FOR STUDENTS WITH DISABILITIES

Grant #H180T70007

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FINAL REPORT

MONITORING AUTHENTIC PROBLEM SOLVING:

MAPS FOR ENHANCING OUTCOMES FOR STUDENTS WITH DISABILITIES

Grant #H180T70007

PURPOSE AND CONTEXT

The national education reform movement seeks to enhance student performance on real-world problem-solving (PS) tasks, rather than on isolated skills. This shift has prompted leaders to reject well established assessment models because of decontextualized testing formats. Instead, leaders have called for a new assessment model, known as problem-solving performance assessment (PSPA), which requires students to solve authentic problems by applying multiple skills and strategies to real-life situations. This PSPA movement has gained tremendous momentum; over 40 states have incorporated PSPAs into high-stakes accountability programs.

For students with disabilities (SWD), who typically have poorly developed strategies for applying skills and who increasingly are expected to participate in state accountability programs, this PSPA movement, along with its goal of redirecting instruction to facilitate skill application and generalization to naturalistic contexts, is critical. Teachers, therefore, need feasible classroom-based PSPAs with which to routinely track improvement in PS capacity and to use that assessment information to plan better programs.

Unfortunately, barriers currently prevent teachers from having PSPAs that feasibly and accurately

index PS capacity among SWD and facilitate better PS instructional planning for SWD. For example, available PSPAs rely on text-based presentation and response formats, spuriously lowering estimates of PS capacity for SWD (who have reading and writing deficits). PSPAs are time consuming for teachers to score and interpret, limiting their usefulness in schools. Teachers have difficulty connecting PSPA information with productive teaching methods for improving PS performance. And, PSPAs do not provide parallel forms for tracking PS improvement over time or for providing SWD with routine opportunities for practice.

The purpose of "**M**onitoring **A**uthentic **P**roblem **S**olving: **MAPS** for Enhancing Outcomes for Students with Disabilities," therefore, was to develop multimedia computer-managed assessment environments to overcome these barriers. These systems comprise multimedia presentations of problem situations and interactive dialogues whereby PS performance automatically is scored, interpreted, and matched to instructional recommendations.

PROJECT ACTIVITIES

In implementing Project MAPS, the following series of actions were accomplished:

We recruited and secured unidentified staff.

Project staff attended weekly staff meetings, at which project activities, timelines, and accomplishments were discussed.

We held quarterly focus group meetings where we reviewed MAPS plans and received input from key stakeholders about plans and activities.

We identified teacher and student field testers and obtained informed consent.

We conducted teacher workshops to prepare teachers for field-testing activities. Teachers field-tested software and provided interative feedback.

We scripted and filmed video presentations of the PS situations and developed procedures for merging the video with multimedia presentation of the problem. We pressed the videos into CDs.

We developed a platform by which to collect student responses so that automatic computerized scoring could occur.

We developed a scoring system, by which every aspect of performance on every performance assessment received credit. We assessed the reliability of the scoring system and its validity against the global scoring rubric, which provided the basis for the scoring system. We programmed the computer to automatically complete the scoring.

We field tested each component of the multimedia system separately and in combination.

We conducted a large-scale study in which 40 students with disabilities and 40 comparable, same-age students completed performance assessments with and without the MAPS multimedia system in a cross-over, counterbalanced design. Results showed how the MAPS system could provide

support for students to show what they know on complex performance assessments. Also, results showed that students could be trained in the use of the software in large group sessions lasting no more than 45 minutes.

The multimedia MAPS systems does the following:

MAPS software was developed for 6 alternate performance assessments at each grade: grades 2, 3, 4, 5, and 6, for a total of 30 multimedia performance assessments.

The multimedia presentation includes CD, options for reviewing selected parts of the CD, options for selecting parts of the text view (on screen), and options for selecting parts of the text for the computer to read/reread aloud.

Students represent their responses on the computer by moving items (words, numbers, operation signs, etc.) from a sticker gallery or by typing in answers.

The interactive scoring scoring system automatically scores the student's responses. It relies on elaborate frameworks for awarding credit for each aspect of the response for each question on each PA. Scores are provided for each assessment in terms of conceptual underpinning, computational applications, problem-solving strategies, and communicative value. In addition, the computer tracks progress on finer-level skills, which the teacher can use to inform her instructional planning.

For student feedback, MAPS uses a video-game format, whereby the student accesses, at any time, the current score total. The computer also provides "tips," which direct the student about how he can improve his response and his score.

The teacher report summarizes salient dimensions of student performance at one point in time and over the course of time, in graphic and descriptive format. The report distinguishes between data representing first-time assessments (real assessment scores) and repeat

administrations (i.e., practice) PA scores.

See Appendix for sample screens for the MAPS system.

CONCLUSIONS

1. A multimedia system can be designed to overcome barriers that (a) typically prevent teachers from having PSPAs that feasibly and accurately index PS capacity among SWD and (b) facilitate PS instructional planning for SWD.

2. Whereas available PSPAs rely on text-based presentation and response formats, which spuriously lower estimates of PS capacity for SWD (who have reading and writing deficits), MAPS avoids reliance on these input and output modes.

3. Although PSPAs typically are time consuming for teachers to score and interpret, limiting their usefulness in schools, MAPS provides automatic scoring.

4. Whereas teachers typically have difficulty connecting PSPA information with productive teaching methods for improving PS performance, MAPS structures teacher feedback in a manner that helps teachers connect complex assessment with instruction.

5. Although students typically have to wait long time periods to obtain feedback on their performance and despite that feedback often is not useful to students for improving their performance, MAPS provides immediate and instructive feedback directly to students so that

they may identify strategies for improving their own performance.

6. Finally, most PSPAs do not provide parallel forms for tracking PS improvement over time or for providing SWD with routine opportunities for practice. MAPS provides teachers with parallel forms of PAs within each grade at grades 2-6.

APPENDICES

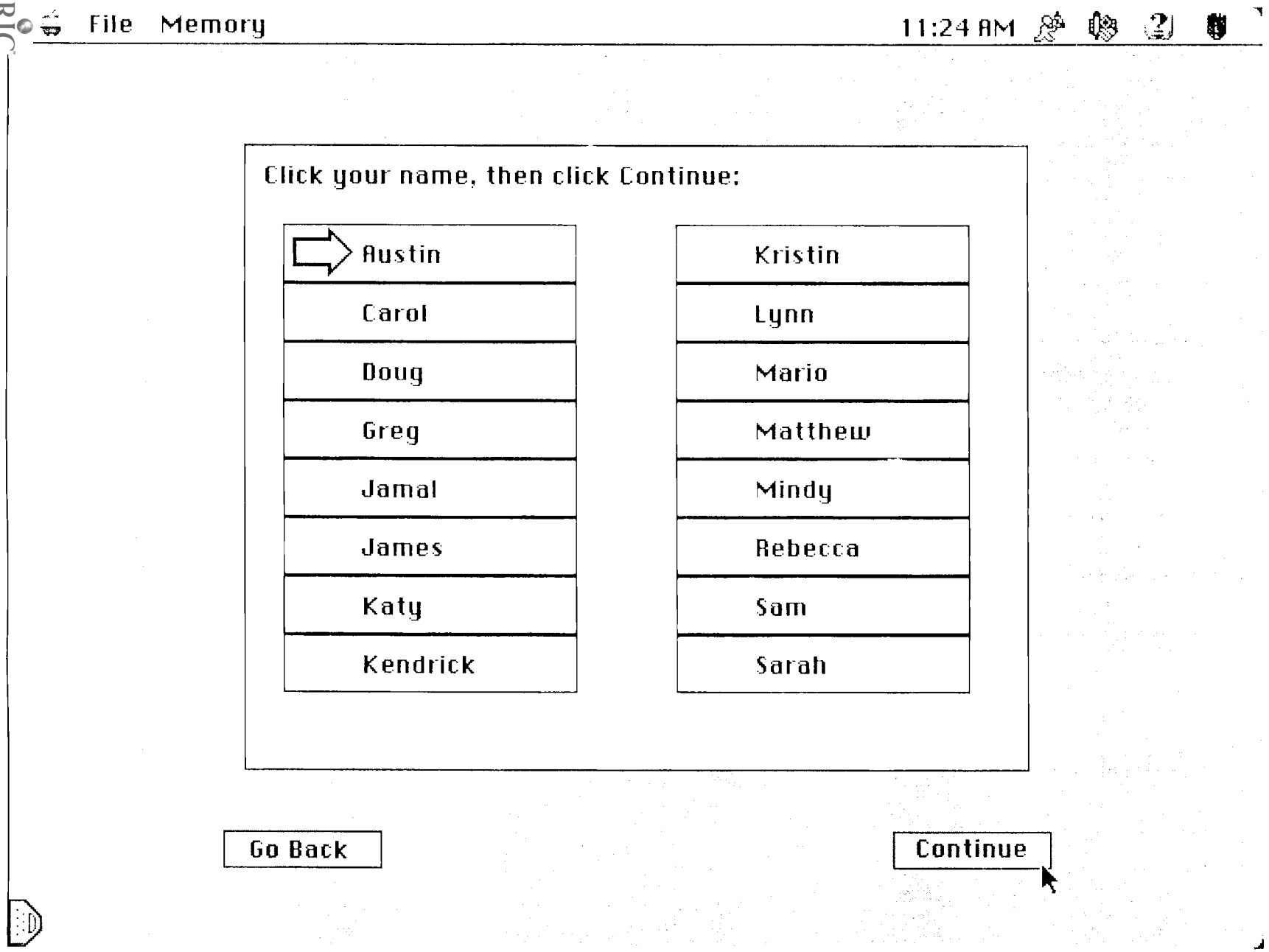
See attached sample screens from the MAPS multimedia system.

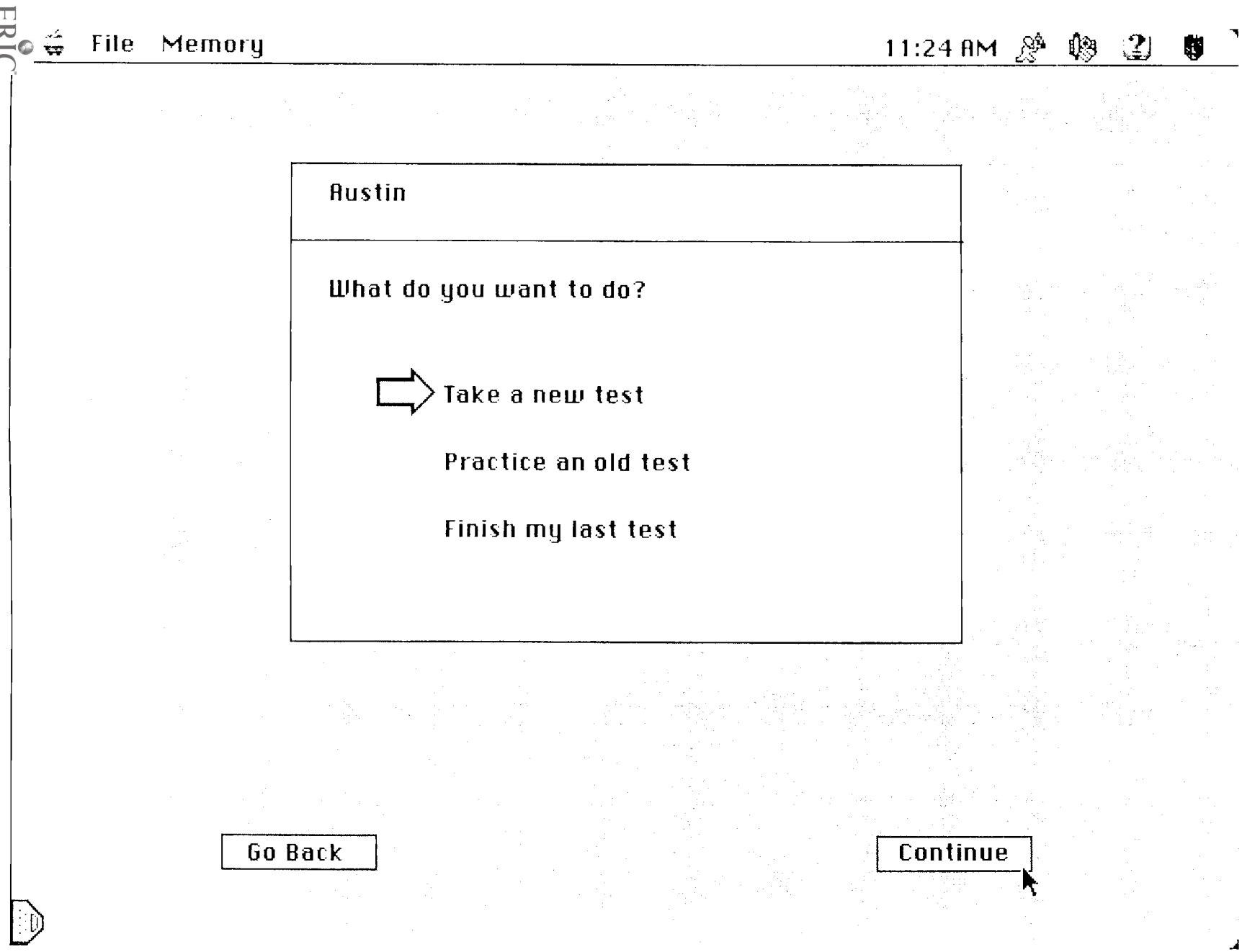
Monitoring Authentic Problem Solving

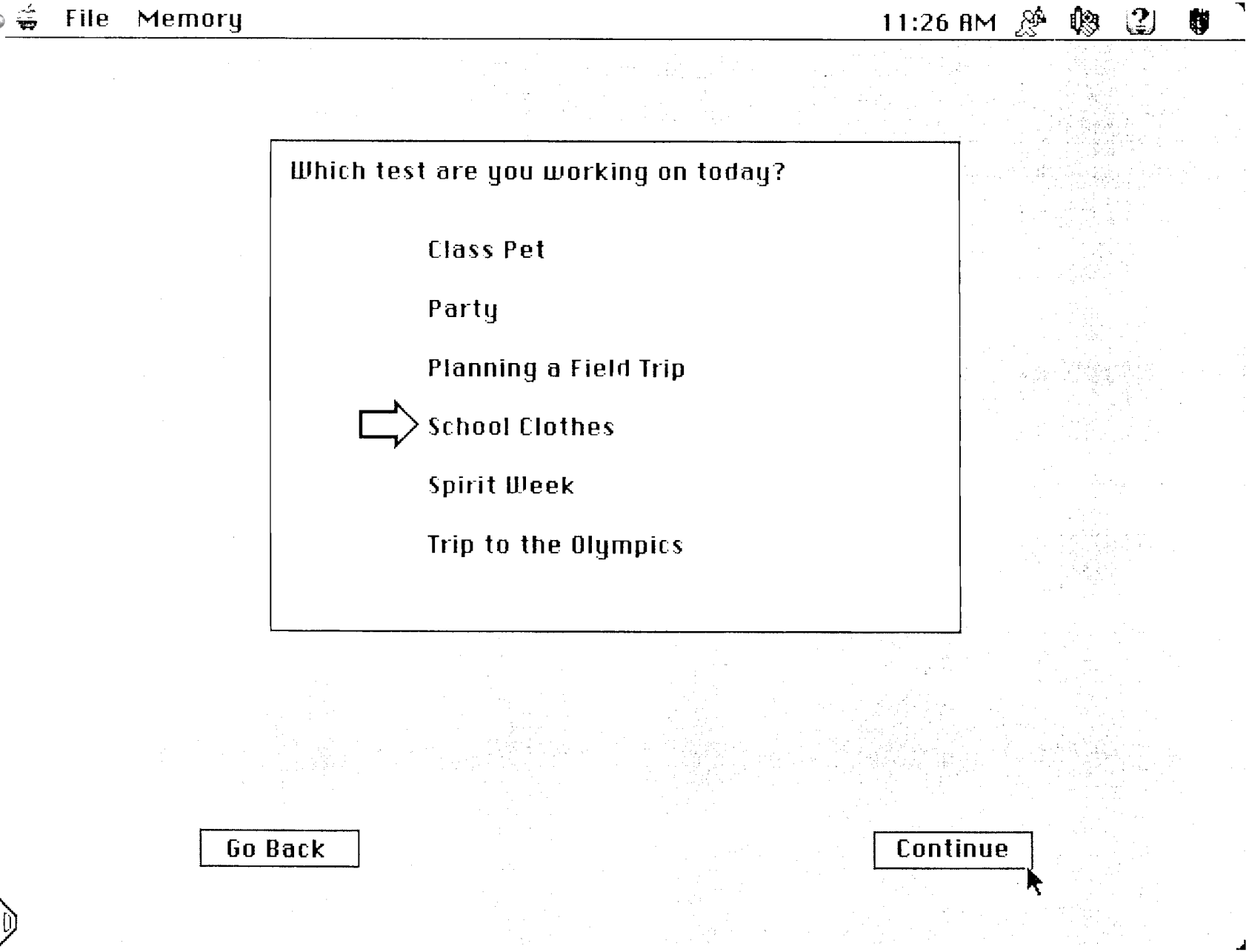
Lynn S. Fuchs
Doug Fuchs
Principal Investigators

Vanderbilt University
Grant #H180T70007
U.S. Department of Education
Office of Special Education

Continue

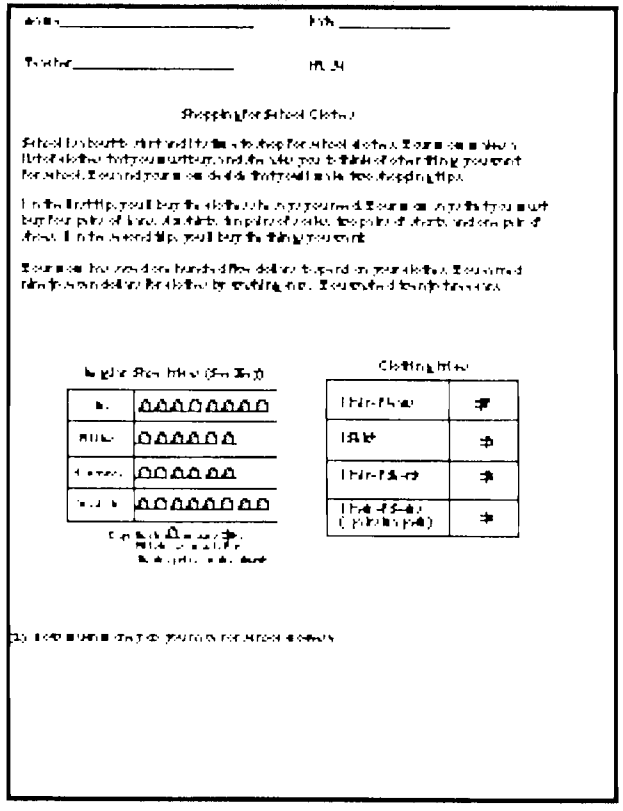

File Memory
11:24 AM
Click your name, then click Continue:
Austin
Carol
Doug
Greg
Jamal
James
Katy
Kendrick
Kristin
Lynn
Mario
Matthew
Mindy
Rebecca
Sam
Sarah
Go Back
Continue

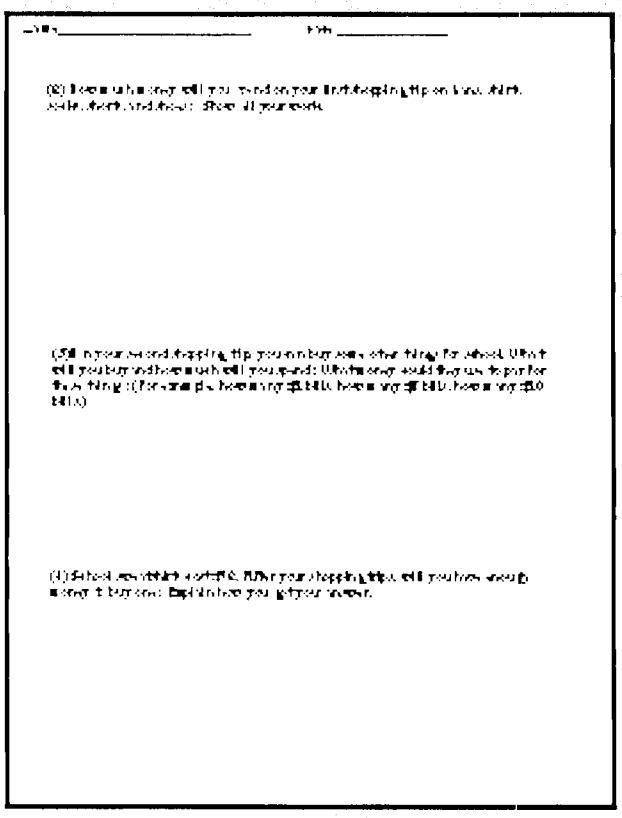

File Memory
11:24 AM
Austin
What do you want to do?
Take a new test
Practice an old test
Finish my last test
Go Back
Continue


File Memory
11:26 AM
Which test are you working on today?
Class Pet
Party
Planning a Field Trip
School Clothes
Spirit Week
Trip to the Olympics
Go Back
Continue

File Memory 11:26 AM

Shopping for School Clothes





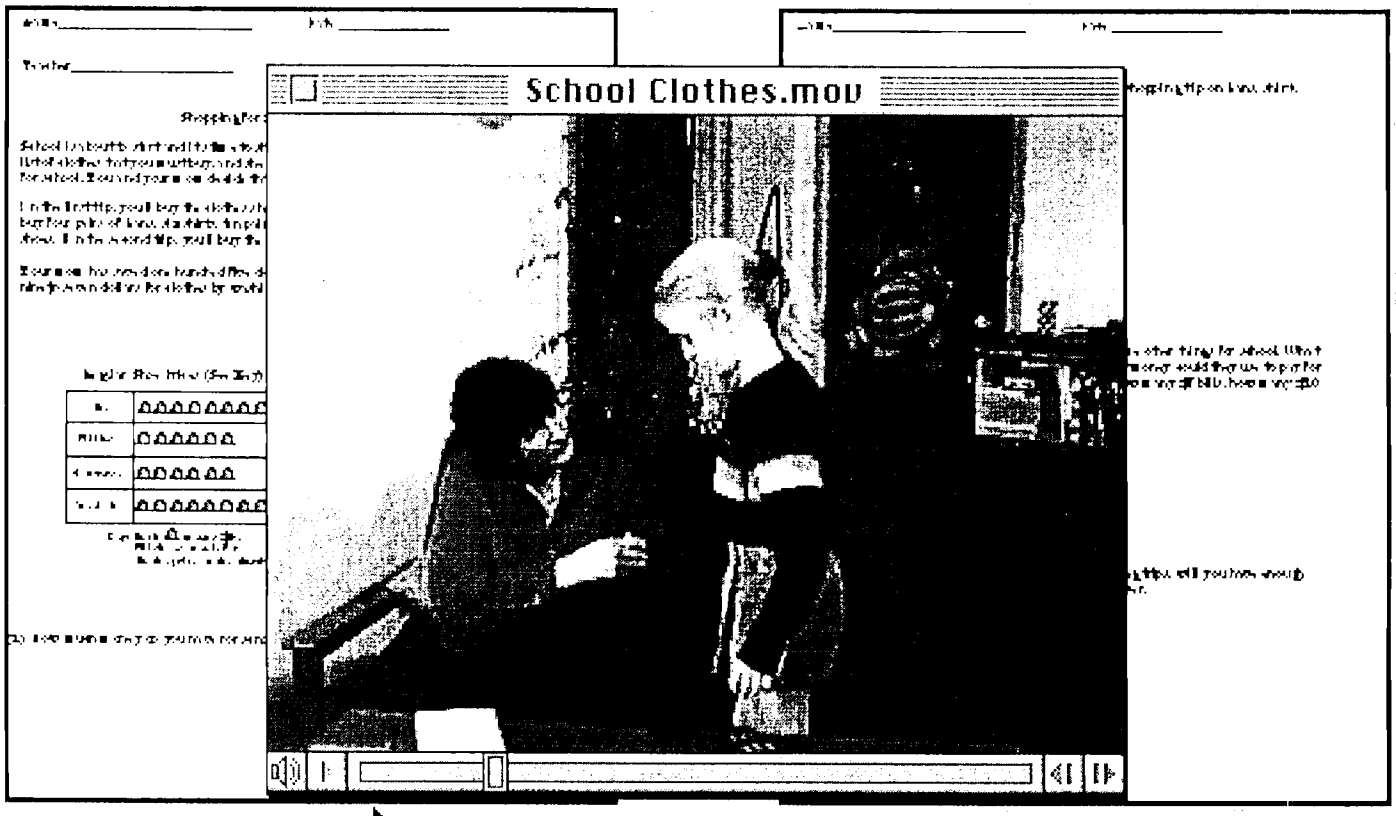
Go Back | See Video | Save Work | Finished!

File Memory 11:27 AM

Shopping for School Clothes

Go Back | See Video | Save Work | Finished!

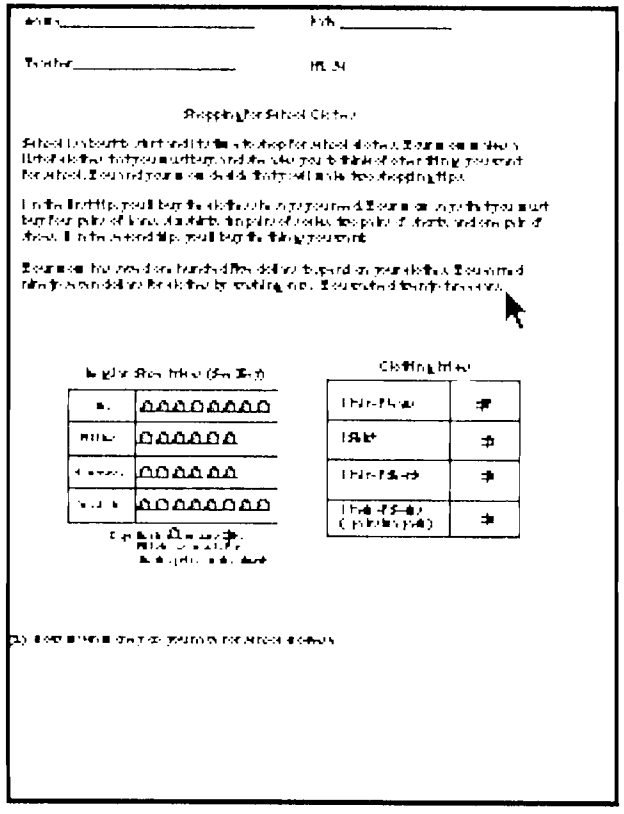
Shopping for School Clothes

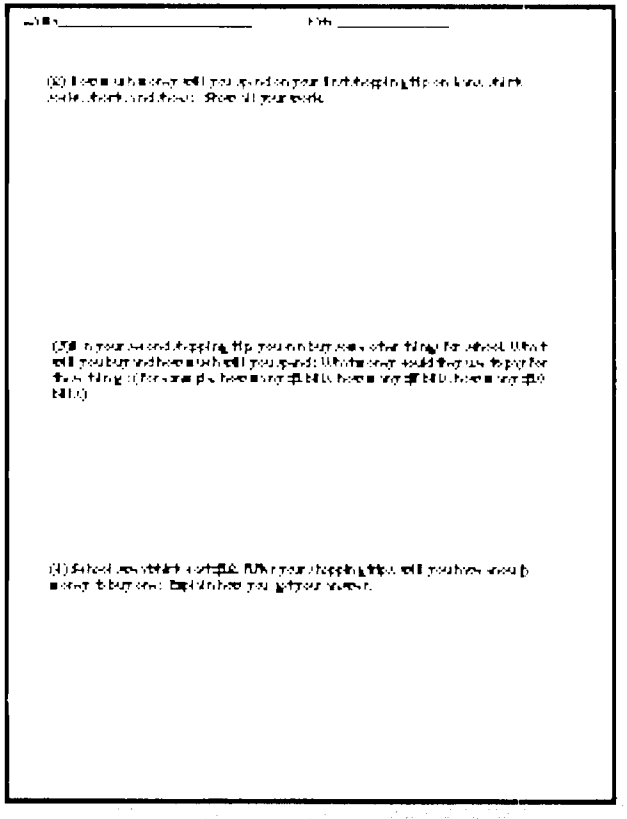


Go Back | See Video | Save Work | Finished!

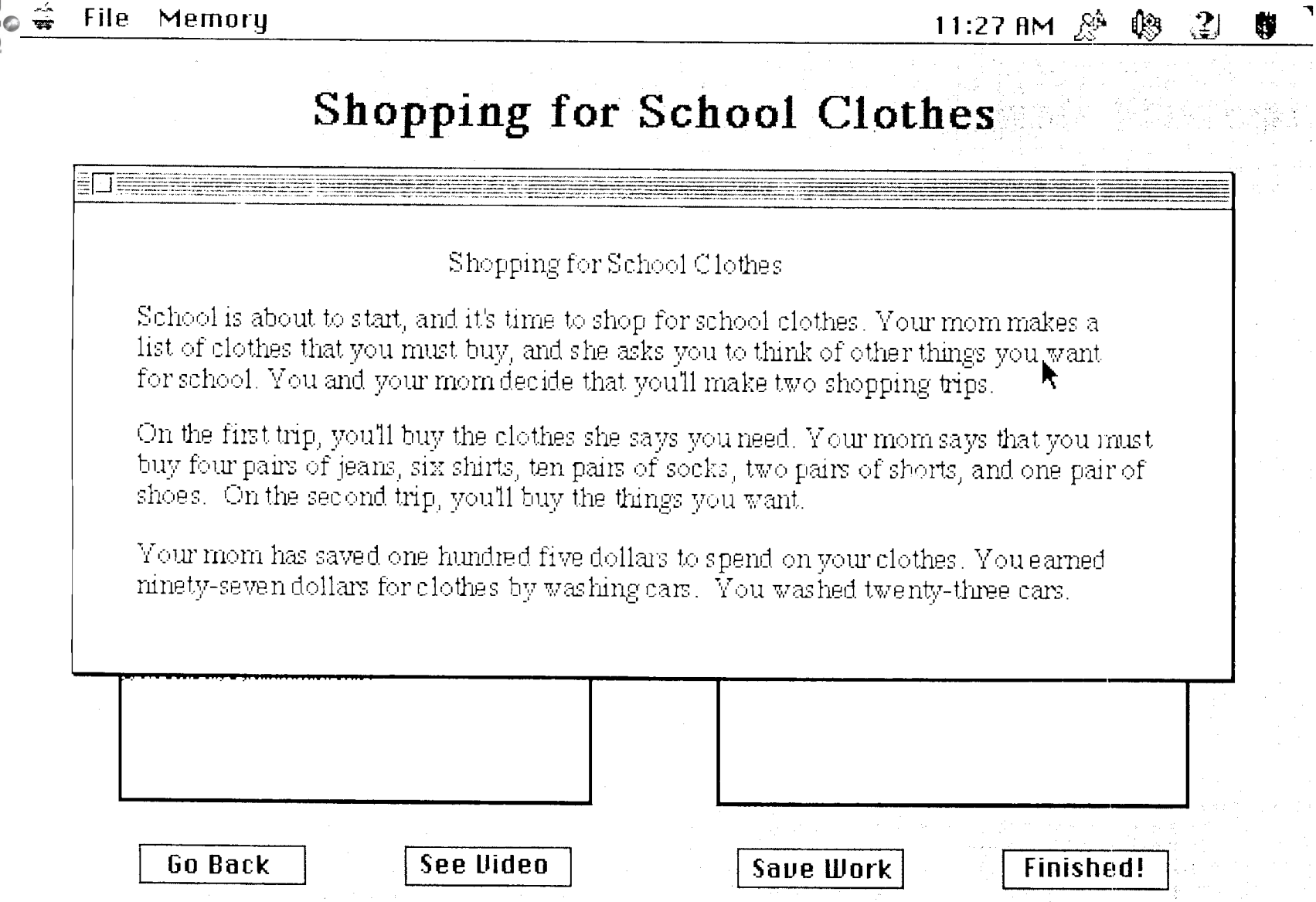
File Memory 11:27 AM

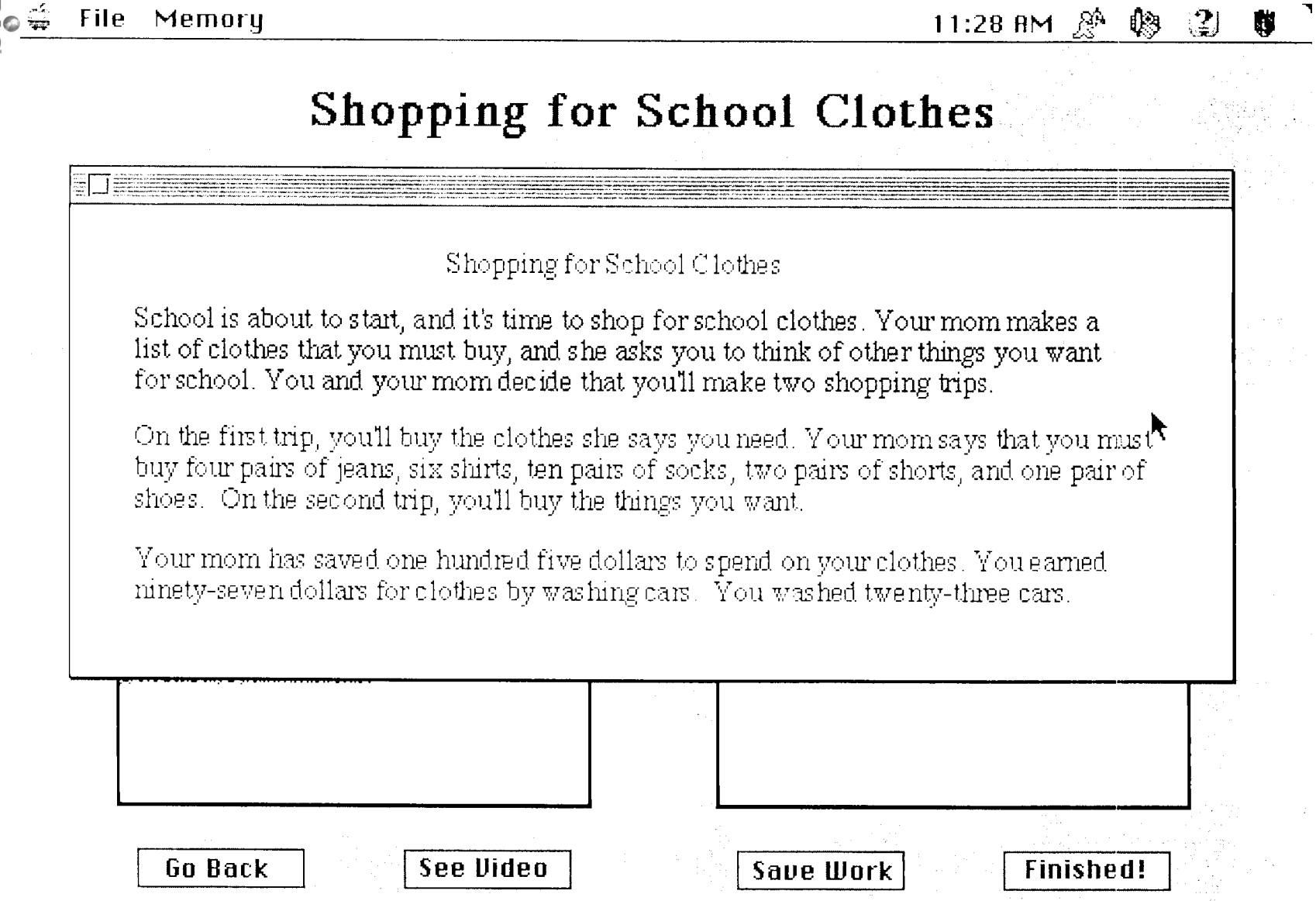
Shopping for School Clothes



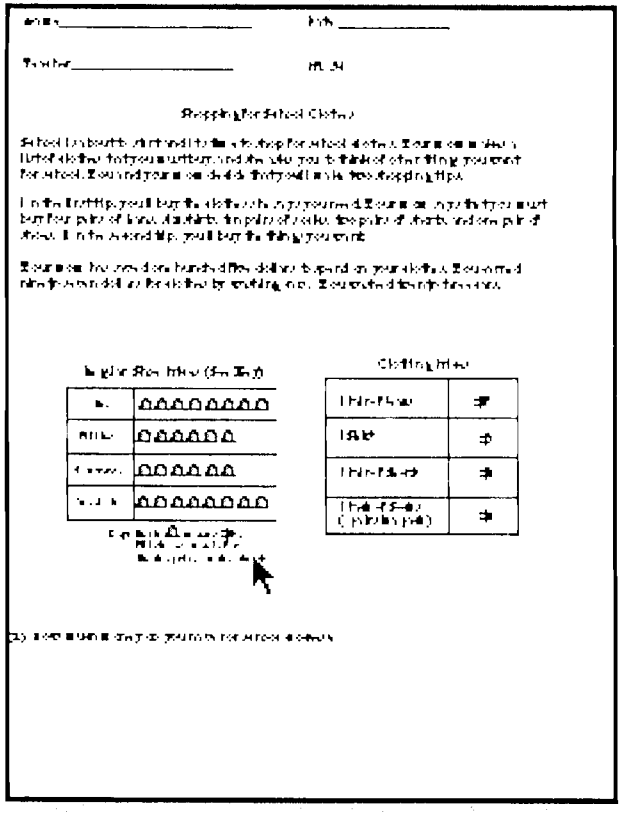


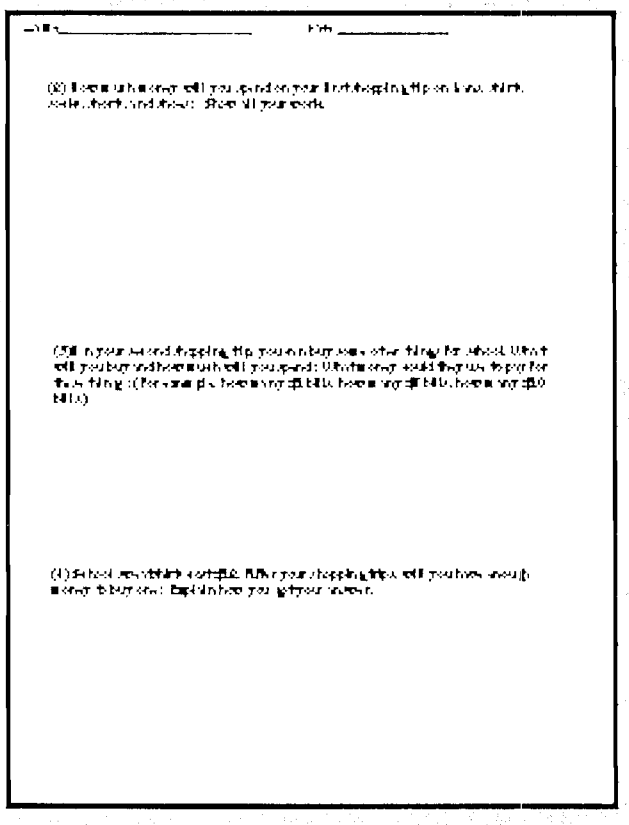
Go Back | See Video | Save Work | Finished!


File Memory
11:27 AM
Shopping for School Clothes
Shopping for School Clothes
School is about to start, and it's time to shop for school clothes. Your mom makes a list of clothes that you must buy, and she asks you to think of other things you want for school. You and your mom decide that you'll make two shopping trips.
On the first trip, you'll buy the clothes she says you need. Your mom says that you must buy four pairs of jeans, six shirts, ten pairs of socks, two pairs of shorts, and one pair of shoes. On the second trip, you'll buy the things you want.
Your mom has saved one hundred five dollars to spend on your clothes. You earned ninety-seven dollars for clothes by washing cars. You washed twenty-three cars.
Go Back
See Video
Save Work
Finished!


File Memory
11:28 AM
Shopping for School Clothes
Shopping for School Clothes
School is about to start, and it's time to shop for school clothes. Your mom makes a list of clothes that you must buy, and she asks you to think of other things you want for school. You and your mom decide that you'll make two shopping trips.
On the first trip, you'll buy the clothes she says you need. Your mom says that you must buy four pairs of jeans, six shirts, ten pairs of socks, two pairs of shorts, and one pair of shoes. On the second trip, you'll buy the things you want.
Your mom has saved one hundred five dollars to spend on your clothes. You earned ninety-seven dollars for clothes by washing cars. You washed twenty-three cars.
Go Back
See Video
Save Work
Finished!

Shopping for School Clothes





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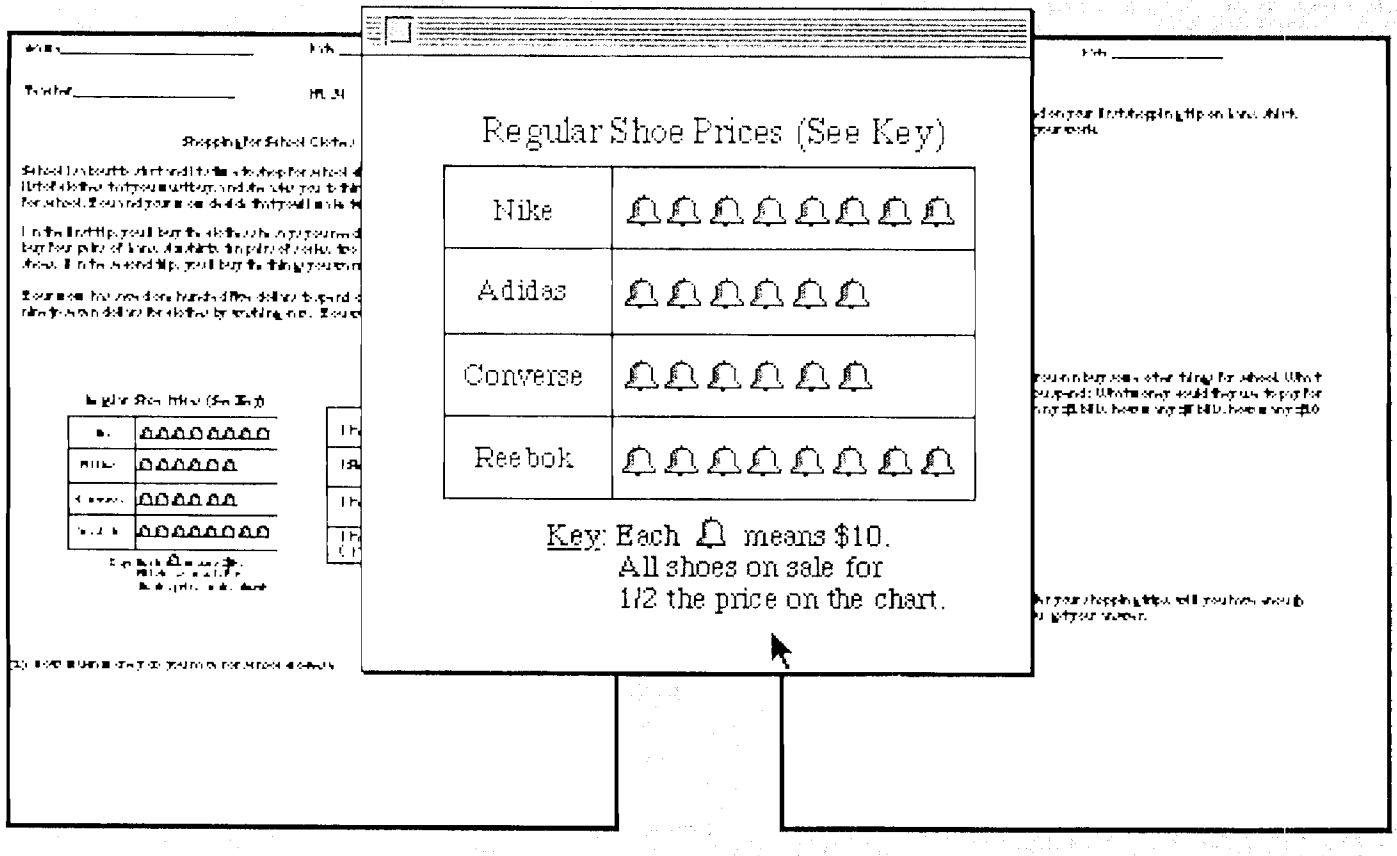
See Video

Save Work

Finished!

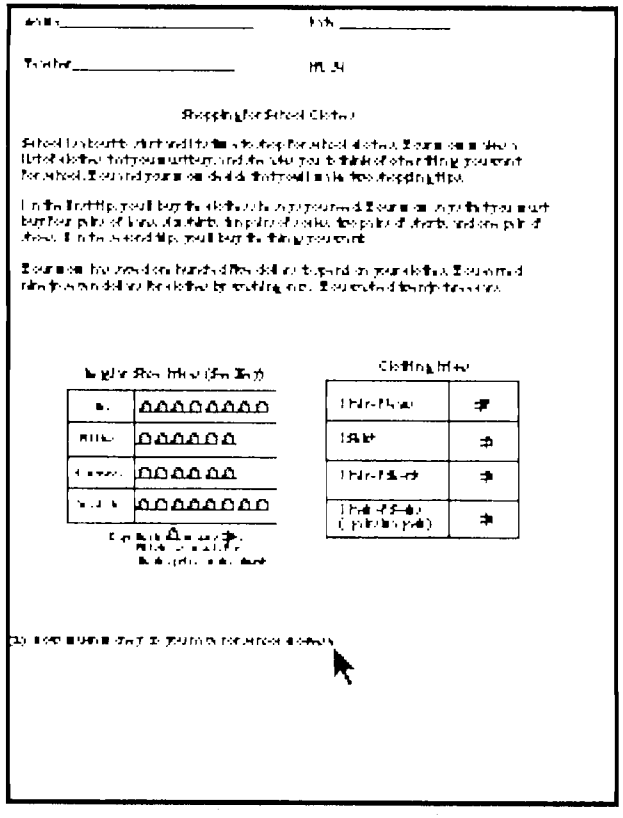
File Memory 11:28 AM

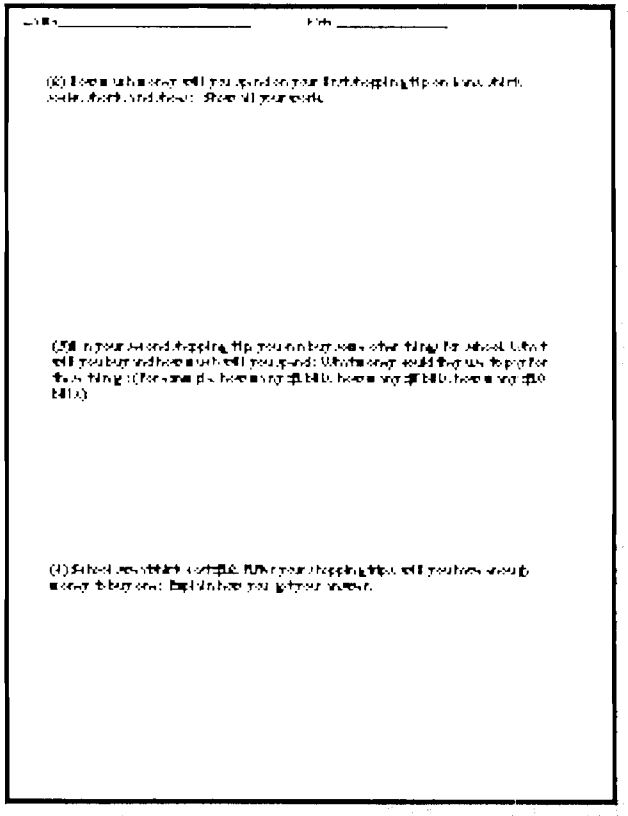
Shopping for School Clothes



Go Back | See Video | Save Work | Finished!

Shopping for School Clothes



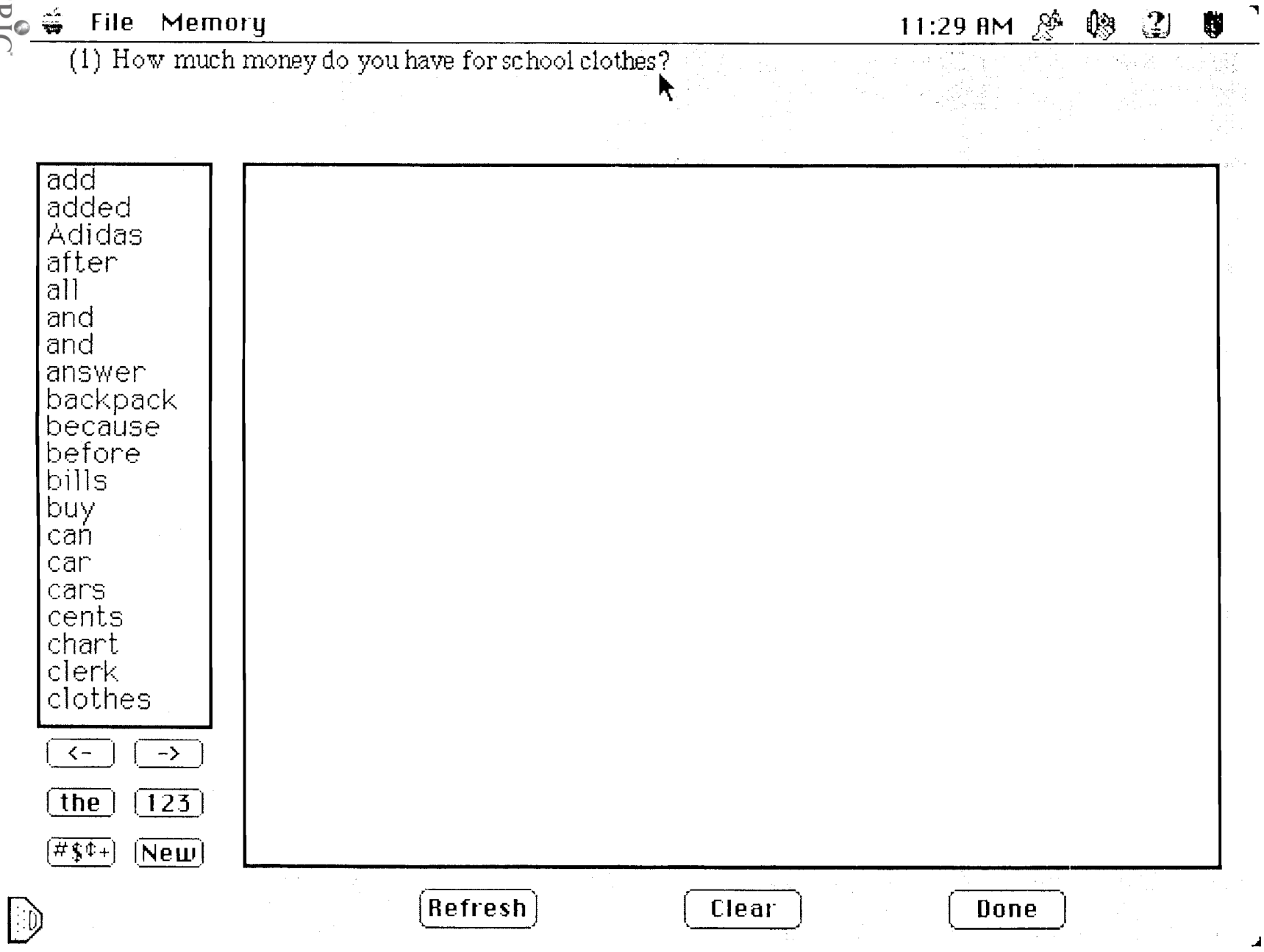


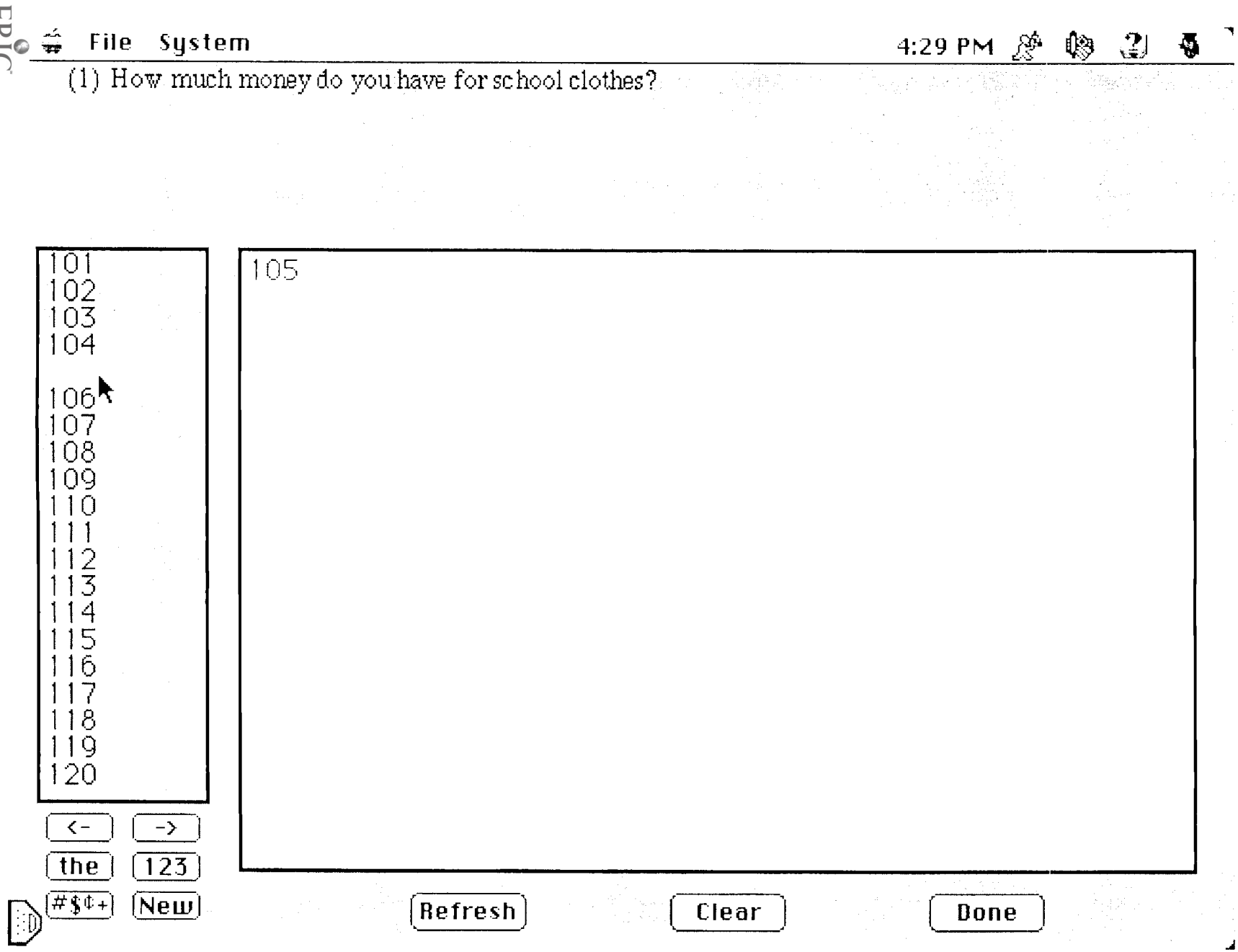
Go Back

See Video

Save Work

Finished!


File Memory
11:29 AM
(1) How much money do you have for school clothes?
add
added
Adidas
after
all
and
and
answer
backpack
because
before
bills
buy
can
car
cars
cents
chart
clerk
clothes
<-
->
the
123
#$¢+
New
Refresh
Clear
Done


File System
4:29 PM
(1) How much money do you have for school clothes?
101
102
103
104
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
105
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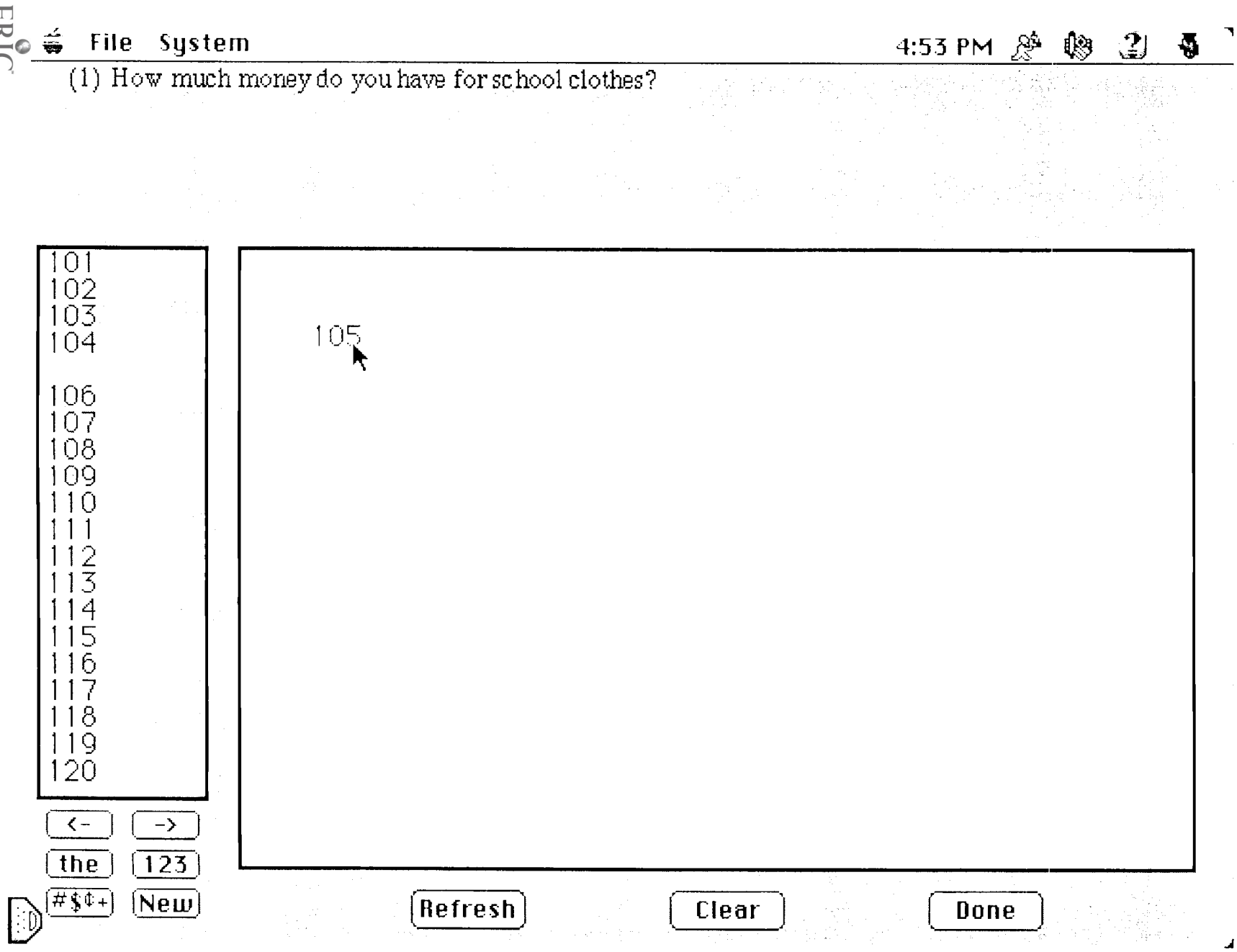
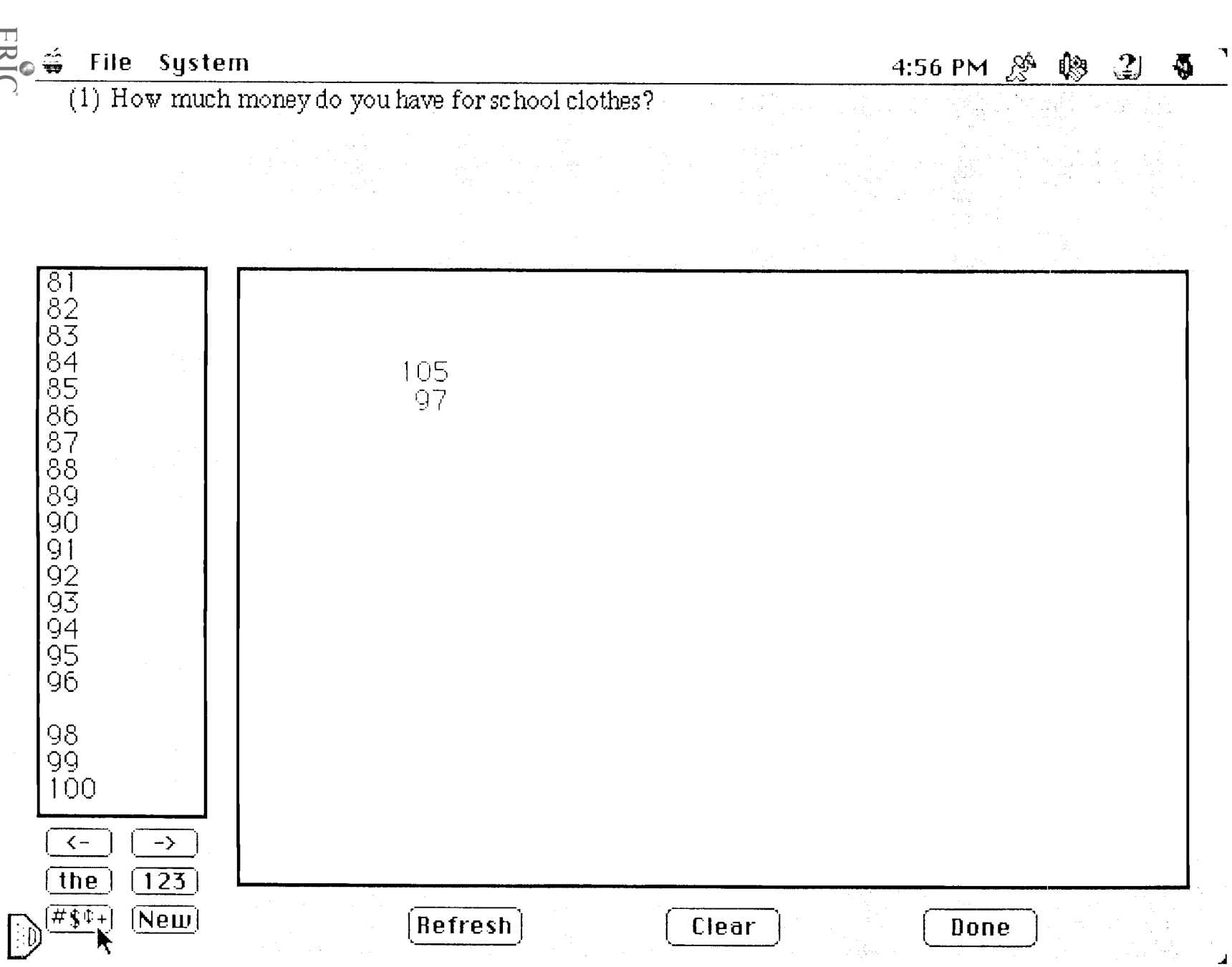
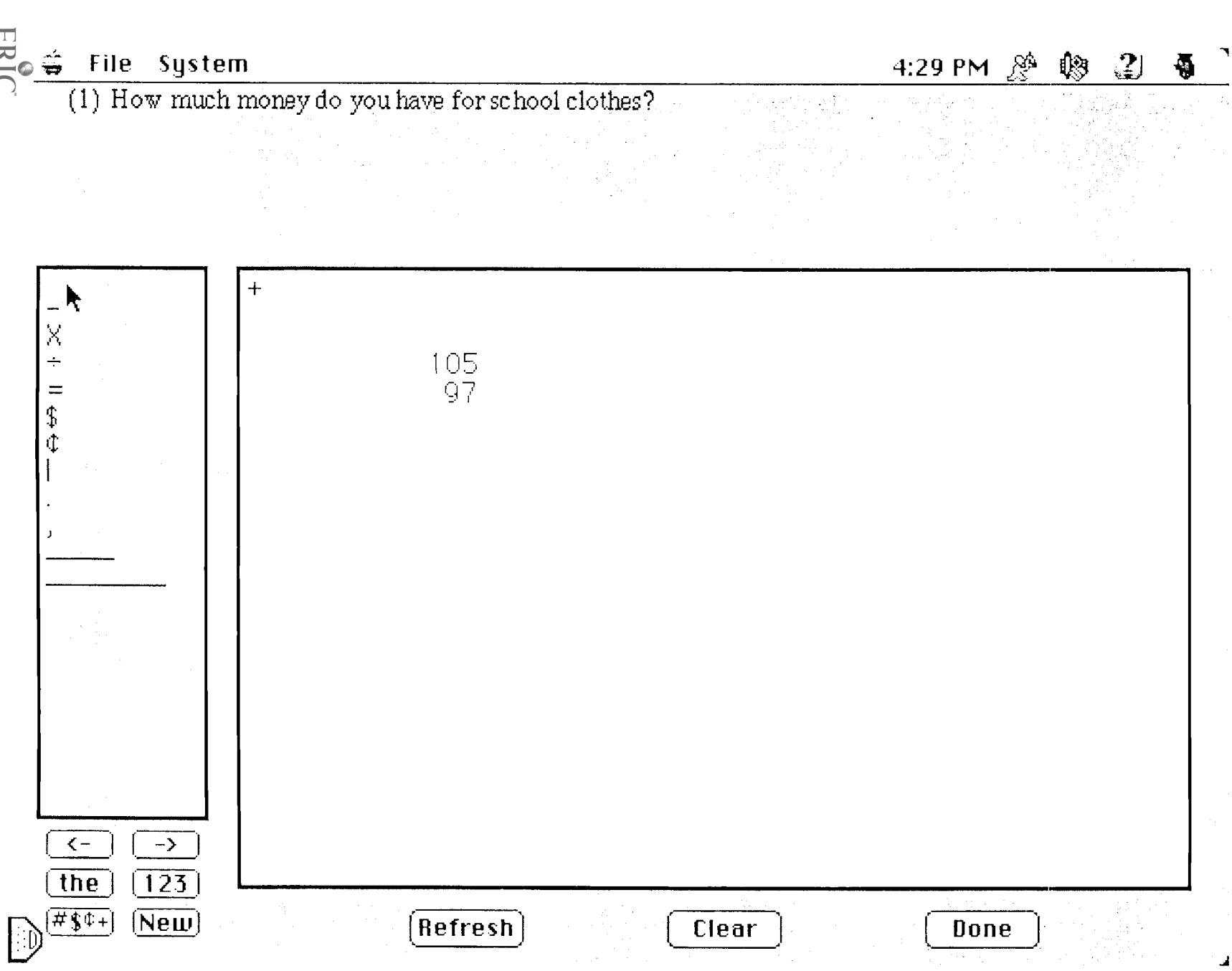
->
the
123
#$¢+
New
Refresh
Clear
Done


File System
4:53 PM
(1) How much money do you have for school clothes?
101
102
103
104
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
105
<-
->
the
123
#$¢+
New
Refresh
Clear
Done


File System
4:56 PM
(1) How much money do you have for school clothes?
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
98
99
100
105
97
<-
->
the
123
#$%+
New
Refresh
Clear
Done


File System
4:29 PM
(1) How much money do you have for school clothes?
+
105
97
_
X
÷
=
$
¢
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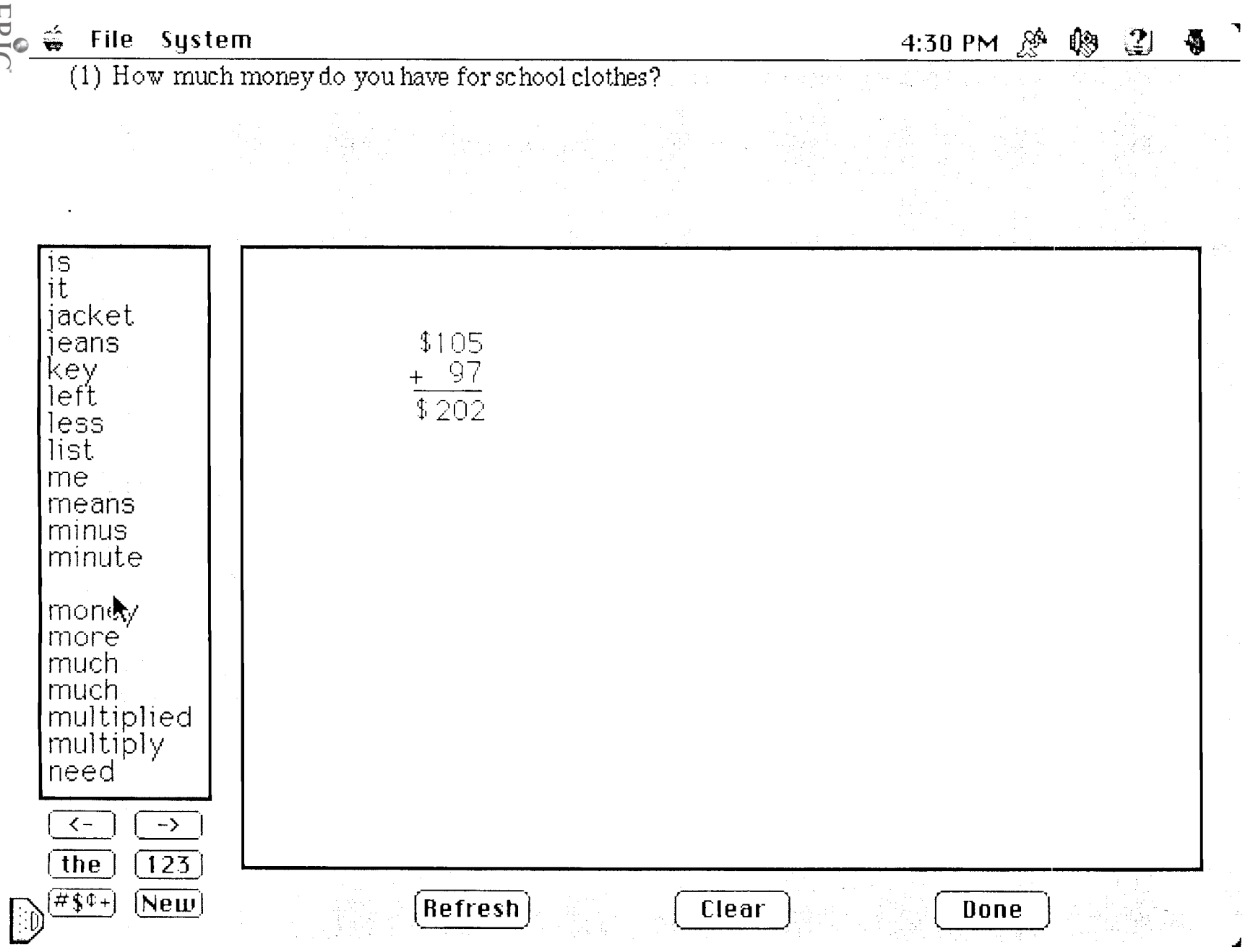
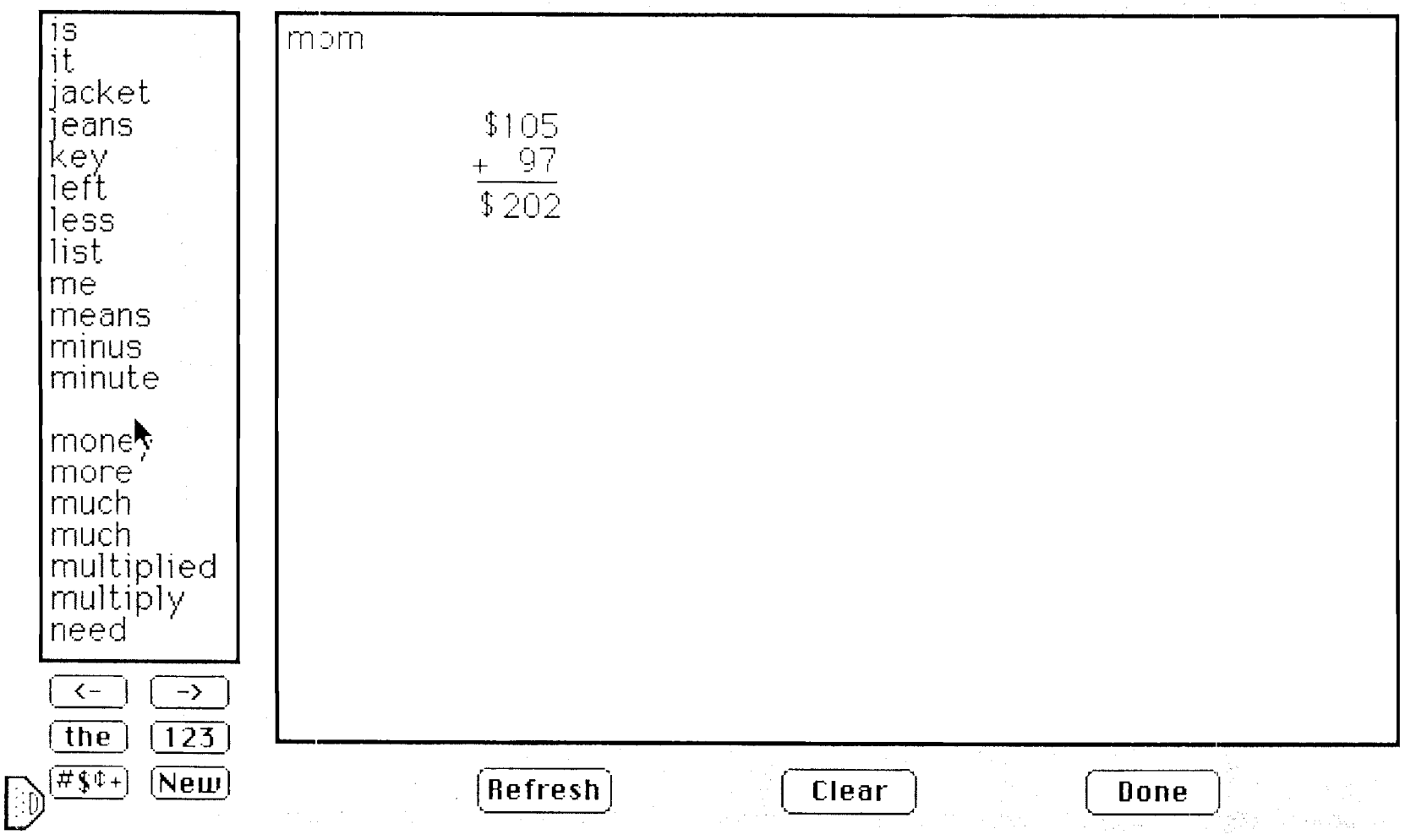
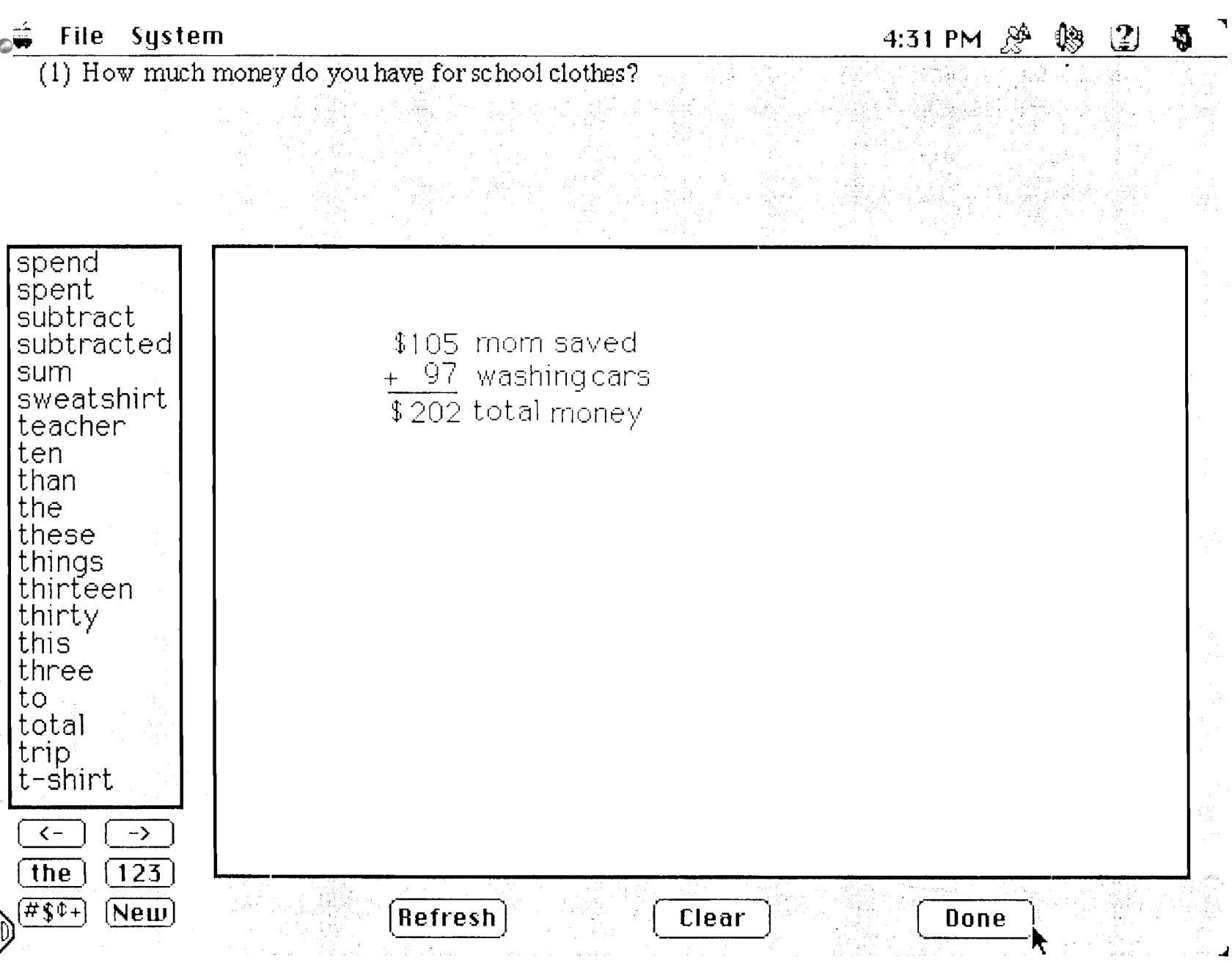
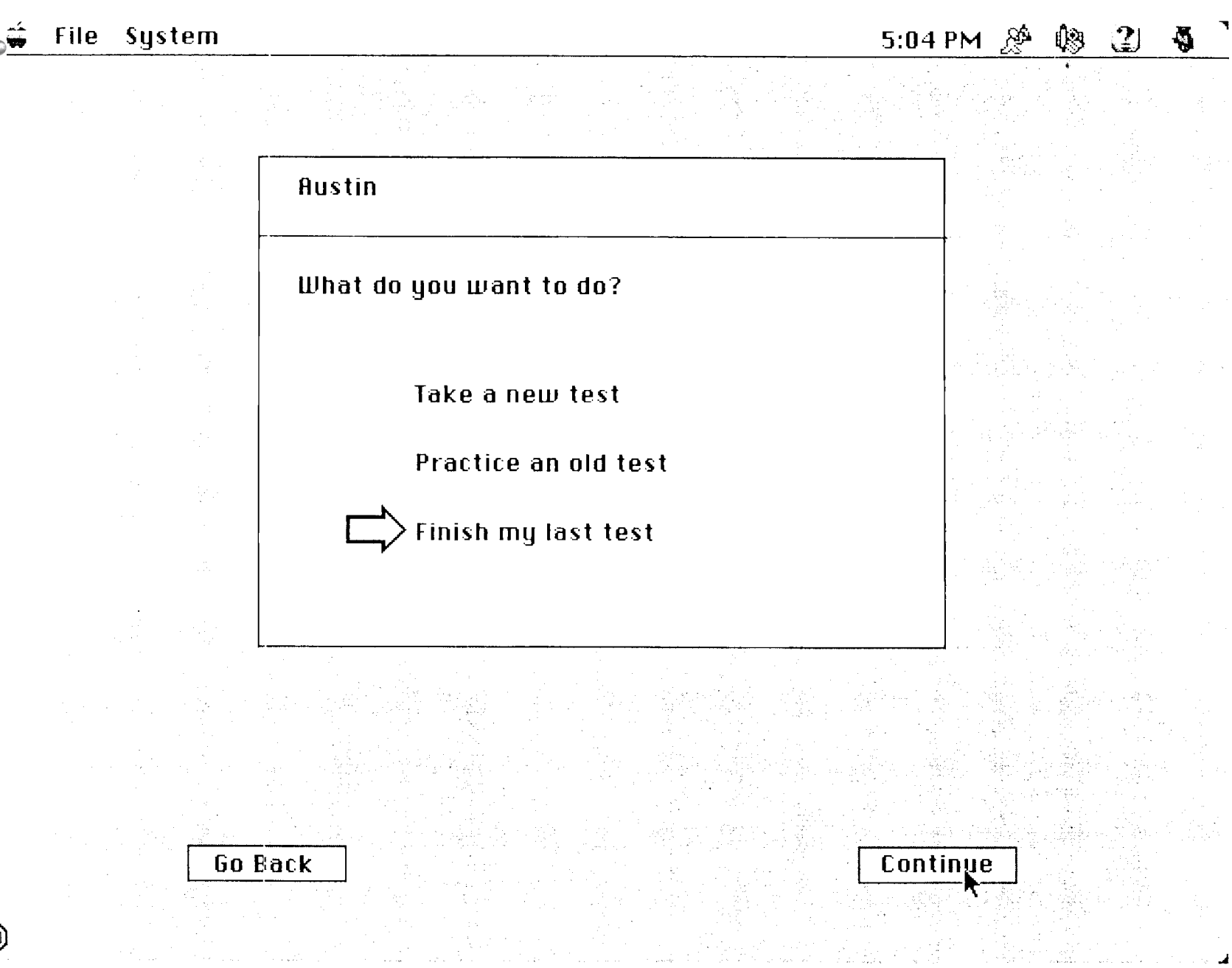
<-
->
the
123
#$¢+
New
Refresh
Clear
Done


File System
4:30 PM
(1) How much money do you have for school clothes?
is
it
jacket
jeans
key
left
less
list
me
means
minus
minute
money
more
much
much
multiplied
multiply
need
$105
+ 97
$202
<-
->
the
123
#$¢+
New
Refresh
Clear
Done

(1) How much money do you have for school clothes?

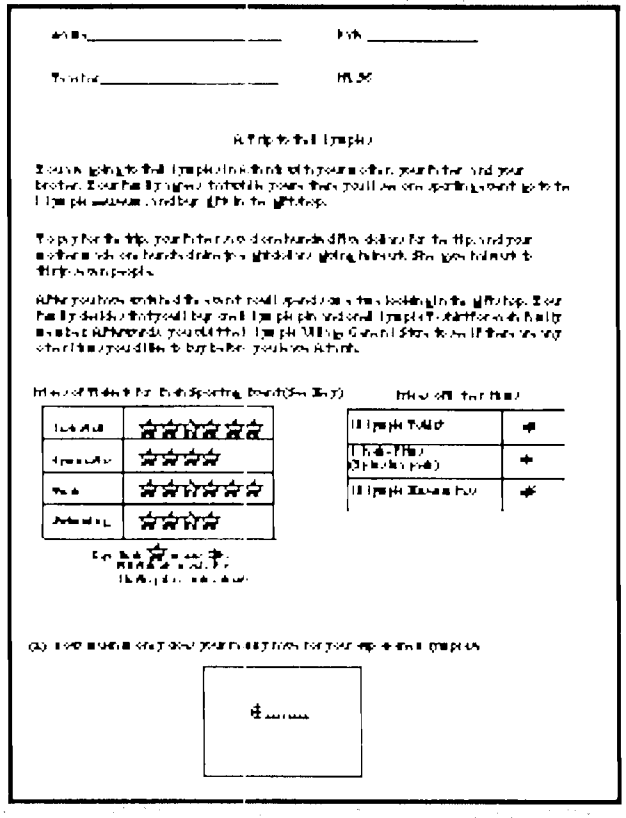


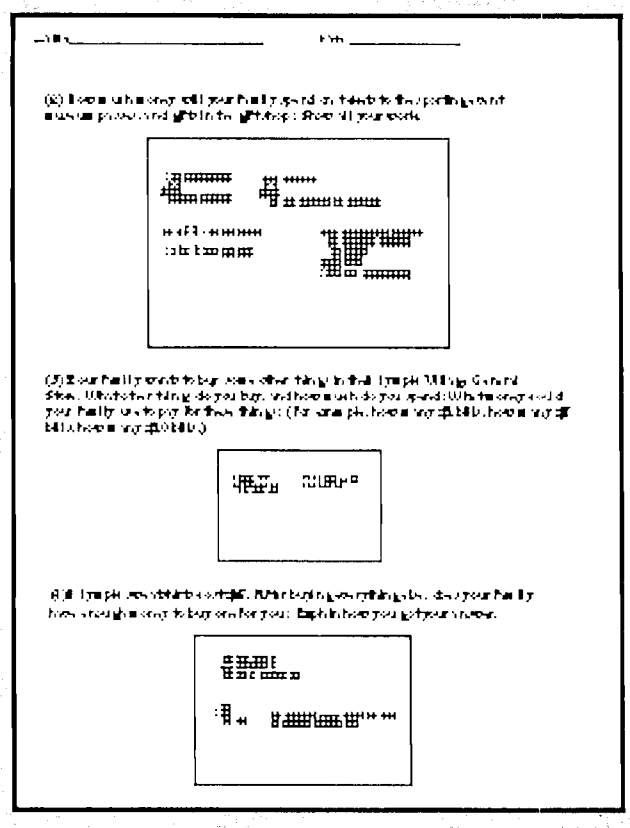

File System
4:31 PM
(1) How much money do you have for school clothes?
spend
spent
subtract
subtracted
sum
sweatshirt
teacher
ten
than
the
these
things
thirteen
thirty
this
three
to
total
trip
t-shirt
<-
->
the
123
#$¢+
New
$105 mom saved
+ 97 washing cars
$202 total money
Refresh
Clear
Done


File System
5:04 PM
Austin
What do you want to do?
Take a new test
Practice an old test
Finish my last test
Go Back
Continue

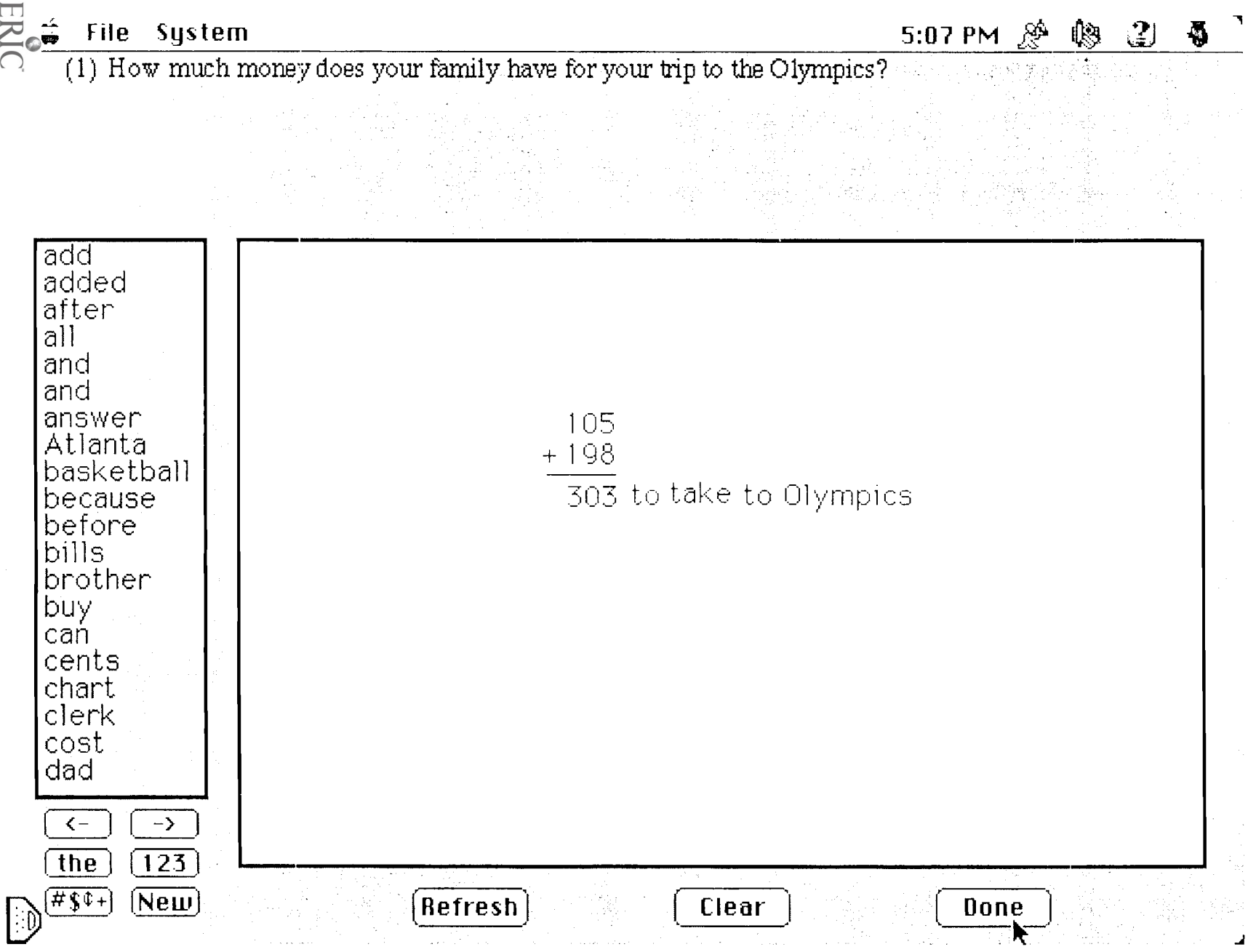
File Memory 11:35 AM

A Trip to the Olympics





Go Back | See Video | Save Work | Finished!


File System
5:07 PM
(1) How much money does your family have for your trip to the Olympics?
add
added
after
all
and
and
answer
Atlanta
basketball
because
before
bills
brother
buy
can
cents
chart
clerk
cost
dad
<-
->
the
123
#$0+
New
105
+ 198
303 to take to Olympics
Refresh
Clear
Done

File Memory 11:35 AM

(2) How much money will your family spend on tickets to the sporting event, museum passes, and gifts in the gift shop? Show all your work.

add
added
after
all
and
and
answer
Atlanta
basketball
because
before
bills
brother
buy
can
cents
chart
clerk
cost
dad

<- -> the 123 #$¢+ New

$ 40 gymnastics
X 4
160 for tickets

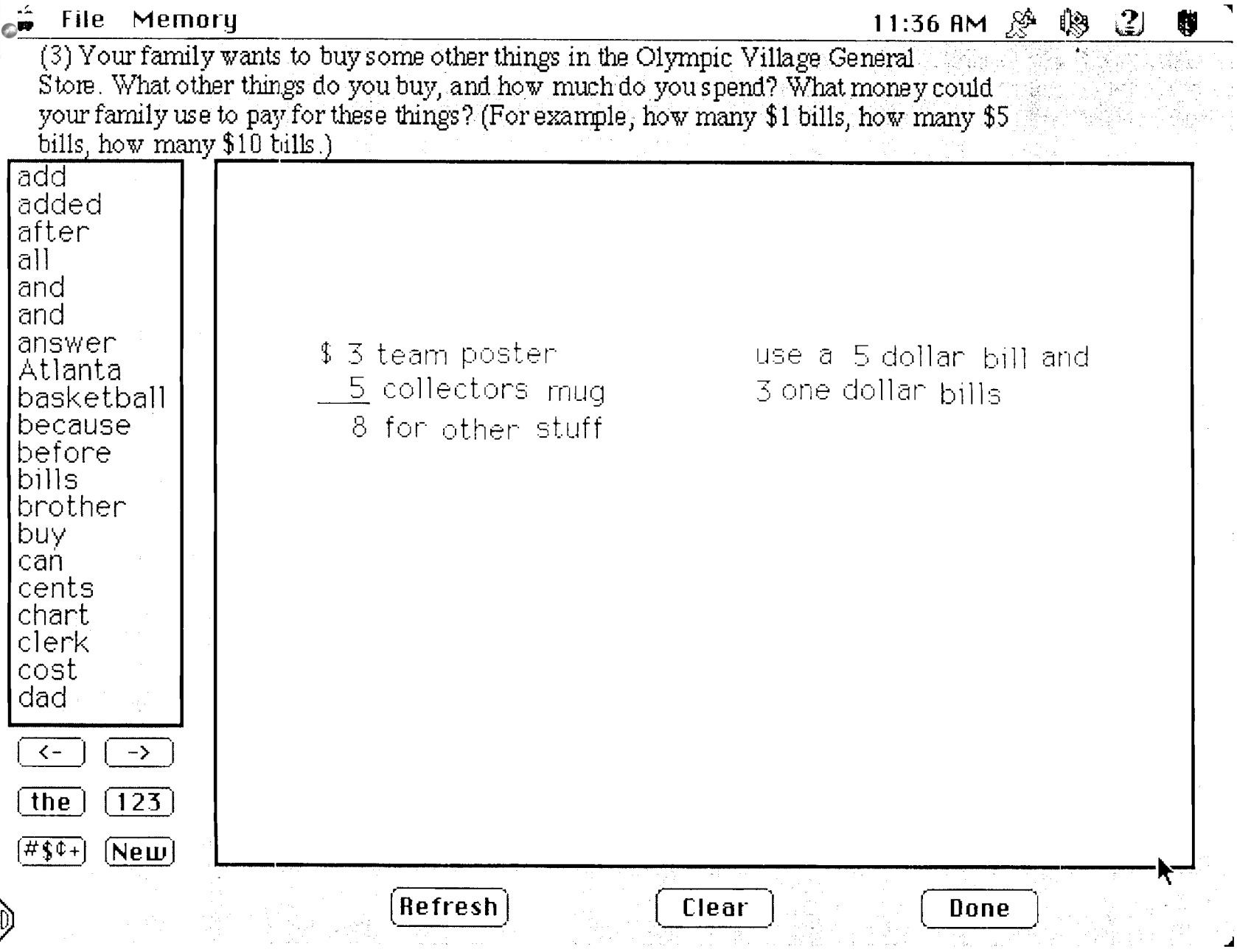
$ 16 museum
X 4
64 for tickets to museum

$8 X 4 = $ 32 for shirts

$ 6 X 4 = $ 24 for pins

$160 gymnastics tickets
64 museum tickets
32 shirts
24 pins
$ 280 for everything

Refresh Clear Done


File Memory
11:36 AM
(3) Your family wants to buy some other things in the Olympic Village General Store. What other things do you buy, and how much do you spend? What money could your family use to pay for these things? (For example, how many $1 bills, how many $5 bills, how many $10 bills.)
add
added
after
all
and
and
answer
Atlanta
basketball
because
before
bills
brother
buy
can
cents
chart
clerk
cost
dad
$ 3 team poster
5 collectors mug
8 for other stuff
use a 5 dollar bill and
3 one dollar bills
<-
->
the
123
#$¢+
New
Refresh
Clear
Done

File Memory 11:36 AM

(4) Olympic sweatshirts cost $25. After buying everything else, does your family have enough money to buy one for you? Explain how you got your answer.

add
added
after
all
and
and
answer
Atlanta
basketball
because
before
bills
brother
buy
can
cents
chart
clerk
cost
dad

<- ->

the 123

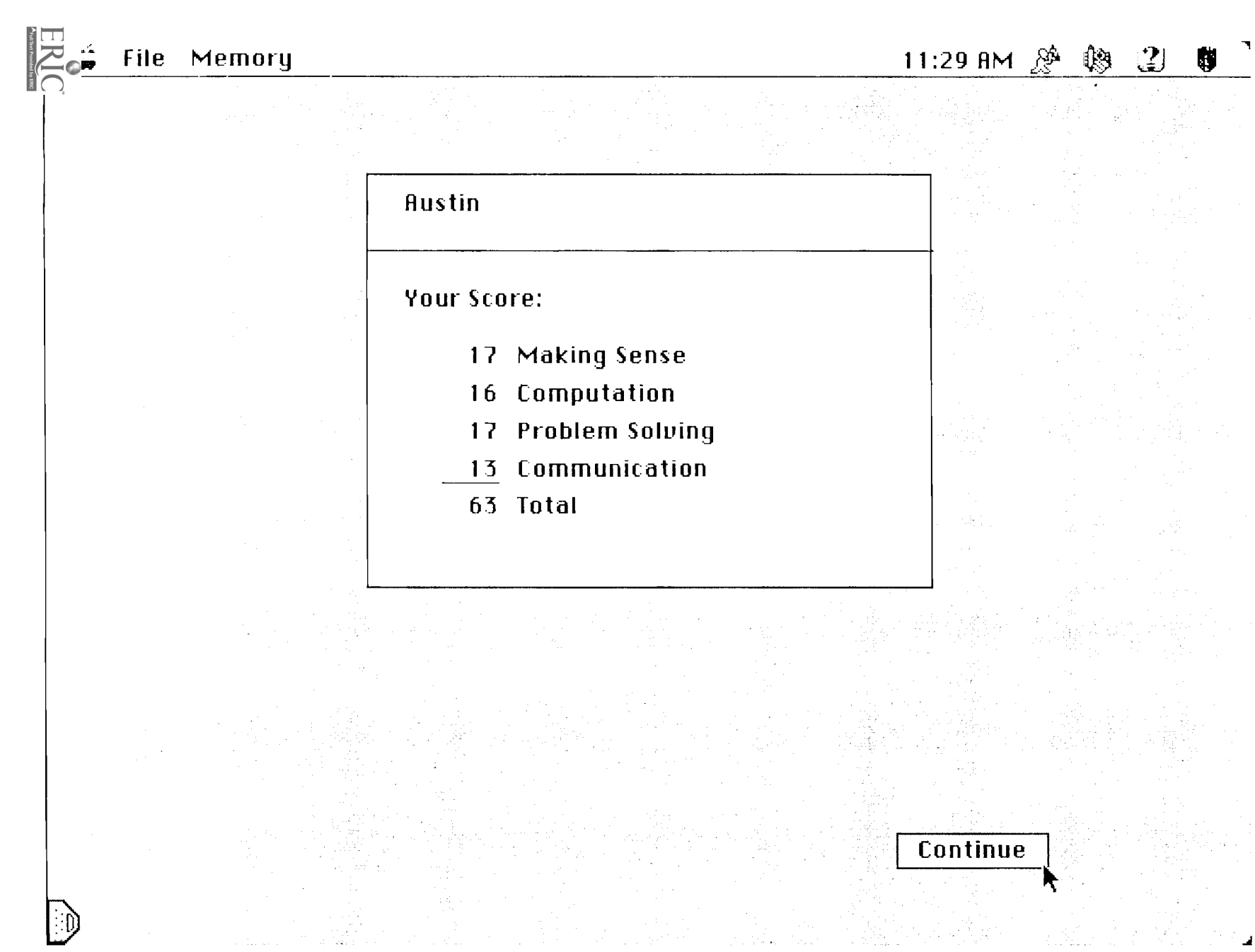
#$¢+ New

280 stuff from #2
+ 8 stuff from #3
288 for all things to buy

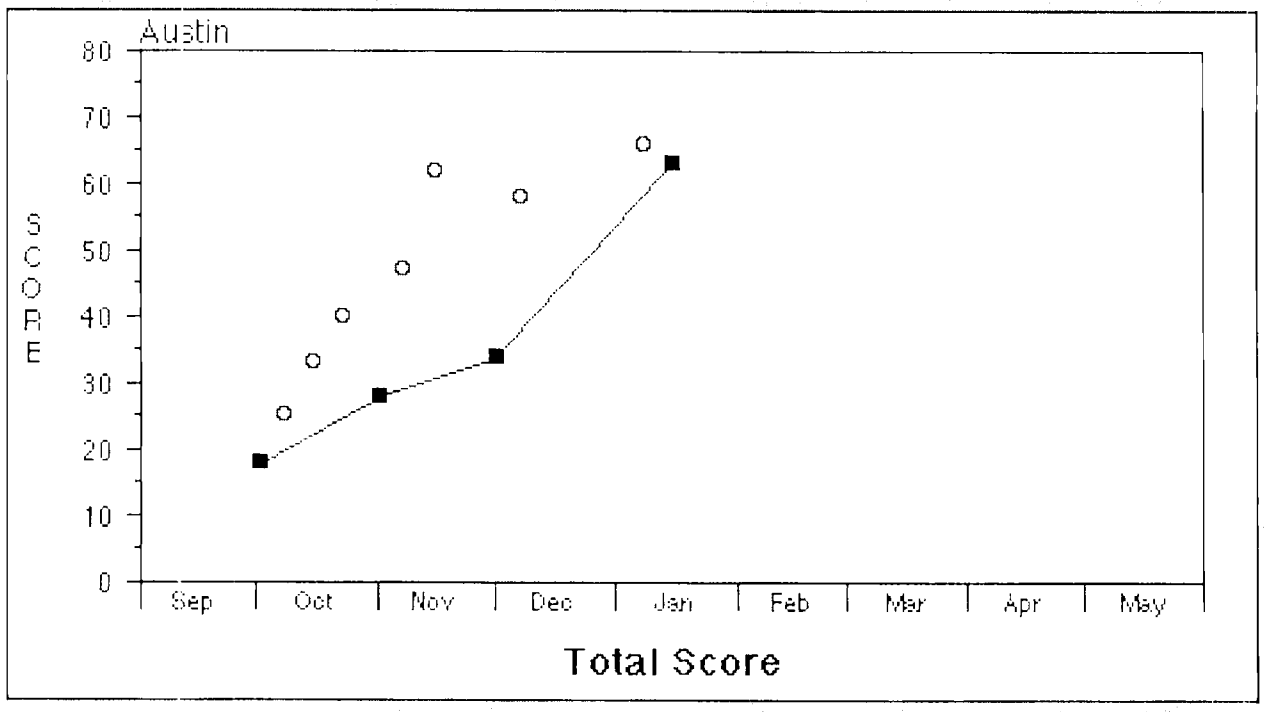
303
- 288
15 left

No, there's not enough money left after we bought all the other stuff

Refresh Clear Done


File Memory
11:29 AM
Austin
Your Score:
17 Making Sense
16 Computation
17 Problem Solving
13 Communication
63 Total
Continue

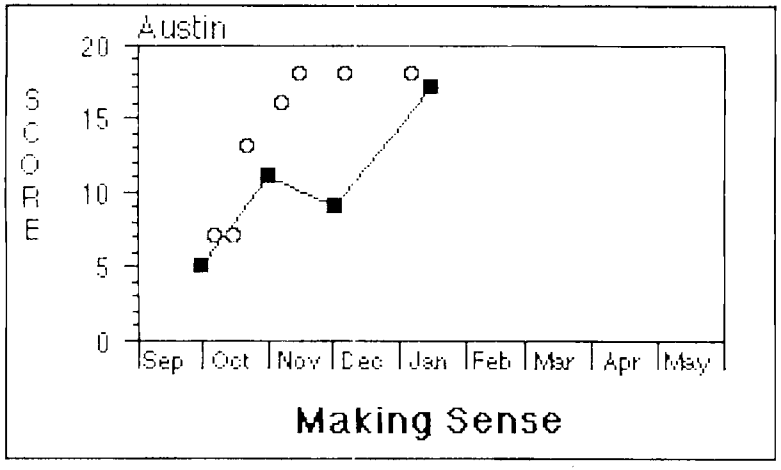
File Memory 11:29 AM

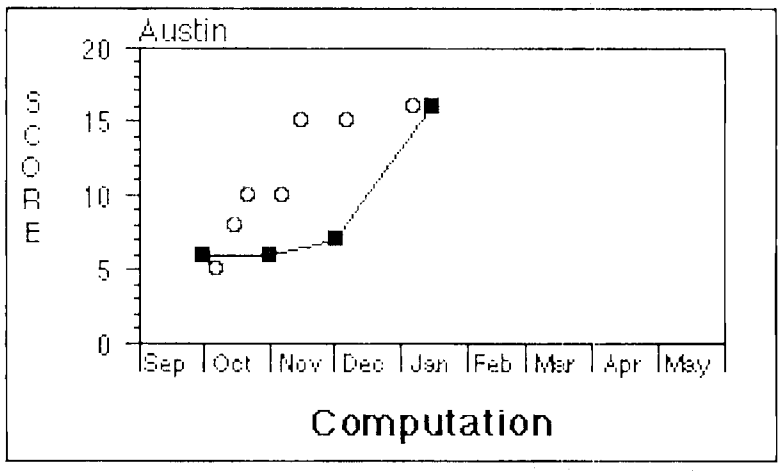


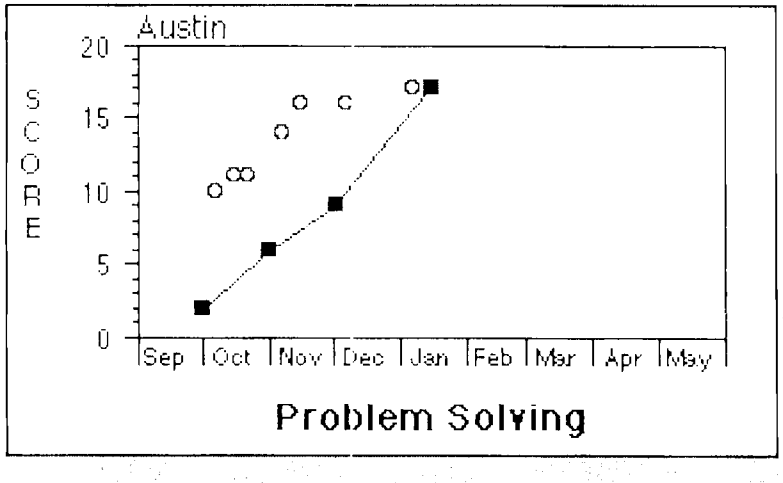
Go Back

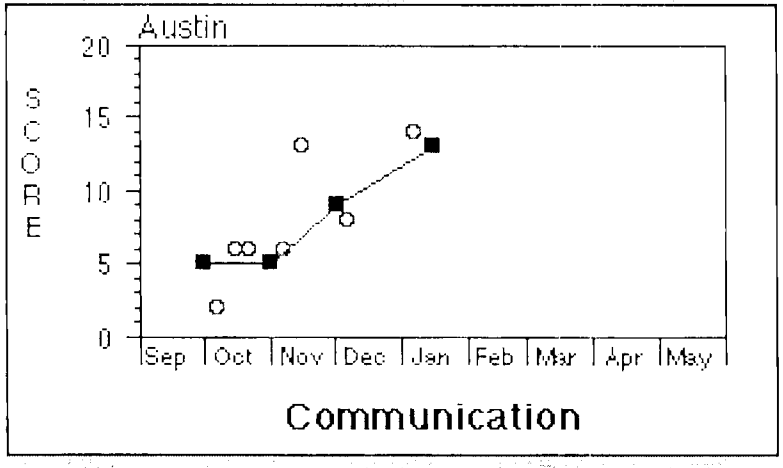
Continue

File Memory 11:29 AM







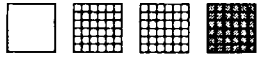
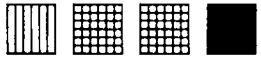
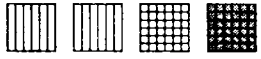
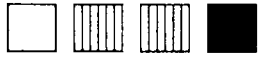
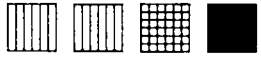


Go Back

Continue

File Memory 11:32 AM

Austin: Strengths and Weaknesses

	New Tests	Practice Tests
Relevant Information		
Adding/Subtracting		
Multiplying		
Math Concepts		
Math Symbols		
Words		
Showing What You know		

Tips:

Communication is important to making high scores. Be sure to use word labels, money signs, and +,−,x,÷ signs. Show Me

Charts and graphs can give you lots of information. Be sure to read charts and graphs carefully. Pay attention to the key below the charts and graphs. Show Me

Go Back Continue

File Memory 11:32 AM

Tip 1

Communication is important to making high scores. Be sure to use word labels, money signs, and +,−,x,÷ signs.

$ 50 games
+ 70 Nintendo
$120 total cost

This answer is fully correct. The addition is correct. Also, it is fully labeled with word labels, dollar signs, and the + sign.

Go Back Continue

File Memory 11:32 AM

Tip 1 (continued)

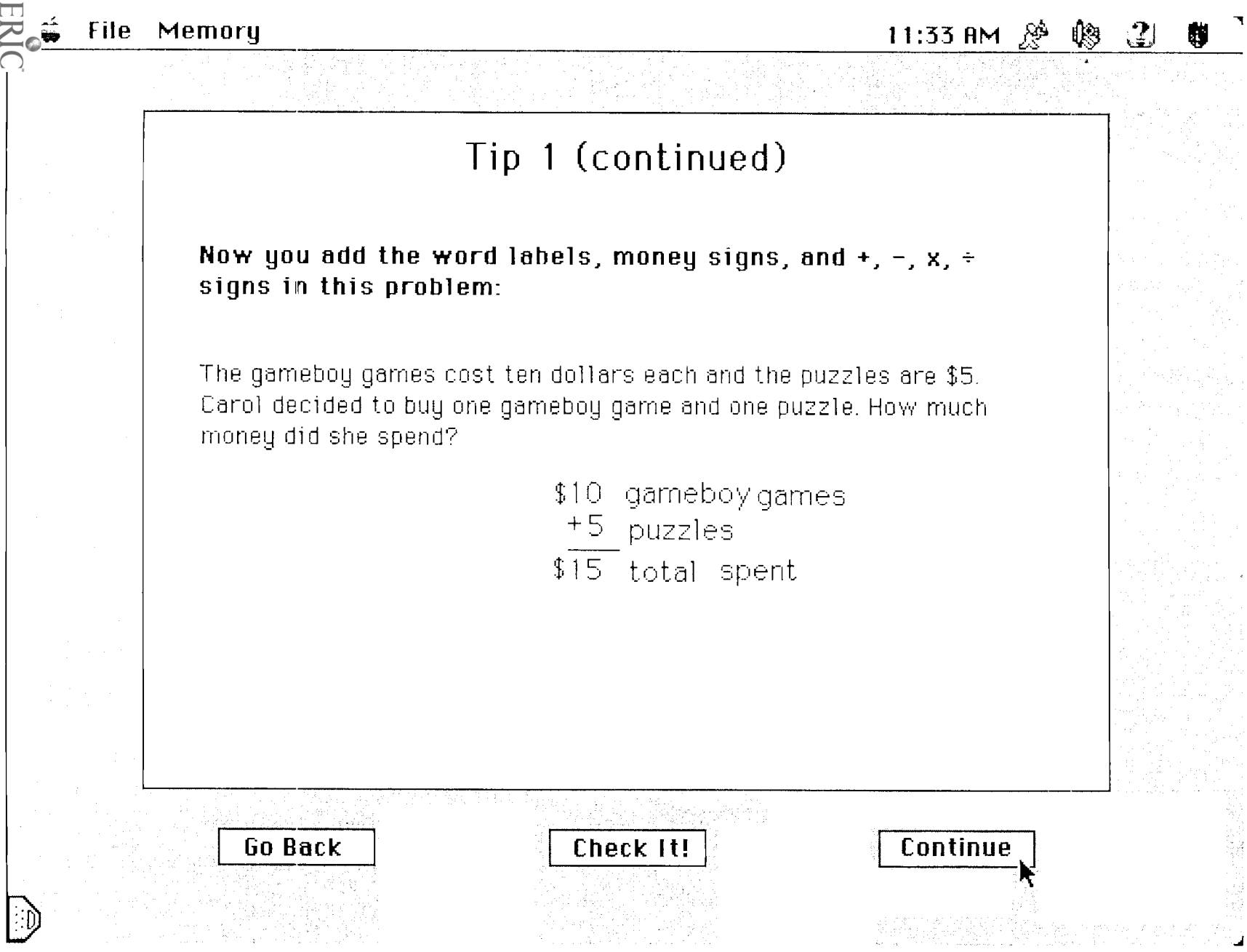
Now you add the word labels, money signs, and +, −, x, ÷ signs in this problem:

The gameboy games cost ten dollars each and the puzzles are $5. Carol decided to buy one gameboy game and one puzzle. How much money did she spend?

$ 10
$ 5
\+ 15

gameboy
games
puzzles
total
spent

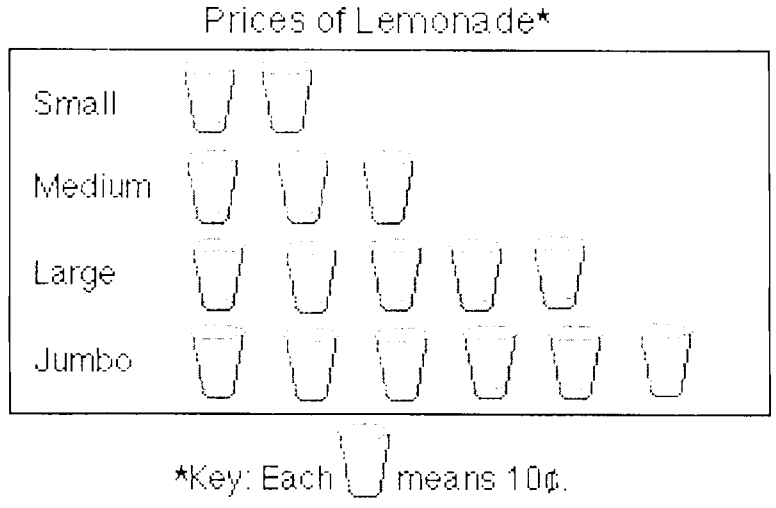
Go Back | Check It! | Continue


File Memory
11:33 AM
Tip 1 (continued)
Now you add the word labels, money signs, and +, −, x, ÷ signs in this problem:
The gameboy games cost ten dollars each and the puzzles are $5. Carol decided to buy one gameboy game and one puzzle. How much money did she spend?
$10 gameboy games
+5 puzzles
$15 total spent
Go Back
Check It!
Continue

Tip 2

Charts and graphs can give you lots of information. Be sure to read charts and graphs carefully. Pay attention to the key below the charts and graphs.

The title above this graph tells you what the graph is about. The key below the graph tells you an important piece of information.



Go Back Continue

File Memory 11:33 AM

Tip 2 (continued)

Use the pointing finger to point to the important information in the key.

Prices of Pizzas*

Small	$4
Medium	$6
Large	$8
Extra Large	$10

* Each pizza is 1/2 the price listed.

Go Back **Check It!** **Continue**

File Memory 11:34 AM

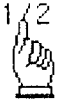
Tip 2 (continued)

Use the pointing finger to point to the important information in the key.

Prices of Pizzas*

Small	$4
Medium	$6
Large	$8
Extra Large	$10

* Each pizza is 1/2 the price listed.



Go Back Check It! Continue

File Memory 11:34 AM

Austin: Teacher Recommendations

Recommendation 1:

The student failed to figure the number of packs (see question #2). The student needs instruction on the concept of packs and operational methods for computing packs.

Recommendation 2:

The student failed to give a final explanation (see question #4). When the question asks a student to explain how he got his answer, he should provide details about the steps he took to solve the problem as well as the reasoning behind them. The student needs instruction on how to write good explanations.

Go Back Quit

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