Learning Java: A Programmed Instruction Approach

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- The links in this original presentation may not work. The tutoring system is freely available here:
  http://nasa1.ifsm.umbc.edu/learnJava/tutorLinks/TutorLinks.html

Background

- I teach ***Graphical User Interface Systems Using Java*** to IFSM undergraduate and graduate students.
- ***These students are not keen on computer programming.***
- ***What could I do*** as an instructor to help these students to master a challenging knowledge domain?

Problems, Problems…

- To meet the ever-increasing ***student demand*** for instructional effectiveness and "training" in information technology within programs having general academic objectives.
  - Bachelor of Science, ***not*** Bachelor of Technology

More Problems, Problems…

- To meet student demand when it is a given that the populations of ***students show heterogeneity in preparation and motivation for training, retraining, and education***.

My Goal (Wishful Thinking…)

- Don't just document individual differences in achievement: ***Overcome them!***
- Adopt a technology of education that ***documents the process of learning*** and ***assures the achievement of domain knowledge mastery in all students***.

Motivational Individual Differences

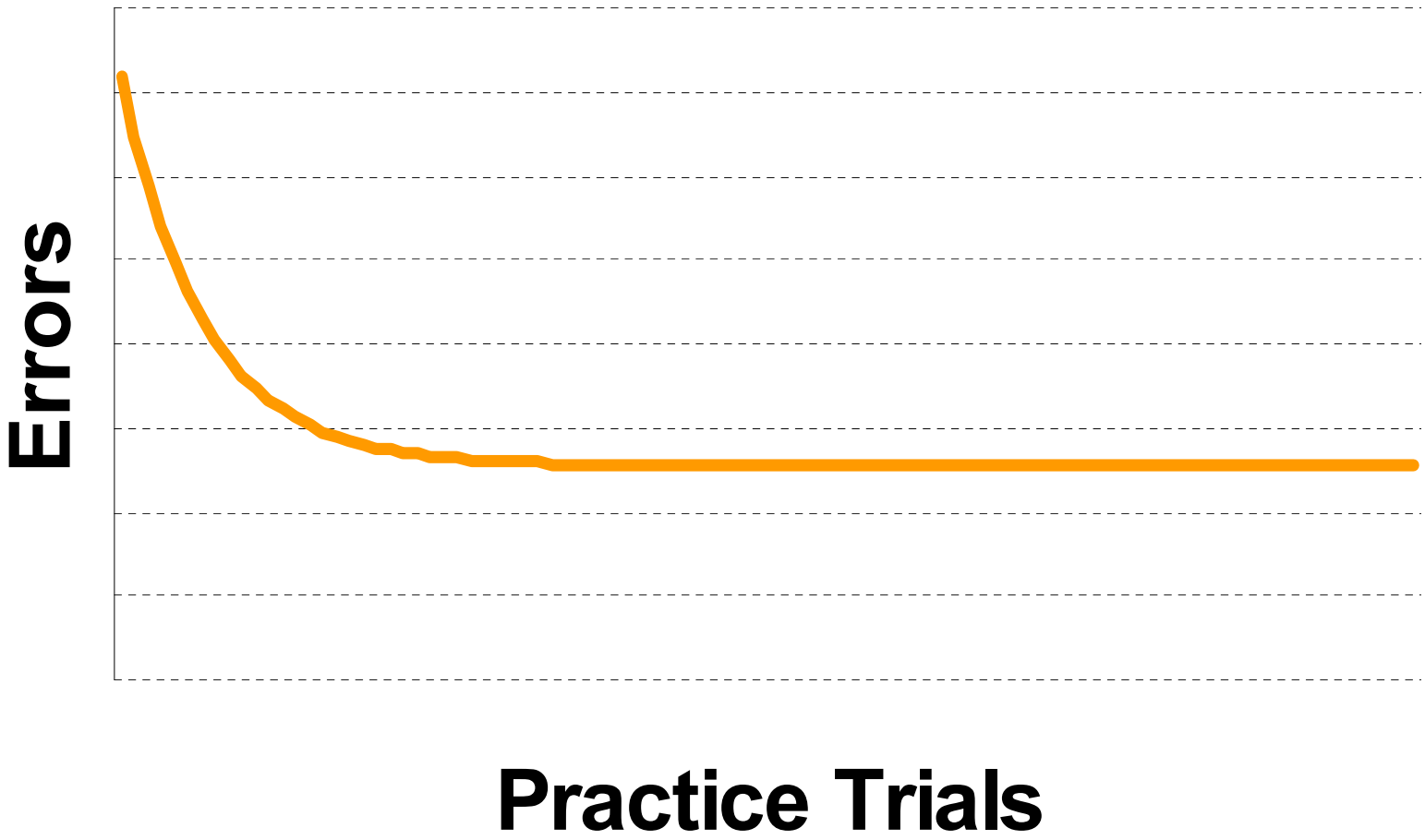
- **Why** do learners seek technology education and training?
  - Groups of learners
    - Undergraduate and graduate students embarking on a first career path
    - Adult students seeking a new career
    - Career enhancement
    - Mandatory and discretionary retraining on the job

Conclusion

Despite over 100 years of published archival research in educational psychology and pedagogy aimed at understanding and producing a technology of learning and retention, with or without information technology, one conclusion still stands out:

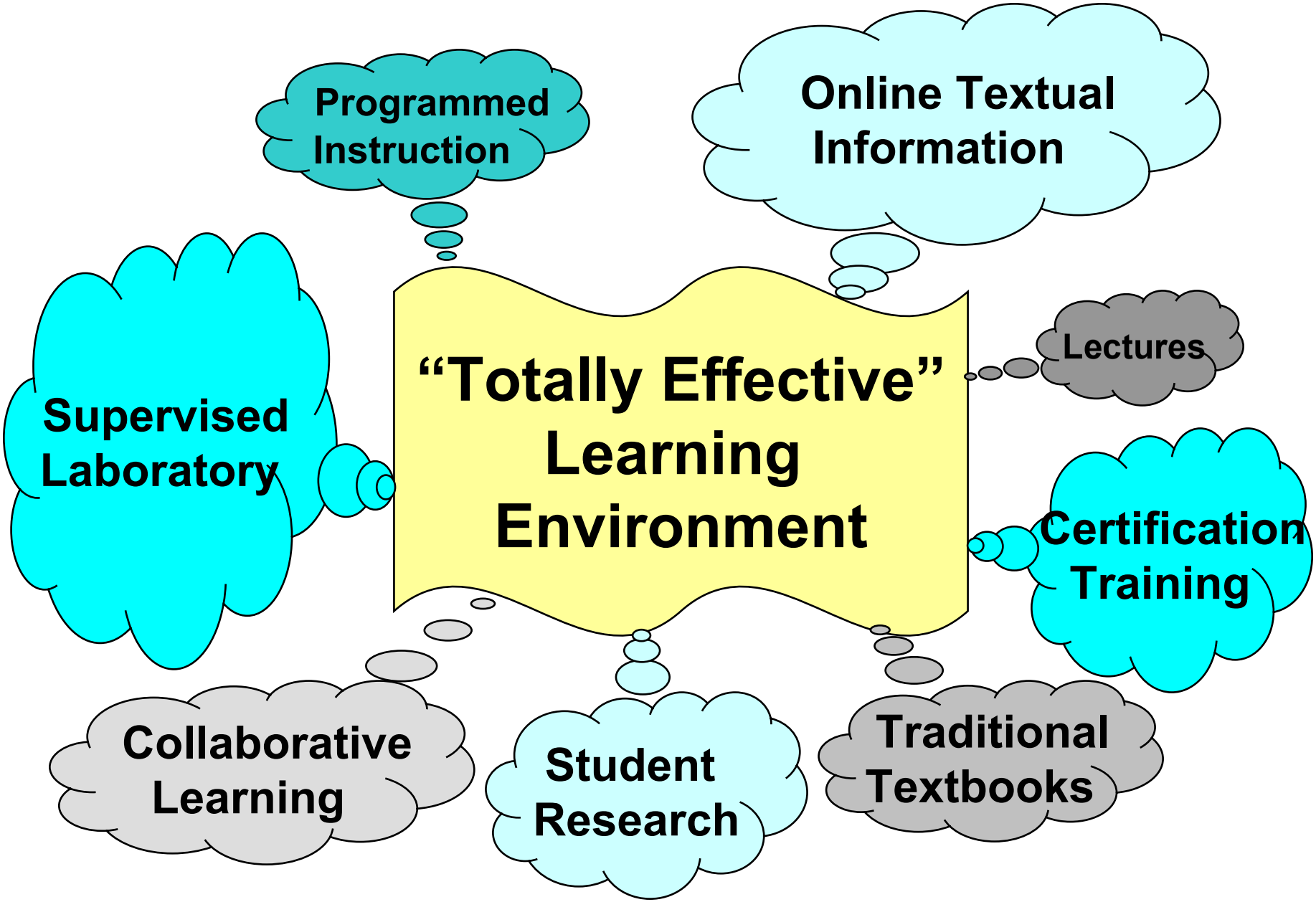
(*Correct…*) ***Practice makes perfect in the mastery of a subject!***

Power Function



Solution: Keller's Personalized System of Instruction (PSI) (Keller, 1968)

- Unit Perfection
- Self-paced progression
- Focus on written word to communicate information
- Repeated testing of concepts
- Collaboration with peers and experts


Programmed Instruction
Online Textual Information
Supervised Laboratory
"Totally Effective" Learning Environment
Lectures
Certification Training
Collaborative Learning
Student Research
Traditional Textbooks

My Experience Suggests…

- Information technology (IT) may **enrich** the learning experiences of students.
- IT will not remove the obvious fact that learning requires **work** and sustained effort.
- The direct and individual supervision of a **teacher or mentor** is often essential.
- The medium of presenting information is less important than a student's **active engagement of the material**.

Technology Training Challenges

- Familiarity and comfort with **strange symbols** and their juxtapositions.
  - Low-level technology: programming in Java
  - High-level technology: word processing
  - Icons
  - "Cyberbabble"

Technology Training Challenges

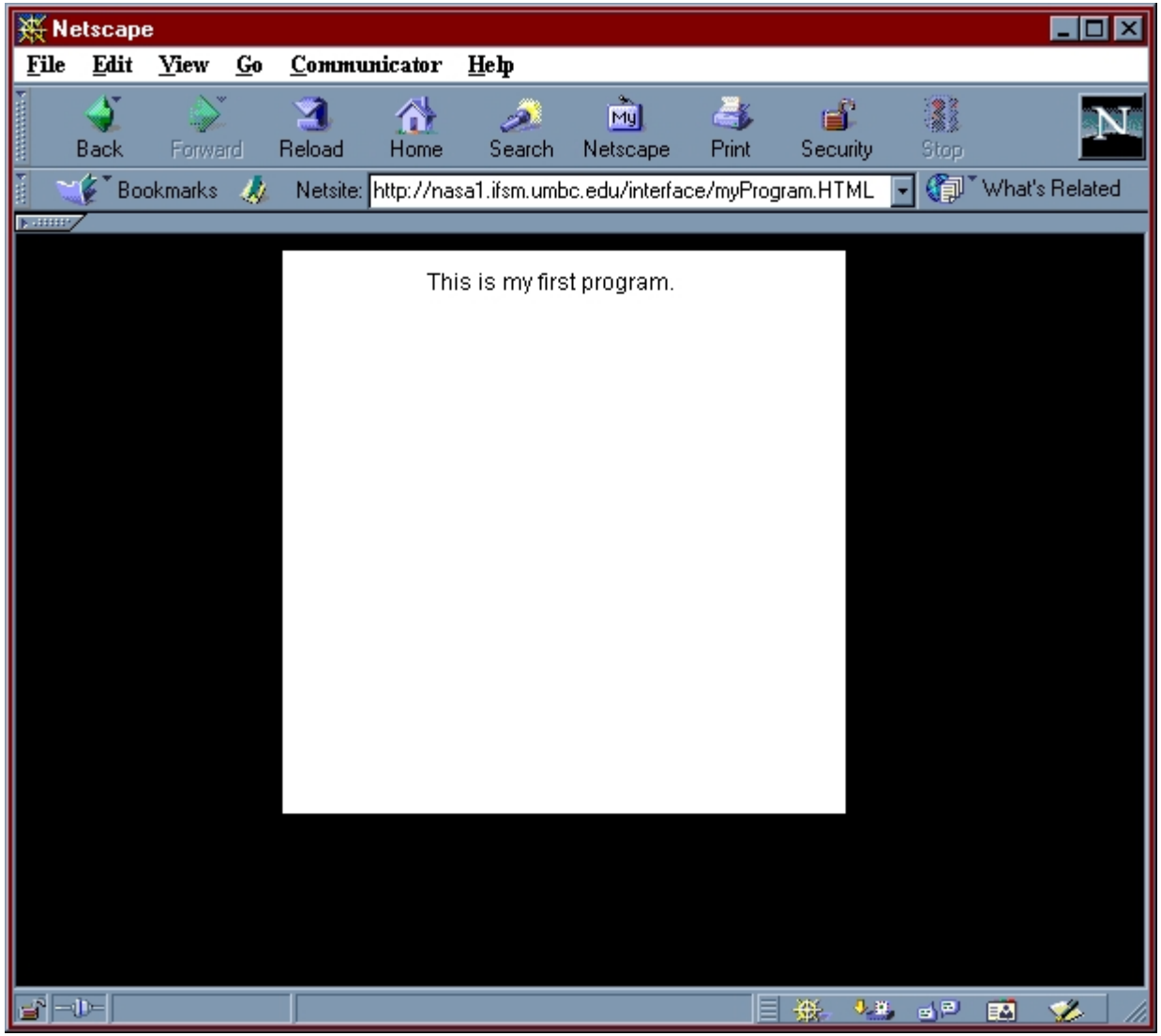
- The immediate **consequence** of correct symbol manipulation is often the production of even **more symbols**.
- The absence of a **history of symbol manipulation** and use often discourages new learners, who may then move away from information technology disciplines.

UMBC Java Tutoring System

- **http://webct.umbc.edu/public/JavaTutor/index.html**

How It Helps...

- Generates a ***history of study behavior*** in students who may lack the study skills and discipline to master the Java code on their own initiative.
- This ***frees the student*** to acquire more advanced levels of skill independent of the support provided by the tutoring system.


Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Netsite: http://nasa1.ifsm.umbc.edu/interface/myProgram.HTML What's Related
This is my first program.

Learning Objective

Verbal Learning Influences: From Aristotle (400 BC) to Li & Lewandowsky (1995)

- Item information
  - Recognition tests
- Associative information
  - Paired associate tests
- Serial order information
  - Serial recall

Item Learning

Item learning example: **import**

Objectives:

1. Learn the meaning of the item.
2. Learn the serial context of the item.
3. Learn the general context of the item.
4. Learn to construct the item.

import java.applet.Applet;

Serial Stream

Serial learning example:

import java.applet.Applet;

Objectives:

1. Learn the serial order of the items.

import java.applet.Applet;

Advanced Serial Stream

Serial Stream with Advanced Units

Objectives:

1. Learn the serial context of a group of items.
2. Learn the general context of a group of items.
3. Learn to construct a group of items as a single unit.

```
import java.applet.Applet;
import java.awt.Label;
```

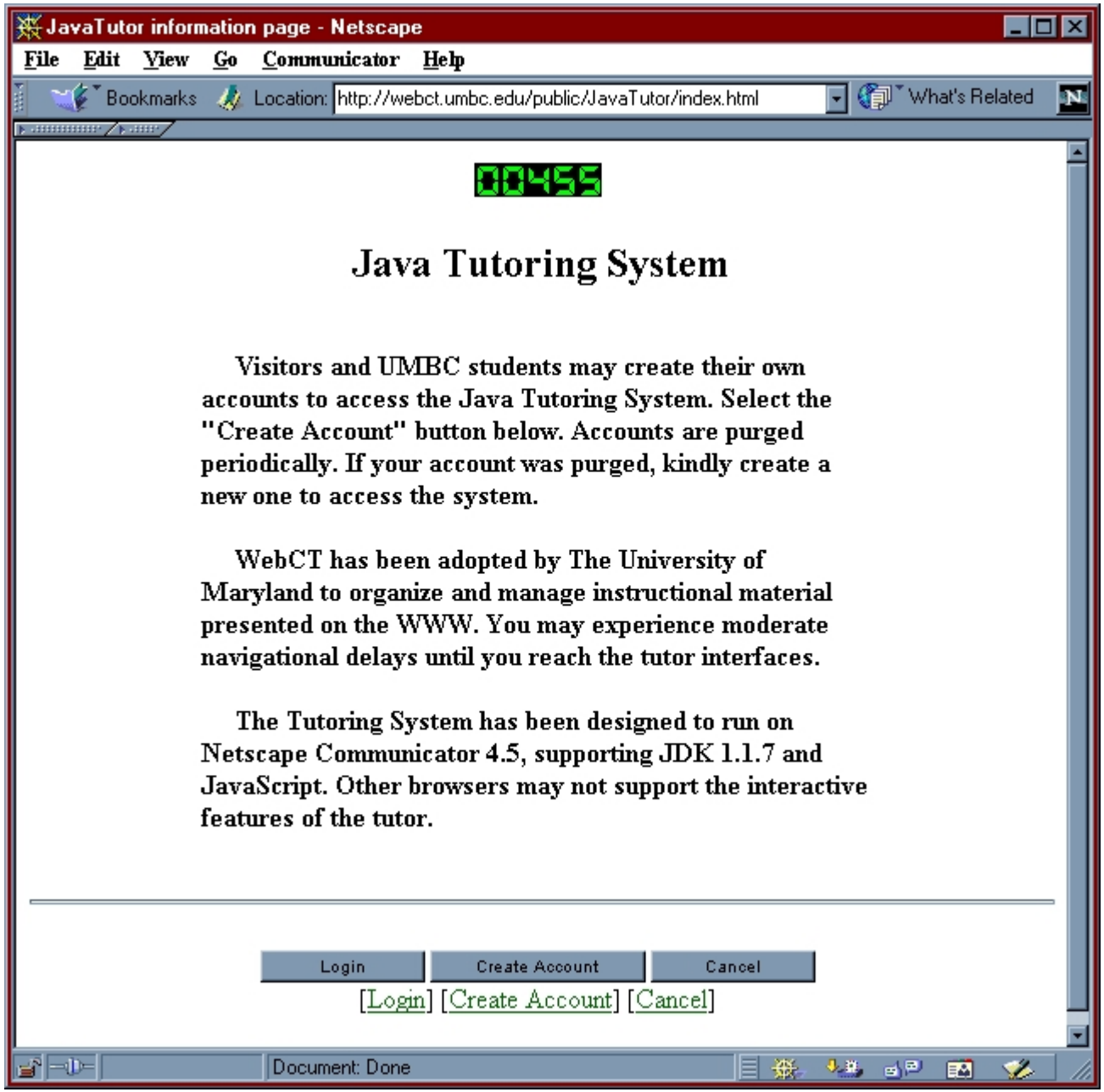
Serial Stream as a Unit

Serial Stream Unit

Objectives:

1. Learn the serial stream as one unit.

```
import java.applet.Applet;
import java.awt.Label;
public class myProgram extends Applet {
Label myLabel;
public void init() {
...
}
```


JavaTutor information page - Netscape
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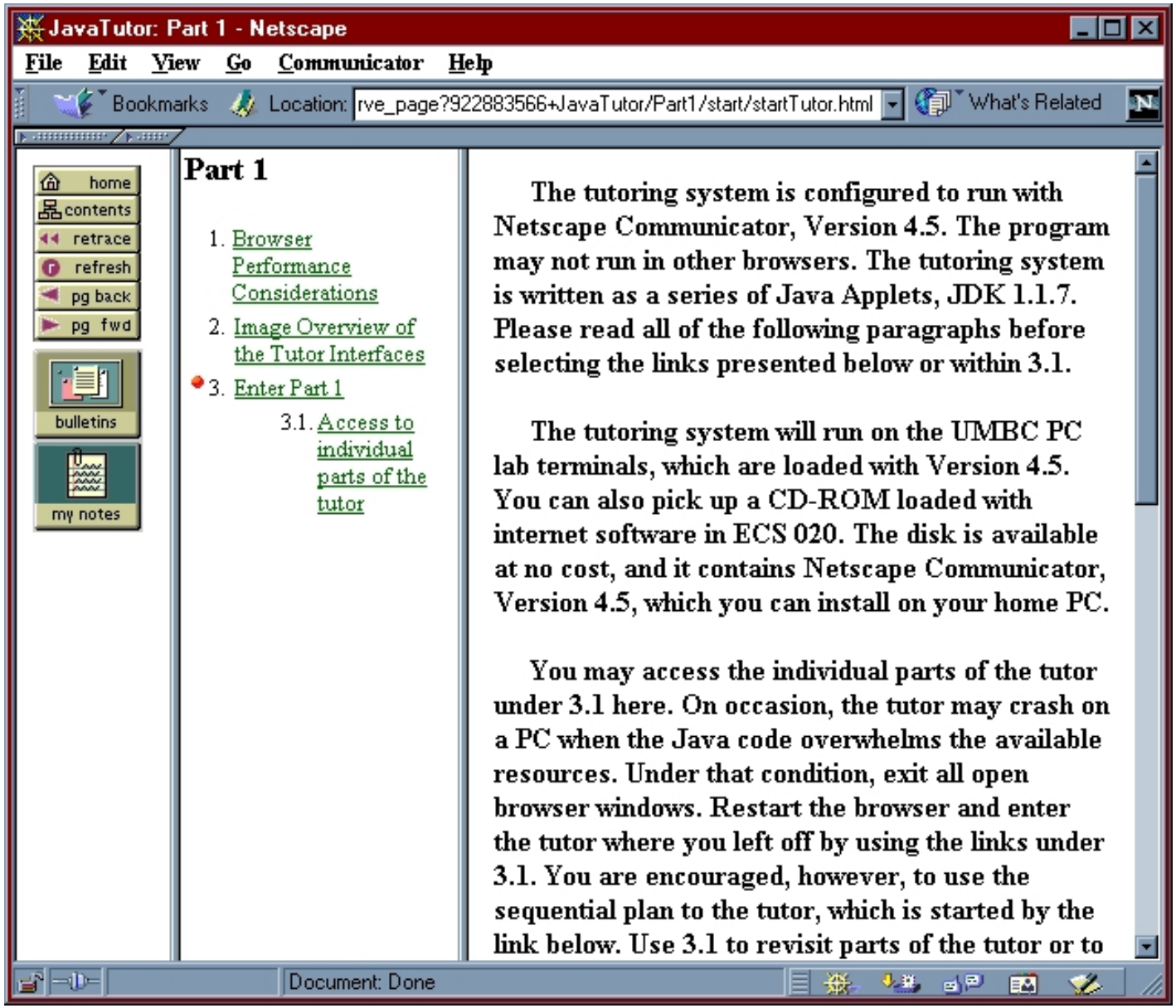
Bookmarks Location: http://webct.umbc.edu/public/JavaTutor/index.html What's Related
00455
Java Tutoring System
Visitors and UMBC students may create their own accounts to access the Java Tutoring System. Select the "Create Account" button below. Accounts are purged periodically. If your account was purged, kindly create a new one to access the system.
WebCT has been adopted by The University of Maryland to organize and manage instructional material presented on the WWW. You may experience moderate navigational delays until you reach the tutor interfaces.
The Tutoring System has been designed to run on Netscape Communicator 4.5, supporting JDK 1.1.7 and JavaScript. Other browsers may not support the interactive features of the tutor.
Login
Create Account
Cancel
[Login] [Create Account] [Cancel]
Document: Done


JavaTutor: Part 1 - Netscape
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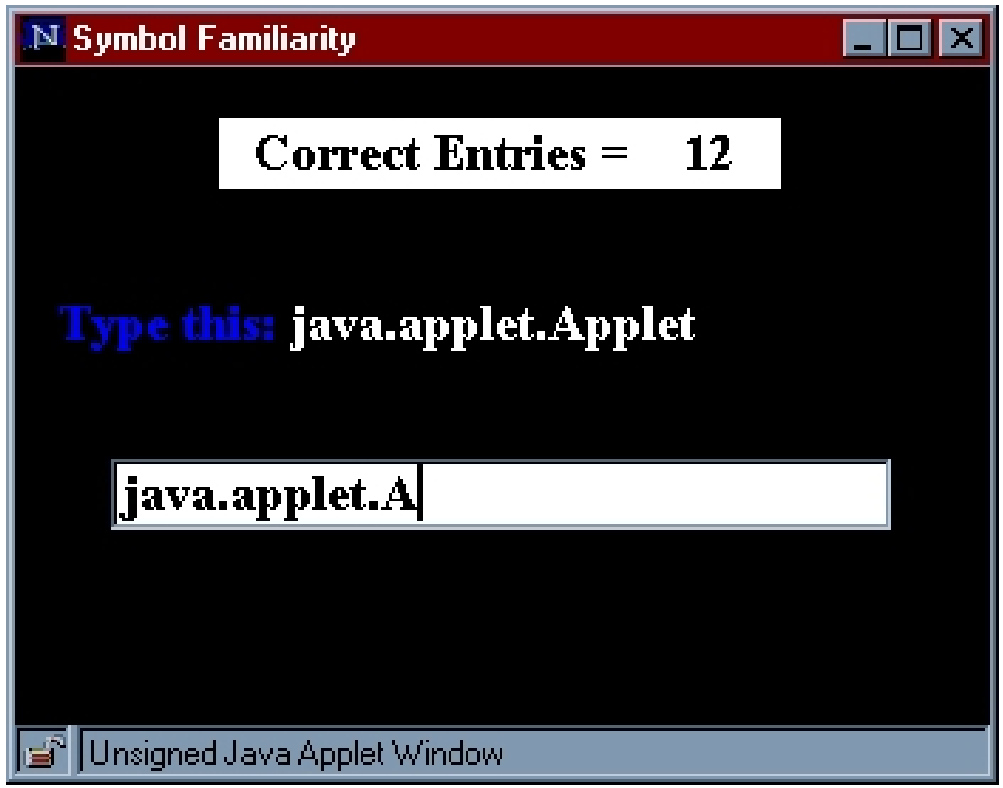
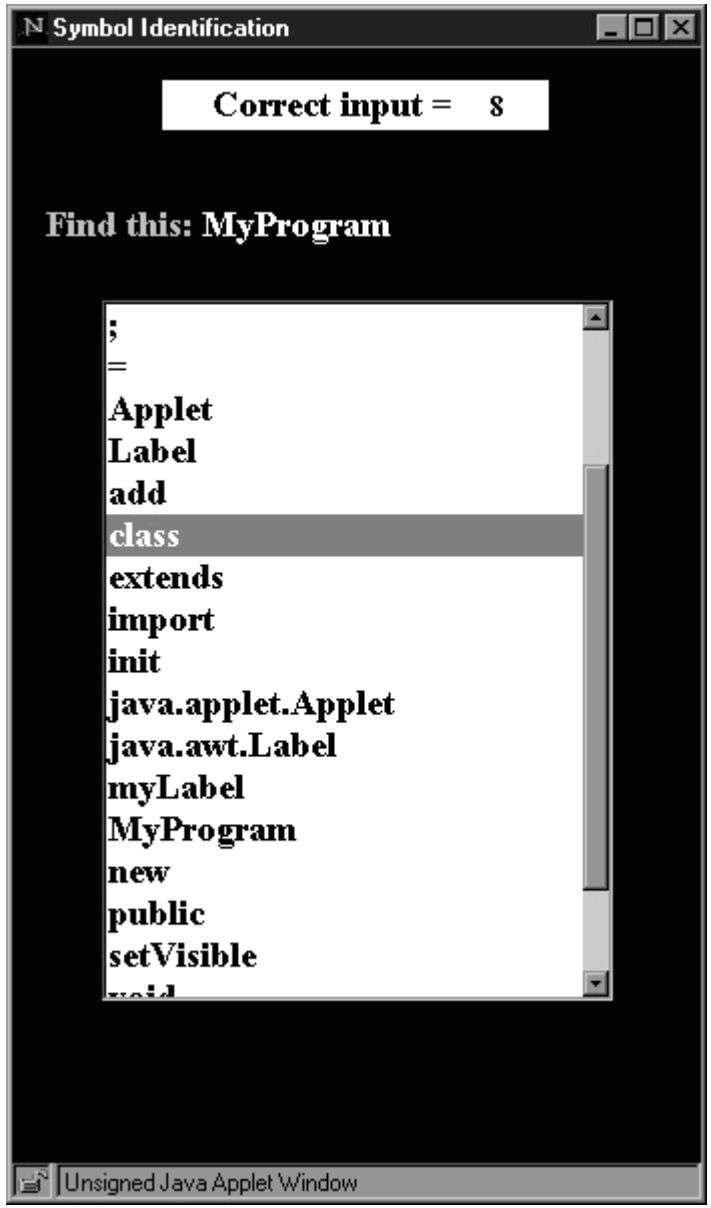
Part 1
1. Browser Performance Considerations
2. Image Overview of the Tutor Interfaces
3. Enter Part 1
3.1. Access to individual parts of the tutor
The tutoring system is configured to run with Netscape Communicator, Version 4.5. The program may not run in other browsers. The tutoring system is written as a series of Java Applets, JDK 1.1.7. Please read all of the following paragraphs before selecting the links presented below or within 3.1.
The tutoring system will run on the UMBC PC lab terminals, which are loaded with Version 4.5. You can also pick up a CD-ROM loaded with internet software in ECS 020. The disk is available at no cost, and it contains Netscape Communicator, Version 4.5, which you can install on your home PC.
You may access the individual parts of the tutor under 3.1 here. On occasion, the tutor may crash on a PC when the Java code overwhelms the available resources. Under that condition, exit all open browser windows. Restart the browser and enter the tutor where you left off by using the links under 3.1. You are encouraged, however, to use the sequential plan to the tutor, which is started by the link below. Use 3.1 to revisit parts of the tutor or to
Document: Done

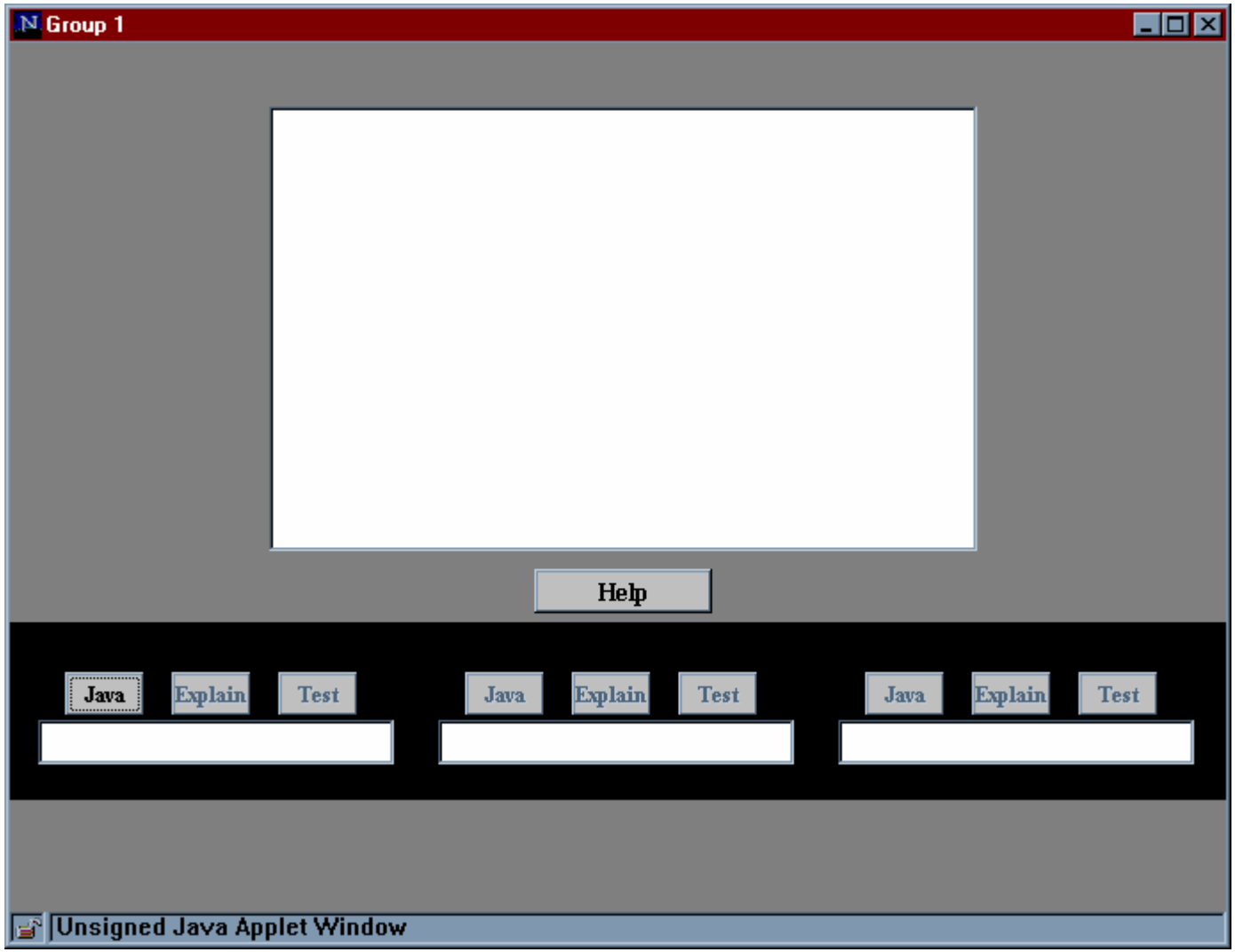
Familiarity with Symbols



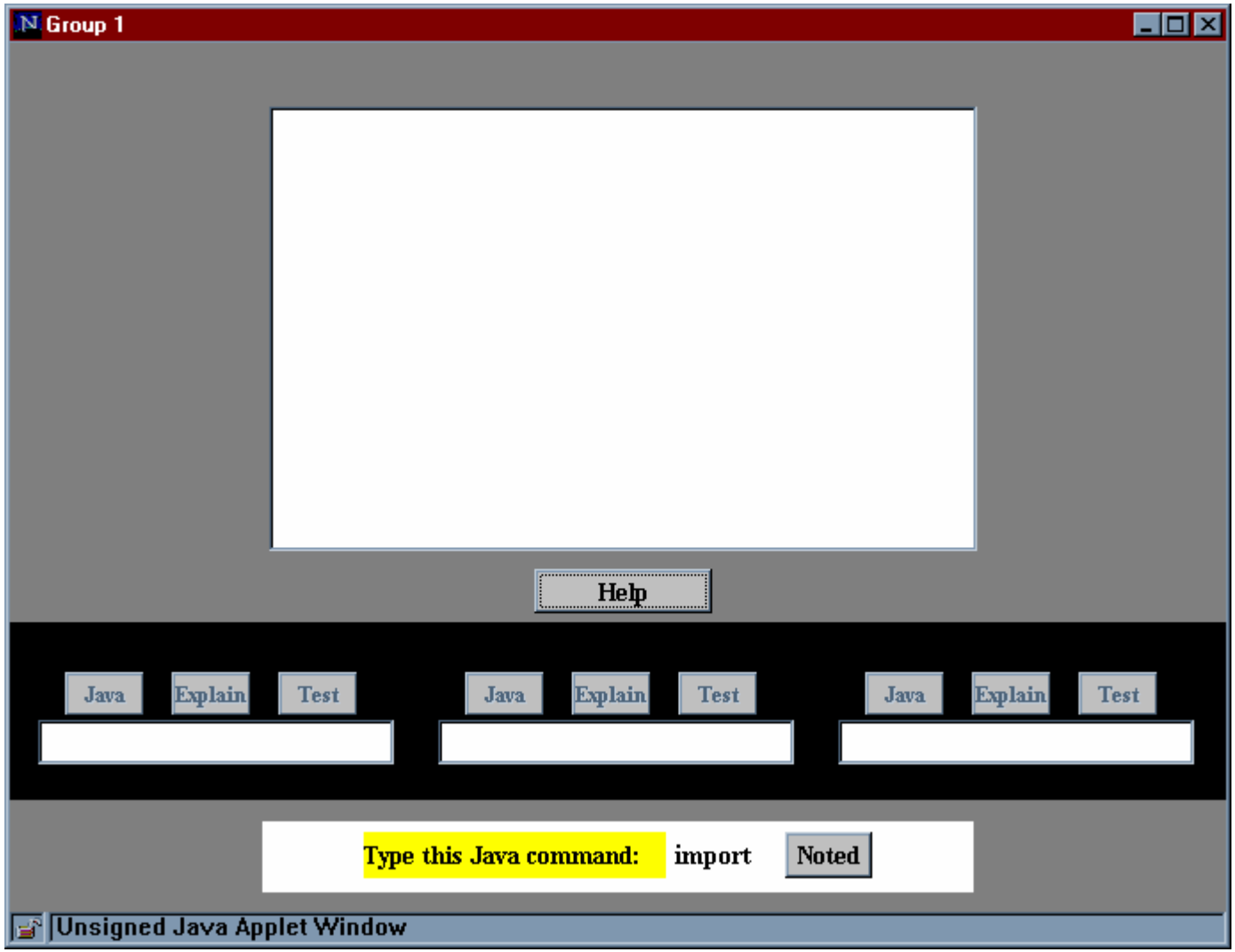
Symbol Identification

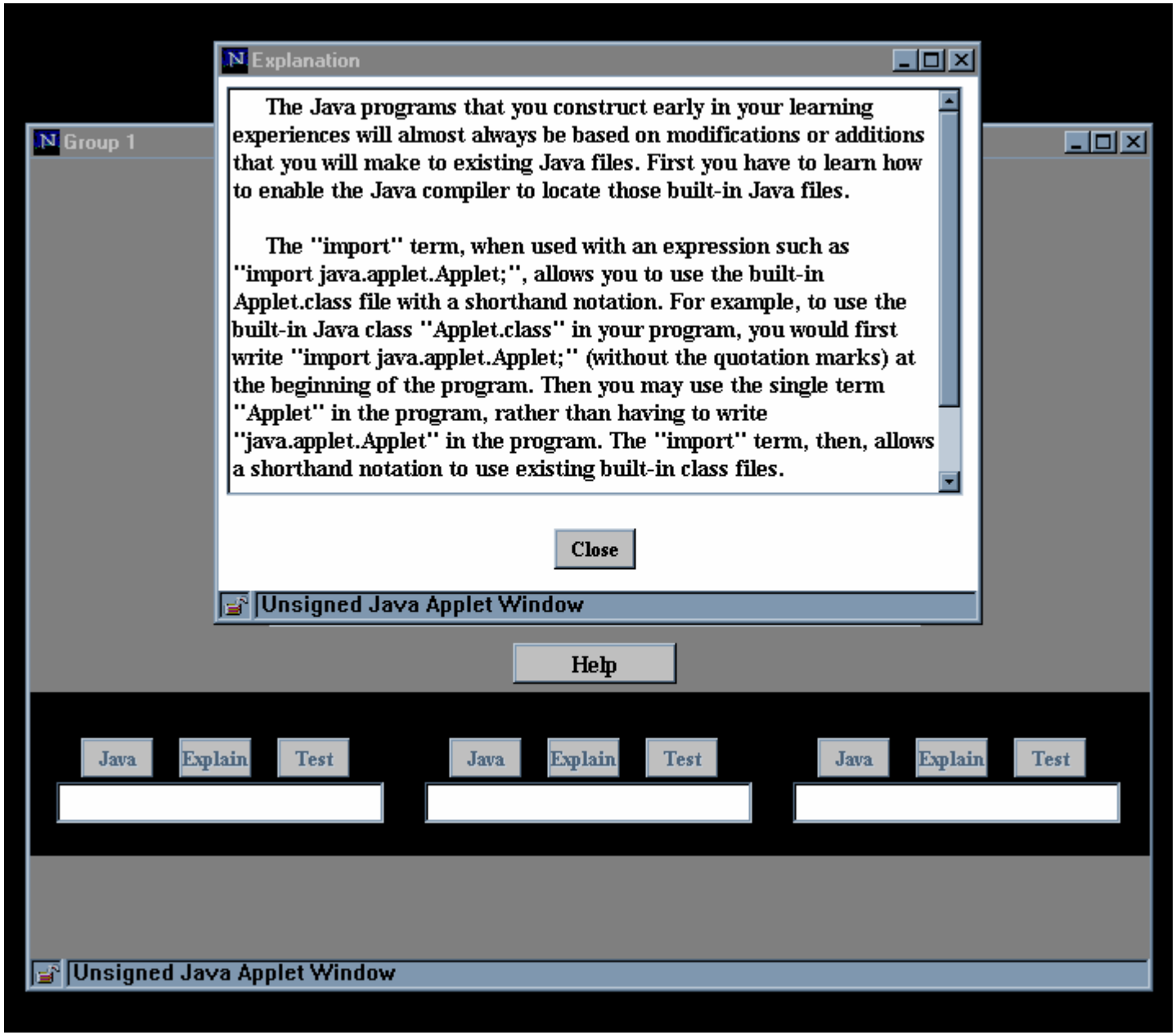


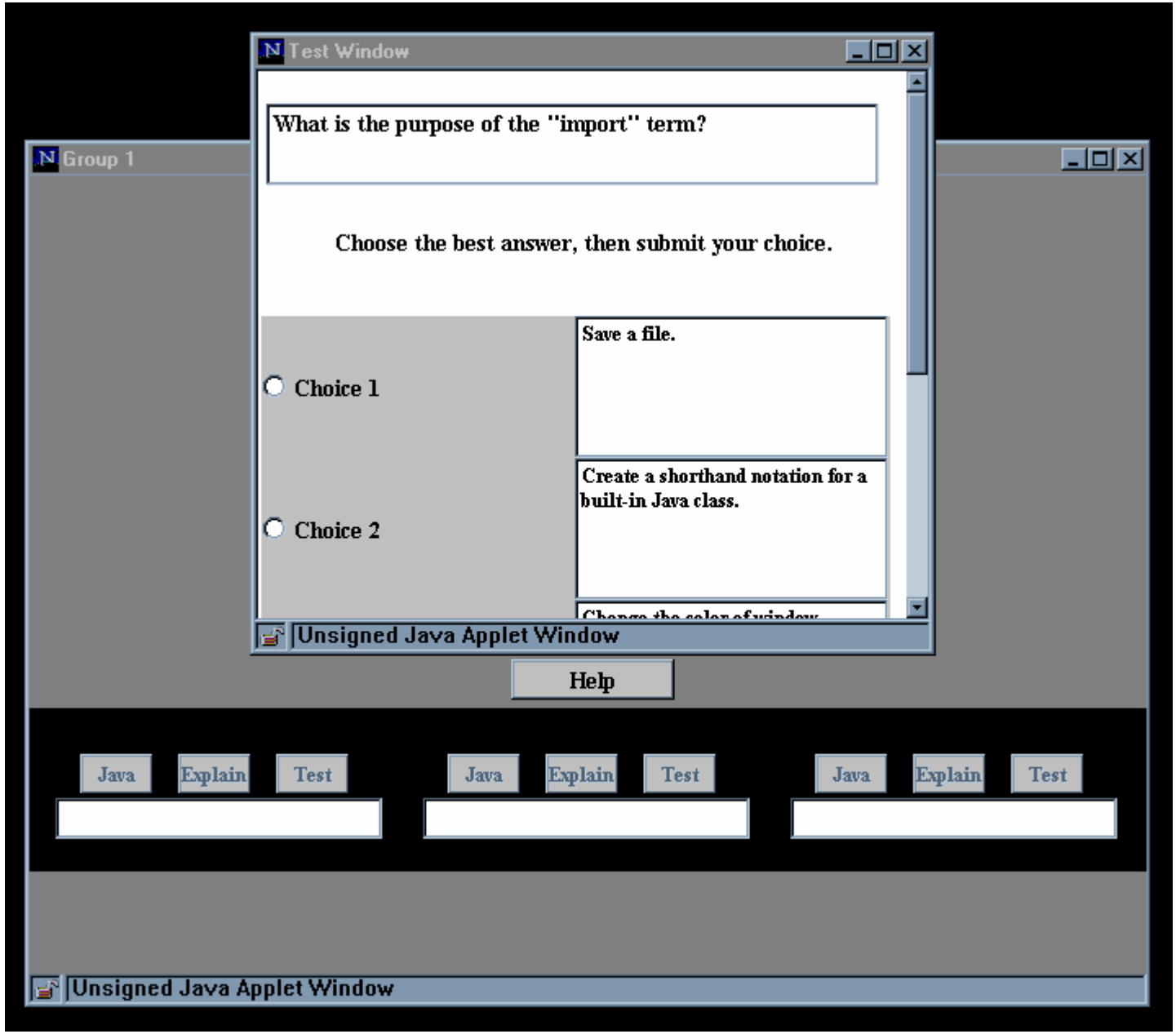
Item by Item Interface



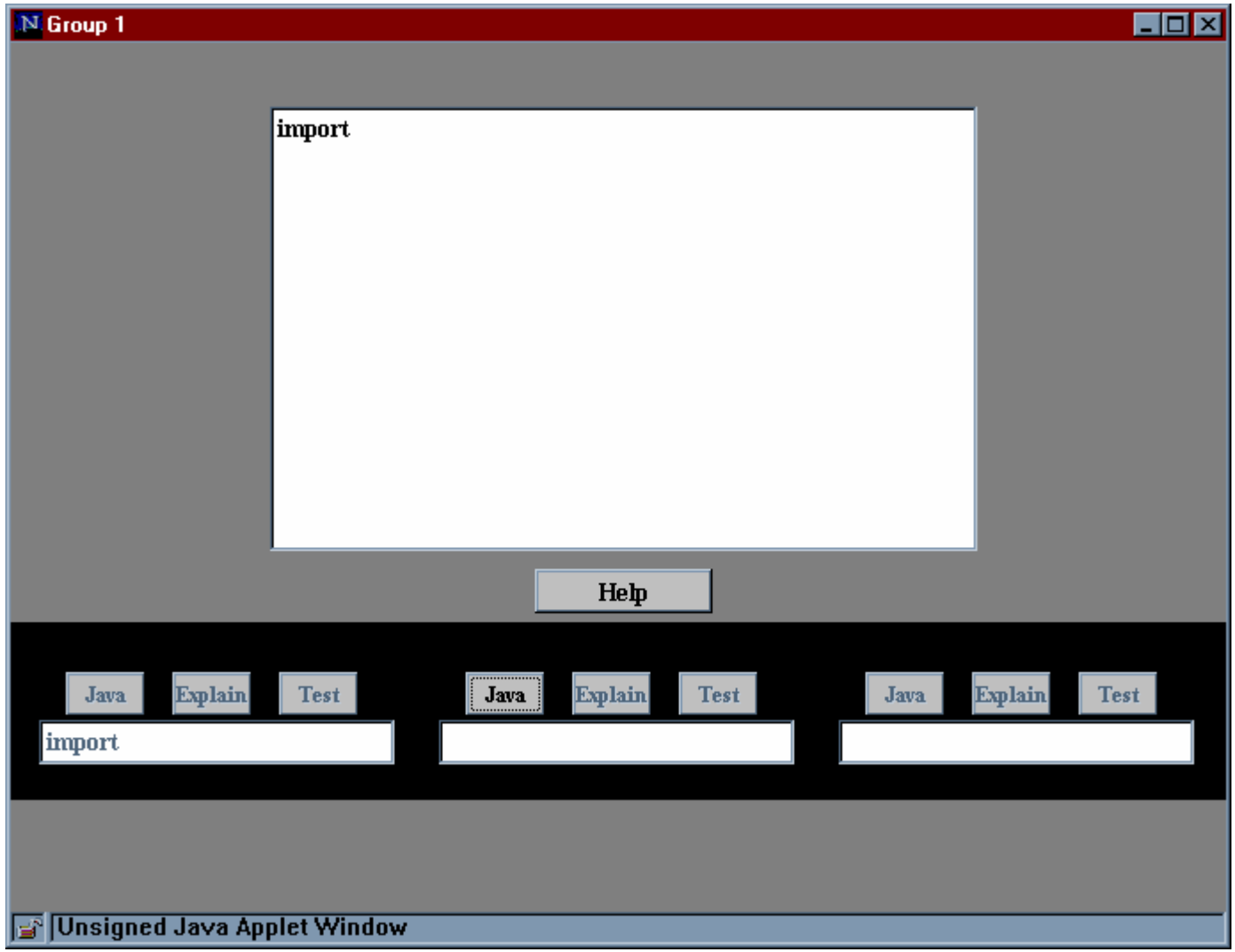
Item by Item Interface




Explanation
The Java programs that you construct early in your learning experiences will almost always be based on modifications or additions that you will make to existing Java files. First you have to learn how to enable the Java compiler to locate those built-in Java files.
The "import" term, when used with an expression such as "import java.applet.Applet;", allows you to use the built-in Applet.class file with a shorthand notation. For example, to use the built-in Java class "Applet.class" in your program, you would first write "import java.applet.Applet;" (without the quotation marks) at the beginning of the program. Then you may use the single term "Applet" in the program, rather than having to write "java.applet.Applet" in the program. The "import" term, then, allows a shorthand notation to use existing built-in class files.
Close
Unsigned Java Applet Window
Group 1
Help
Java
Explain
Test
Java
Explain
Test
Java
Explain
Test
Unsigned Java Applet Window

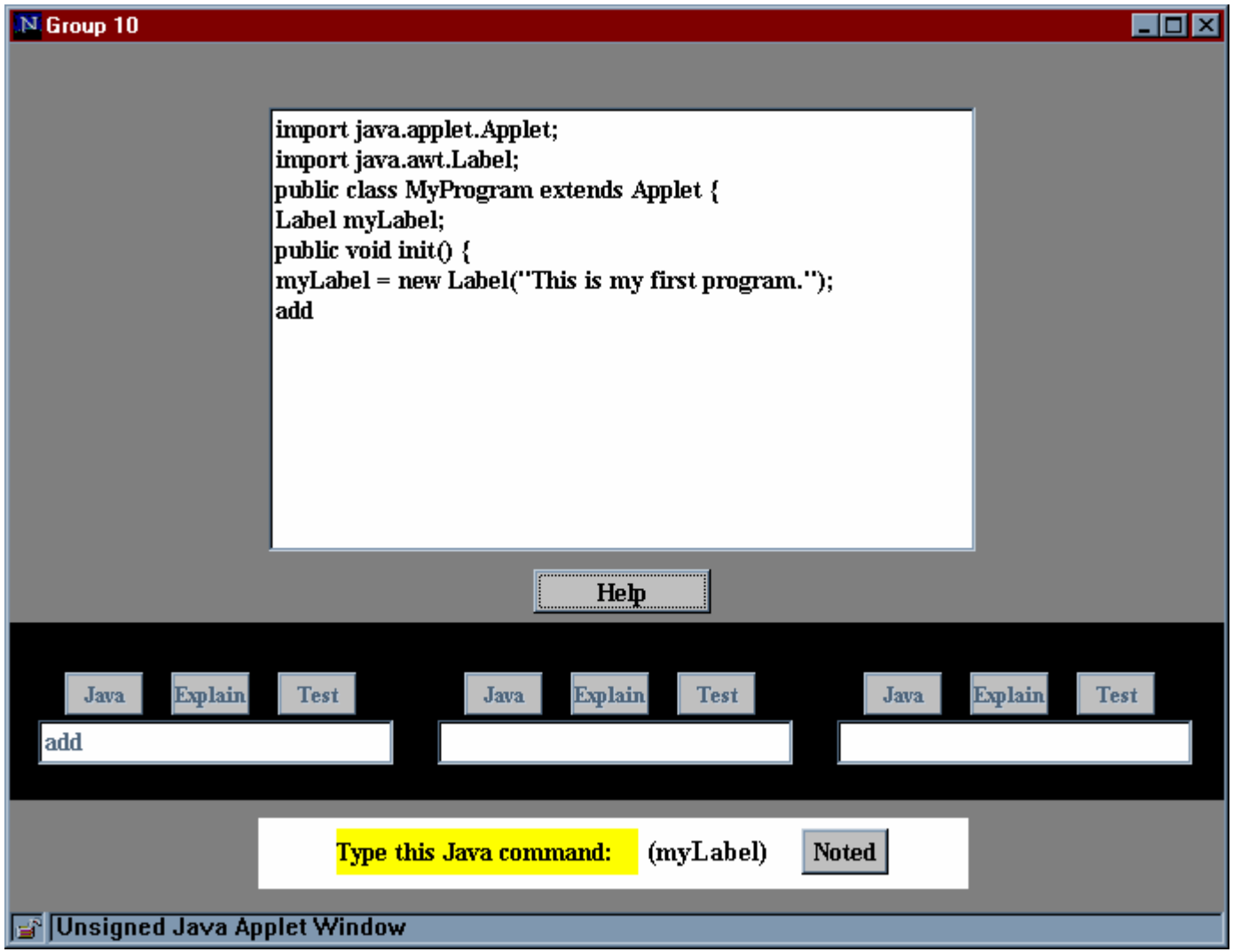

Test Window
What is the purpose of the "import" term?
Choose the best answer, then submit your choice.
Choice 1
Save a file.
Choice 2
Create a shorthand notation for a built-in Java class.
Unsigned Java Applet Window
Help
Group 1
Java
Explain
Test
Java
Explain
Test
Java
Explain
Test
Unsigned Java Applet Window

Item by Item Interface



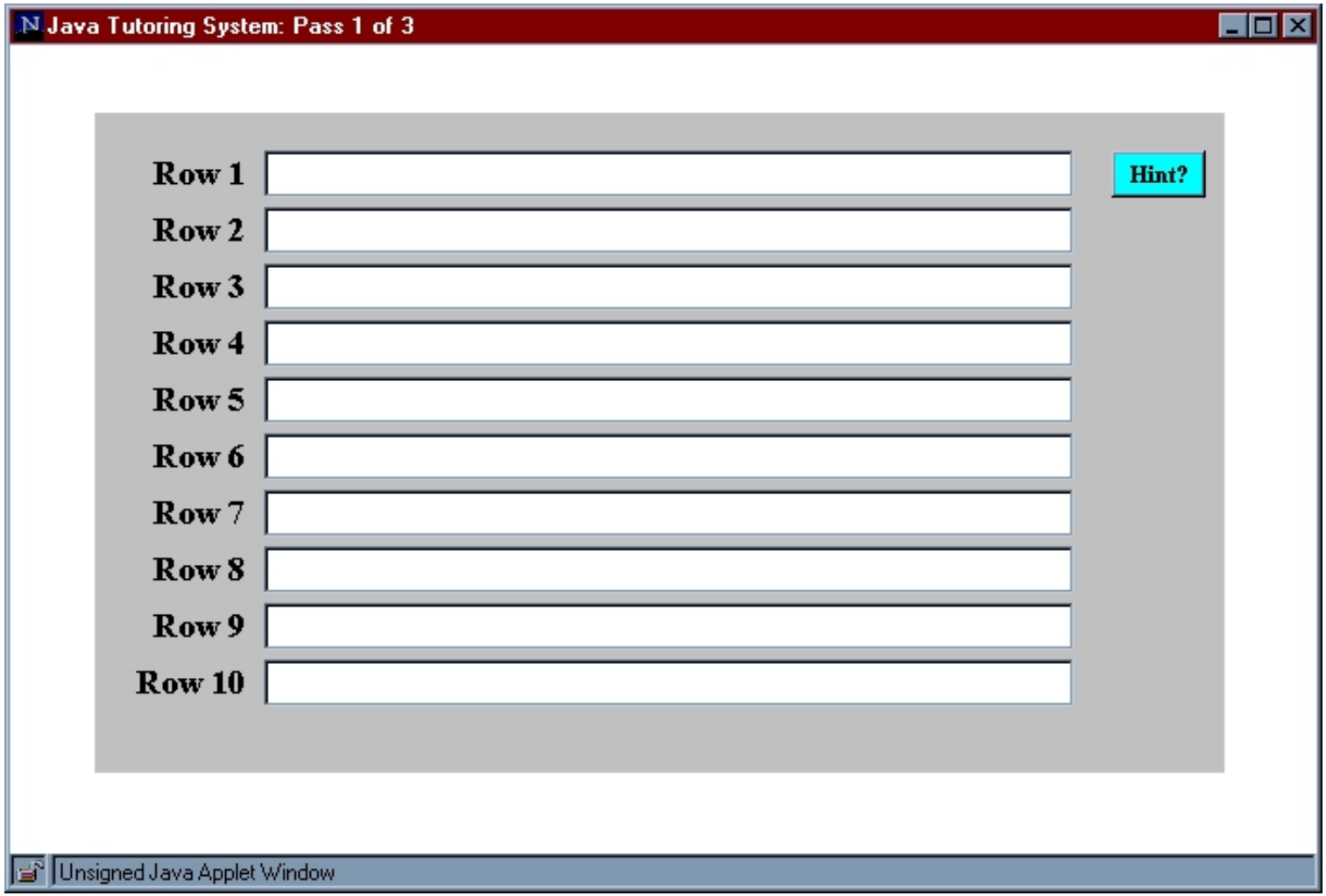
Serial Stream

Item by Item Interface

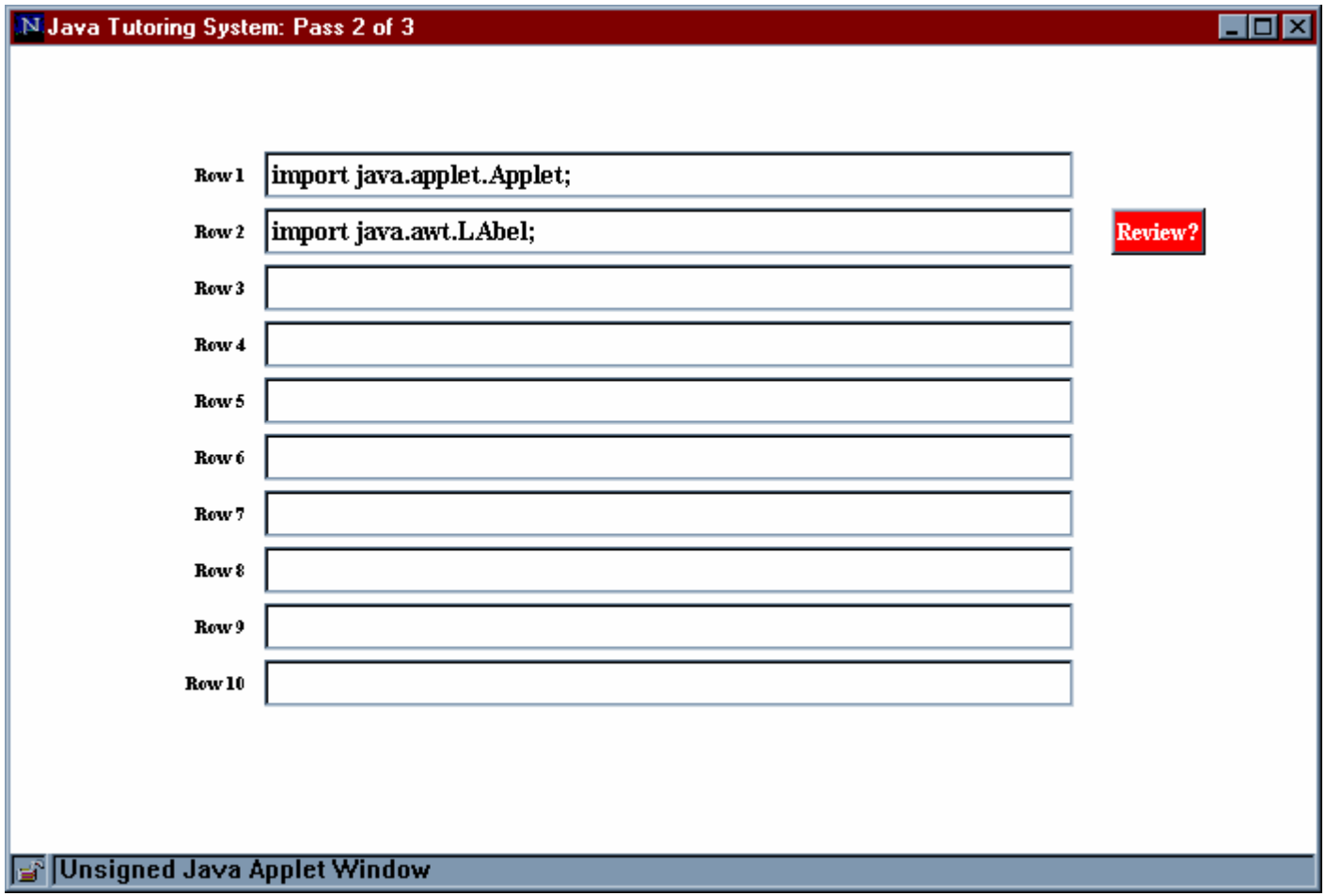


Item by Item Interface

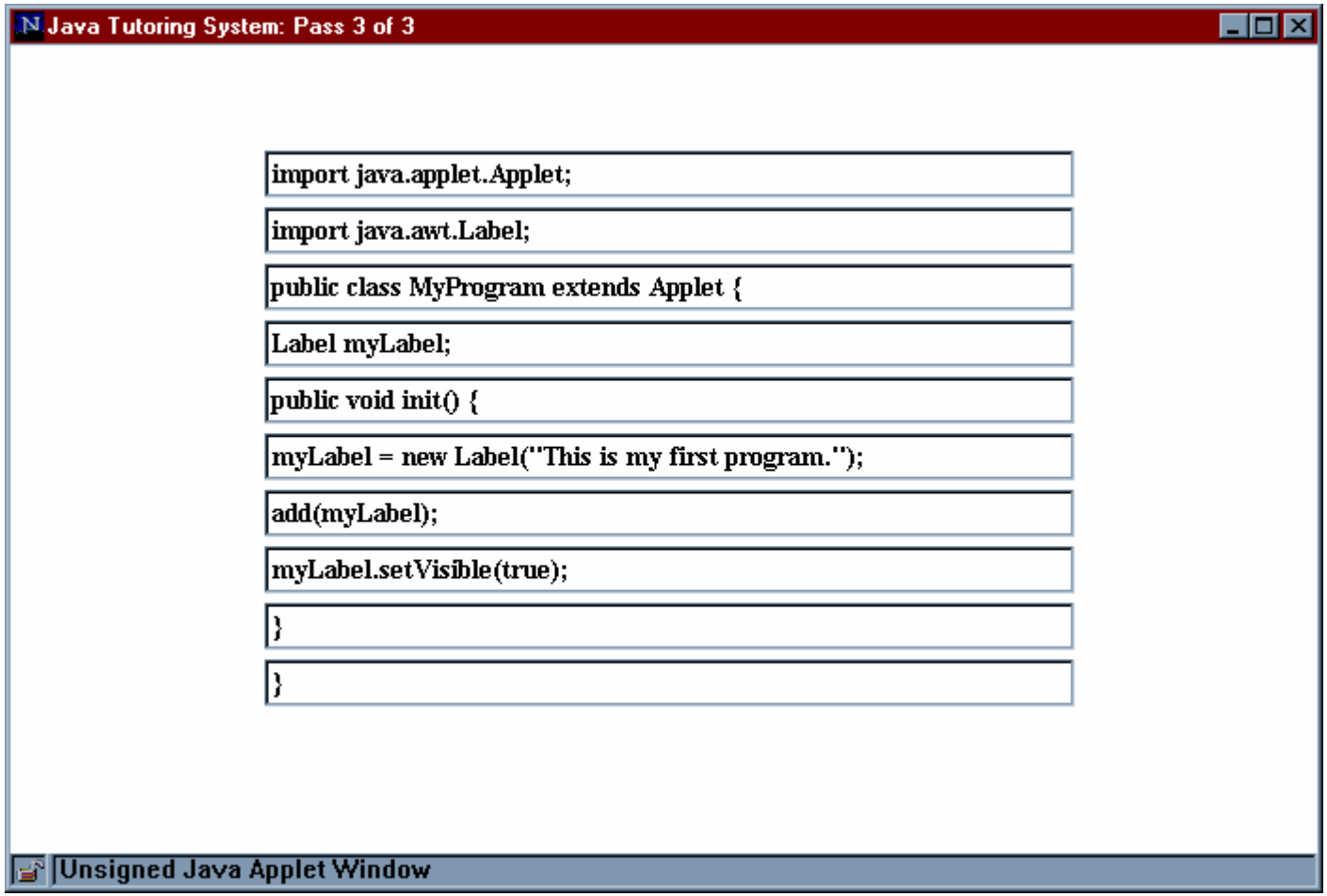
Row by Row Interface: Pass1



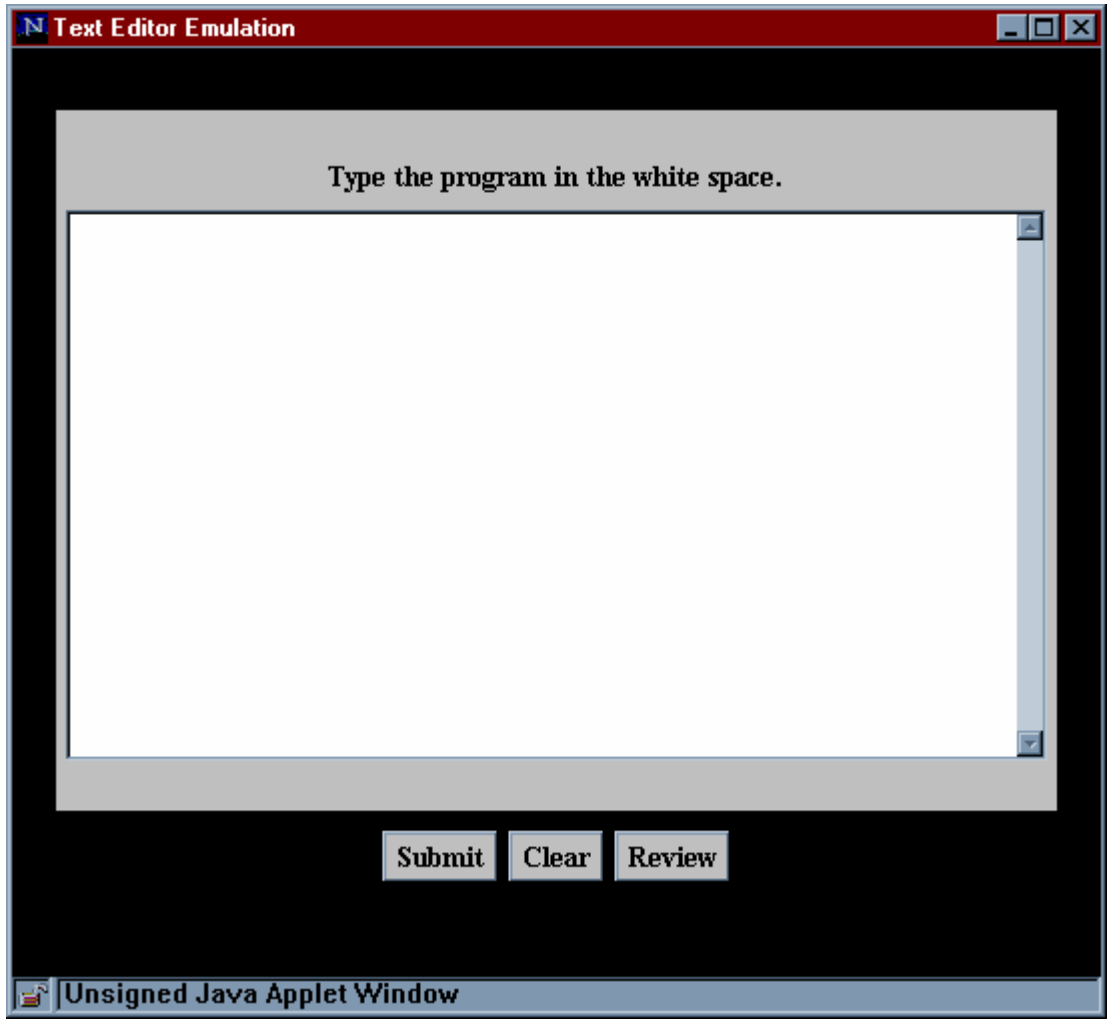
Row by Row Interface: Pass 2



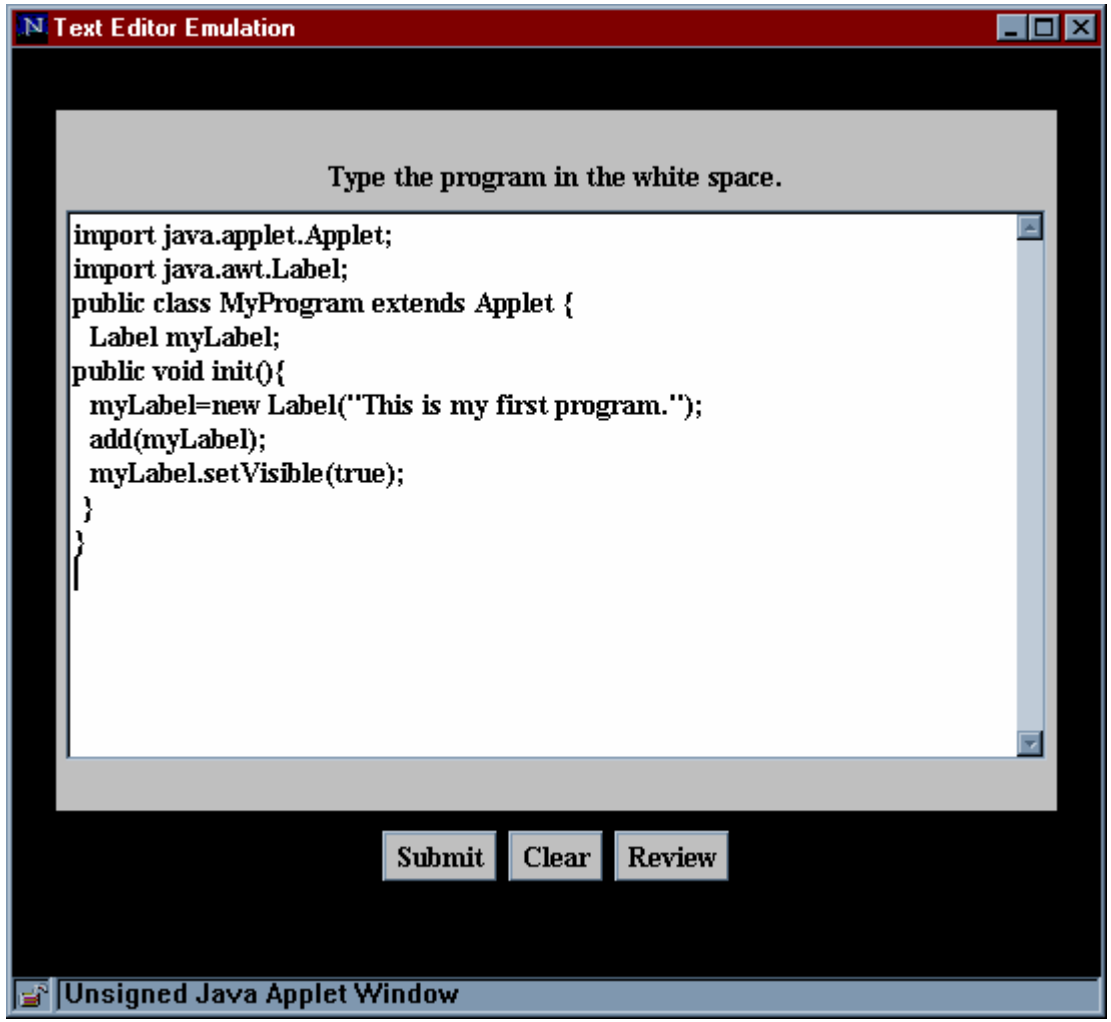
Row by Row Interface: Pass 3



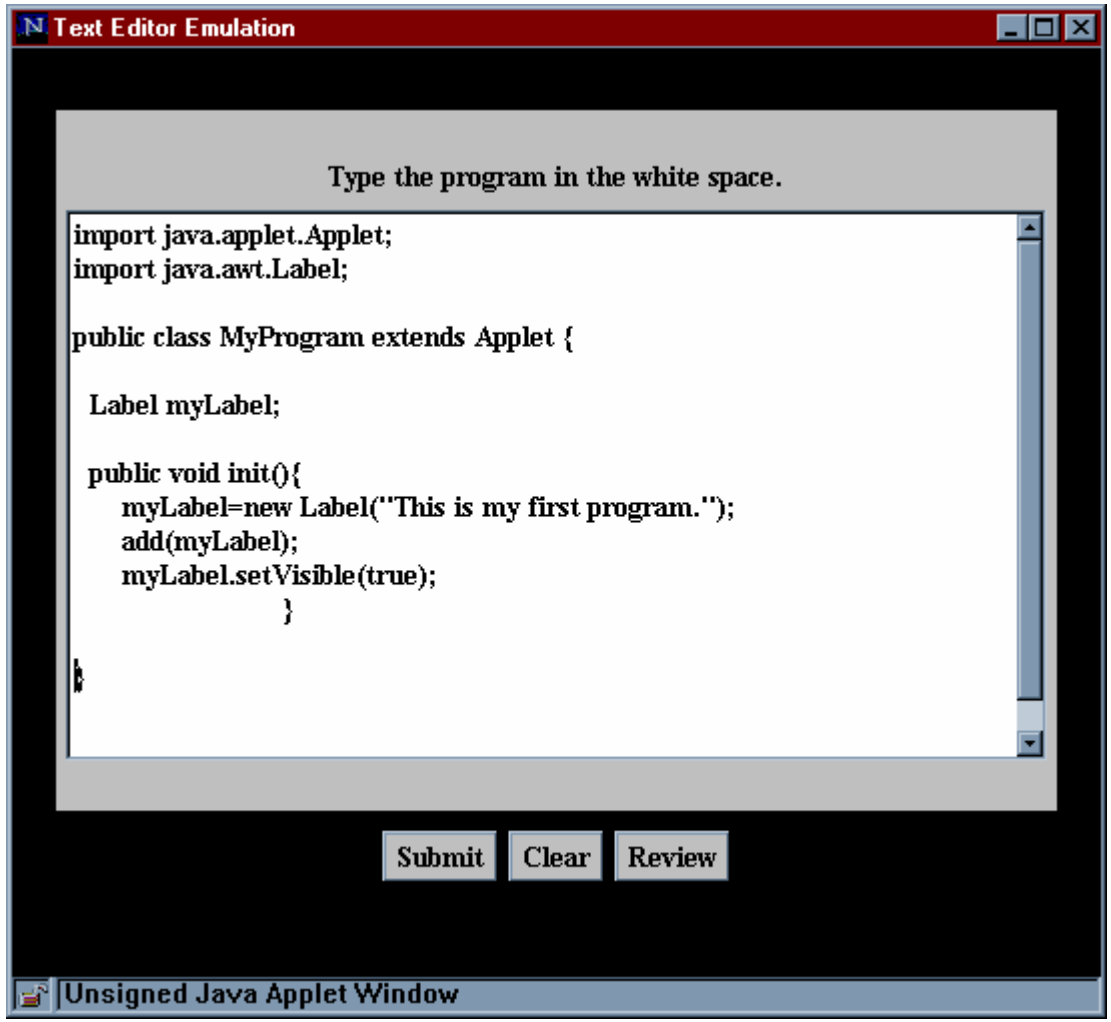
Text Editor Emulation



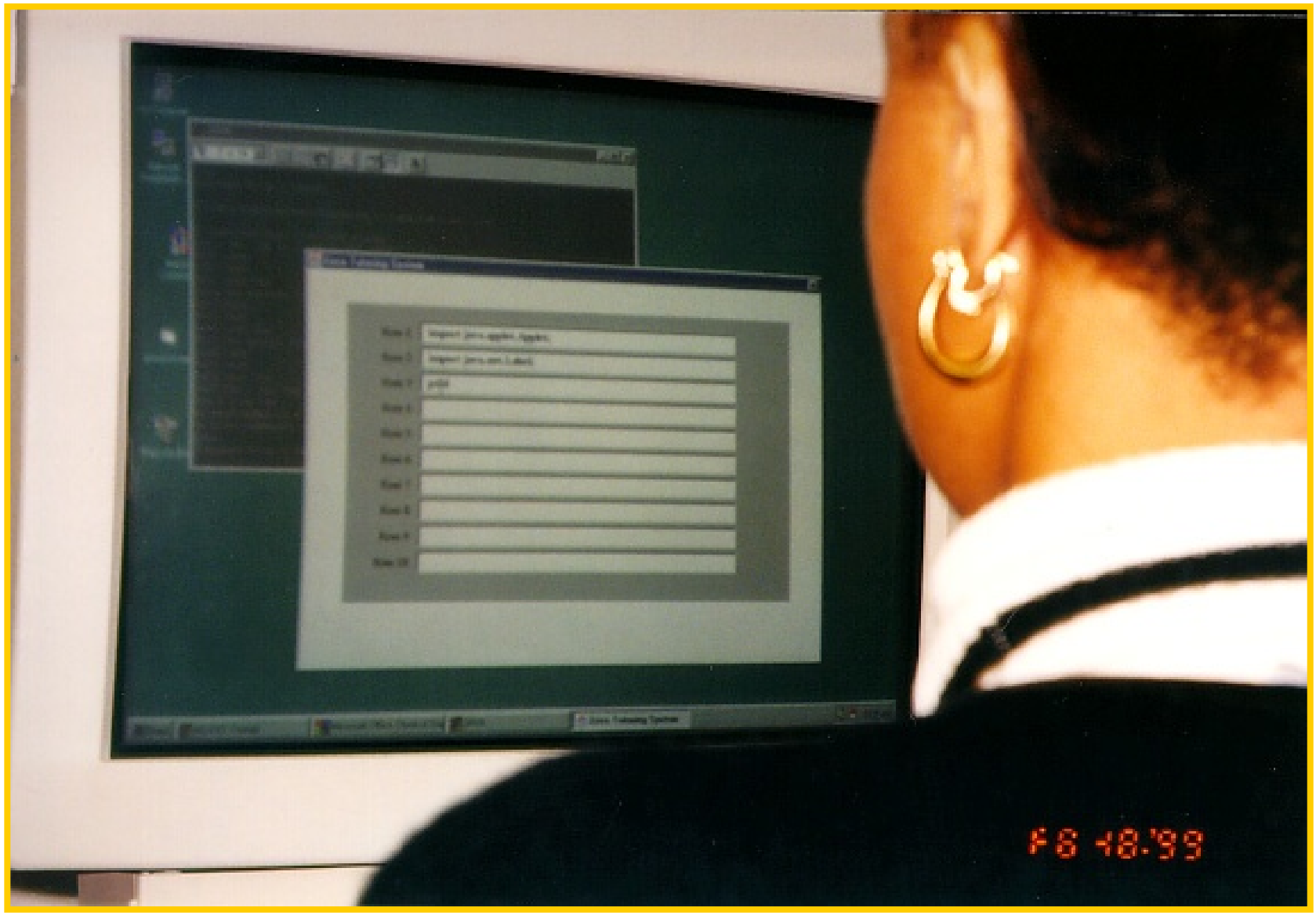
Learning Outcome



Learning Outcome



At Work...



How We Use the Tutor at UMBC

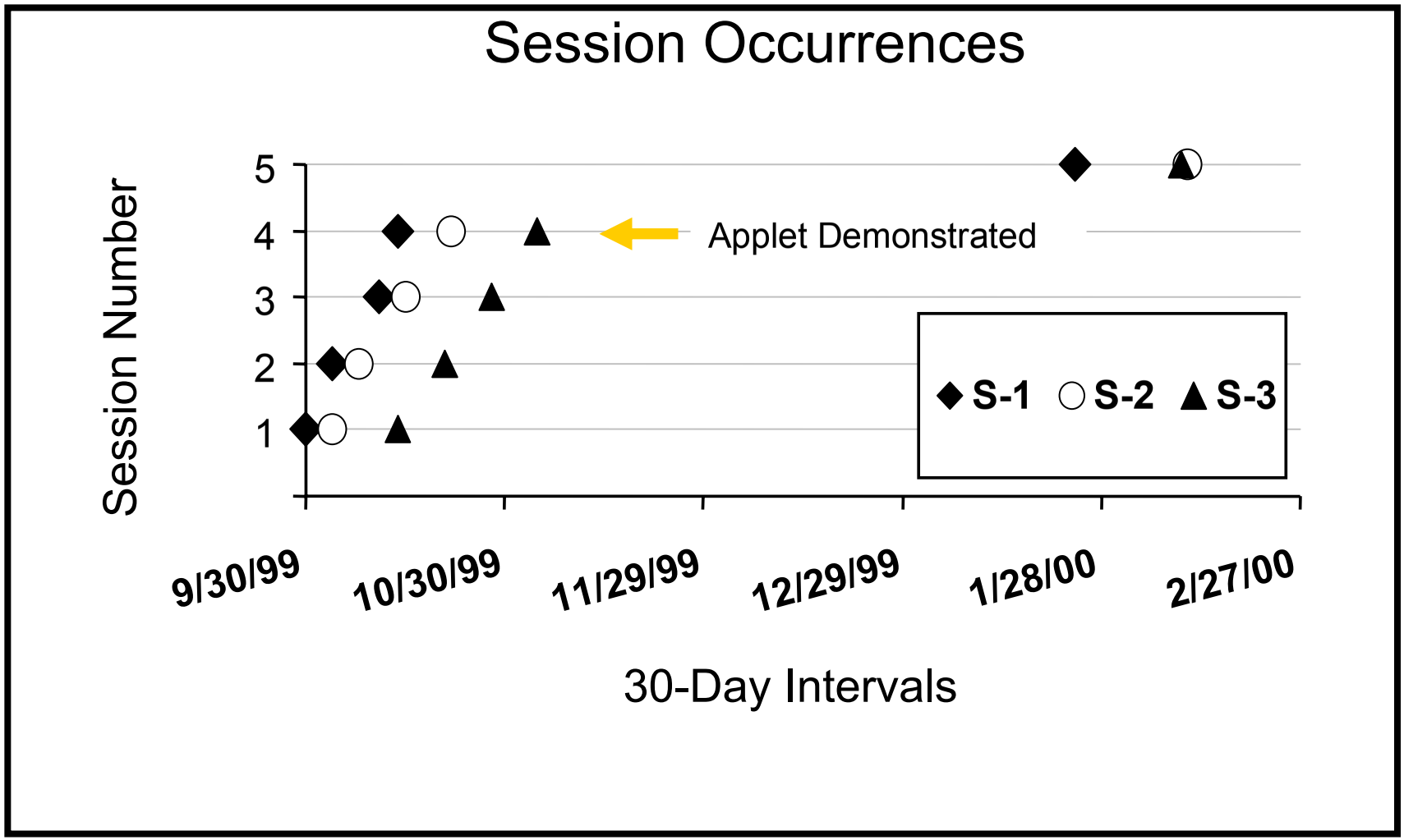
We use the tutor during the first laboratory session of a semester course in Java GUI systems.

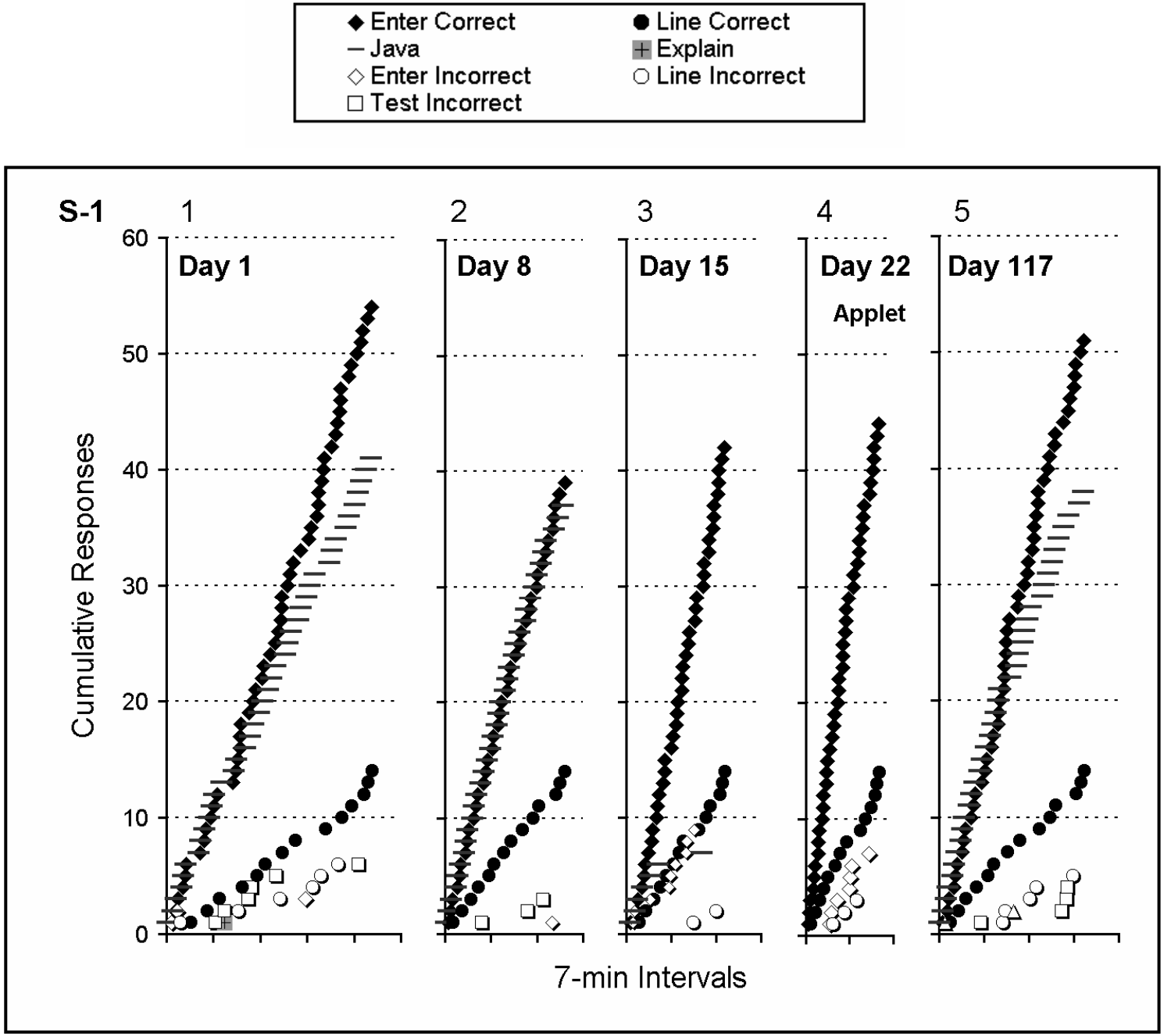
Collaboration with Peers

Performance Assessment

- Individual performance data
- Classroom surveys

Individual Performance




Enter Correct
Line Correct
Java
Explain
Enter Incorrect
Line Incorrect
Test Incorrect
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4
5
Day 1
Day 8
Day 15
Day 22
Applet
Day 117
Cumulative Responses
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10
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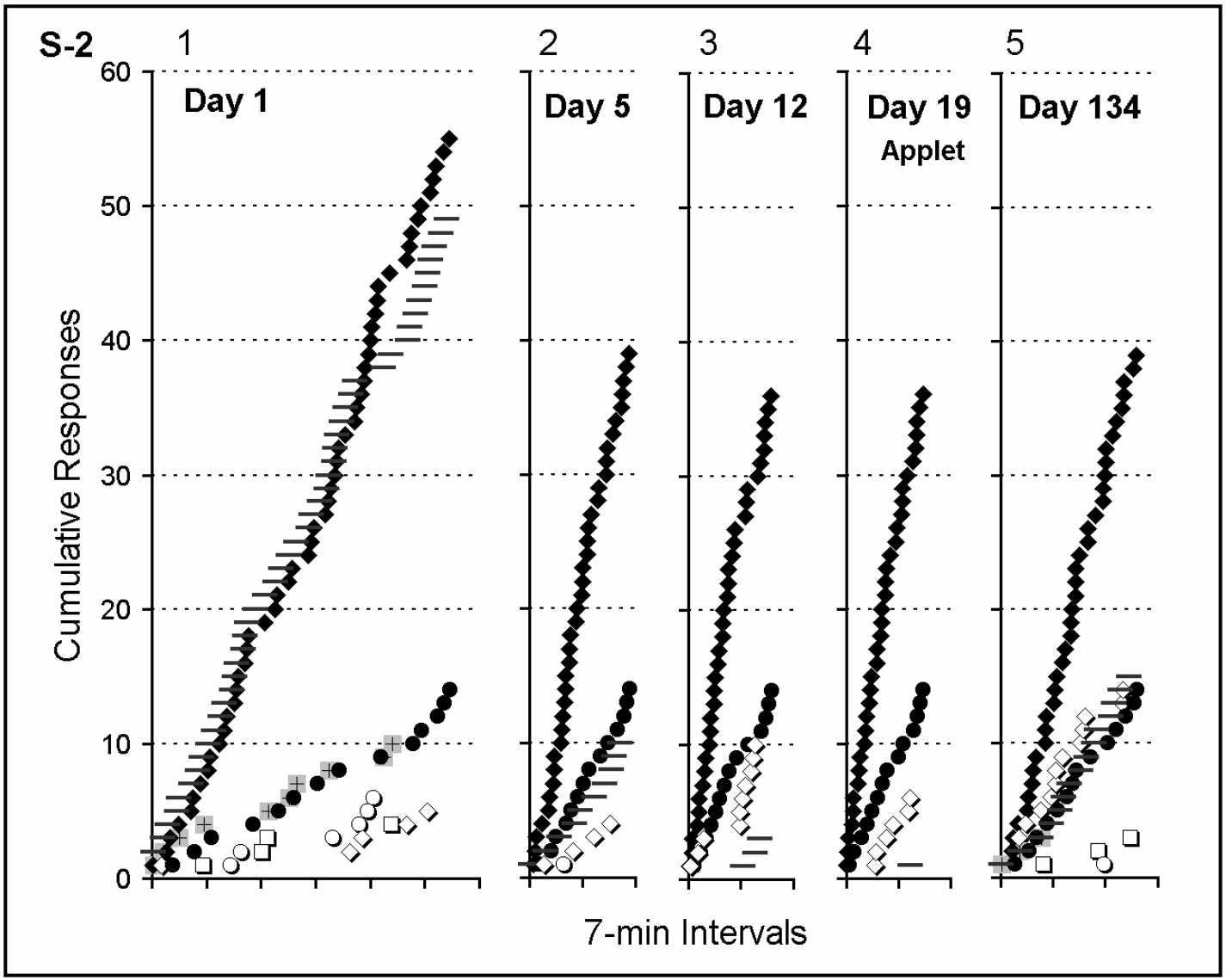
7-min Intervals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Java
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Day 12
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Applet
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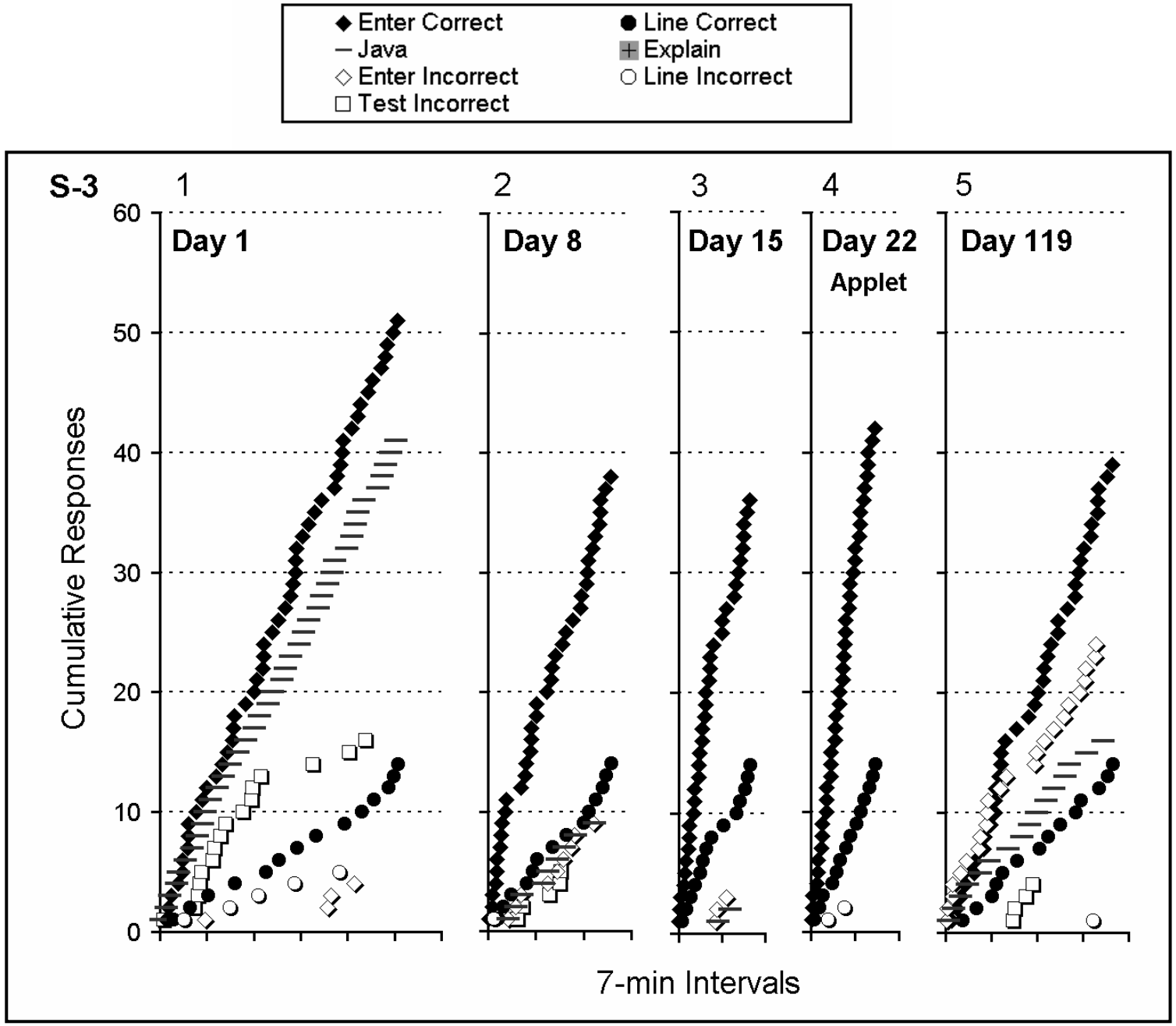
Cumulative Responses
7-min Intervals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Cumulative Responses
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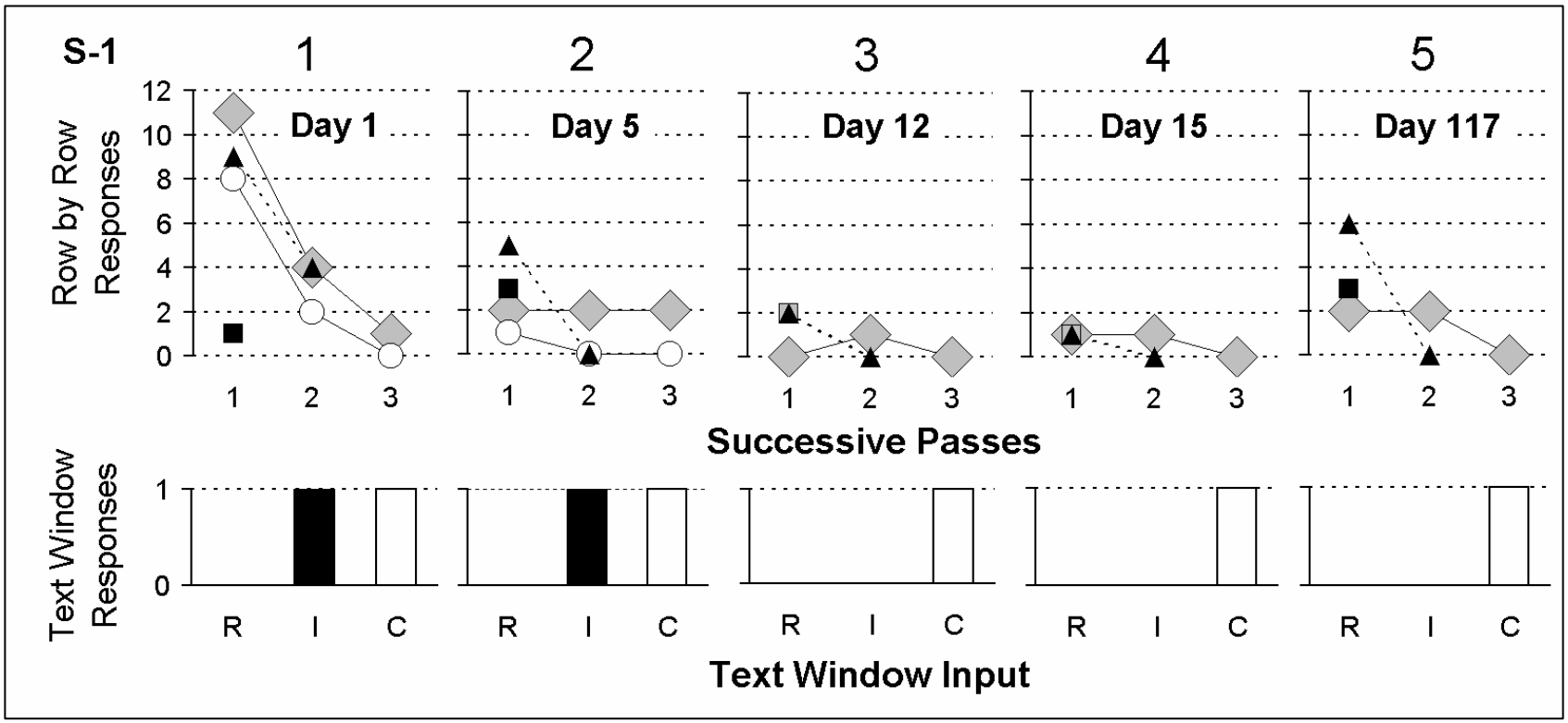
Errors
Test Incorrect
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Hint
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Day 1
Day 5
Day 12
Day 15
Day 117
Row by Row Responses
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Successive Passes
Text Window Responses
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I
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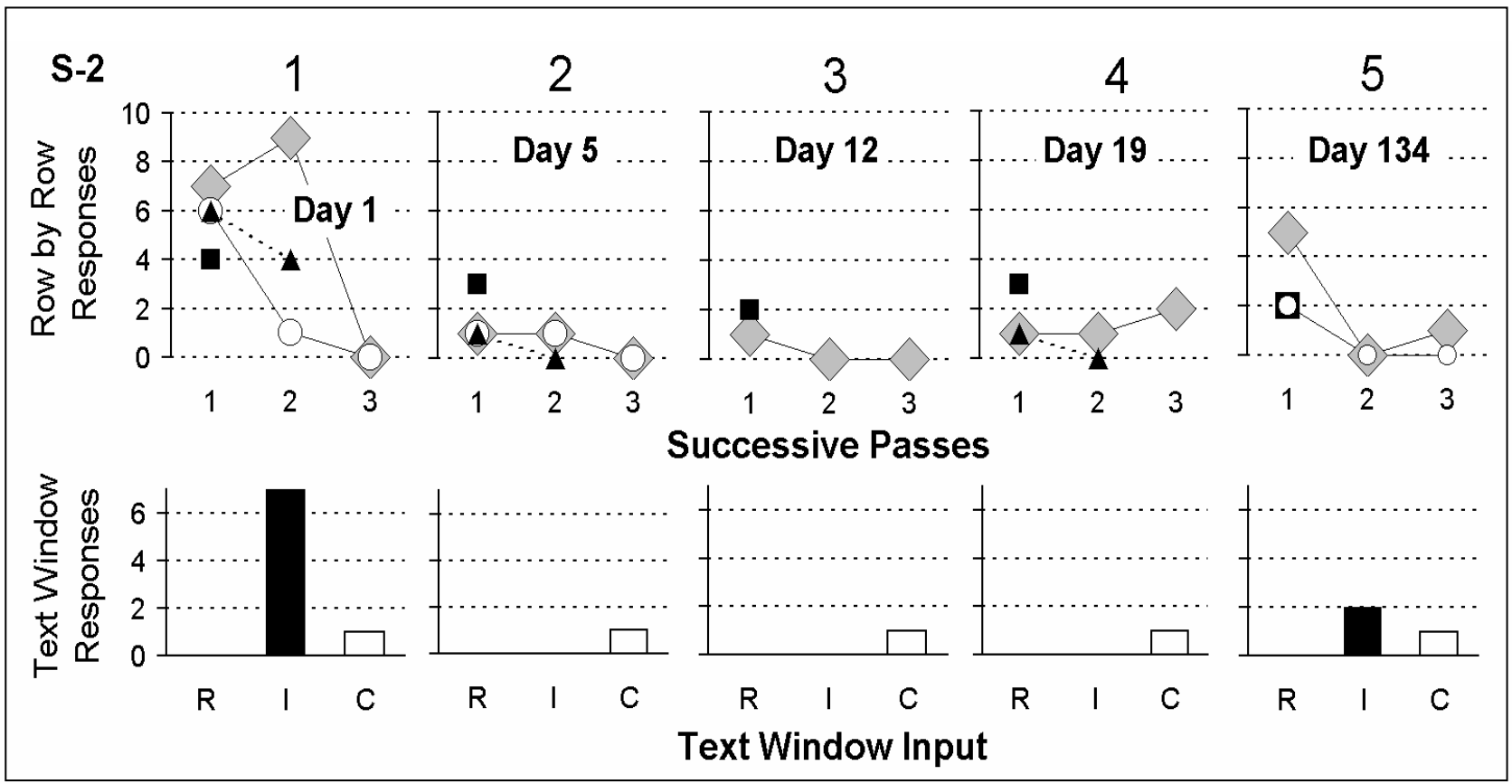
Text Window Input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Successive Passes
Text Window Responses
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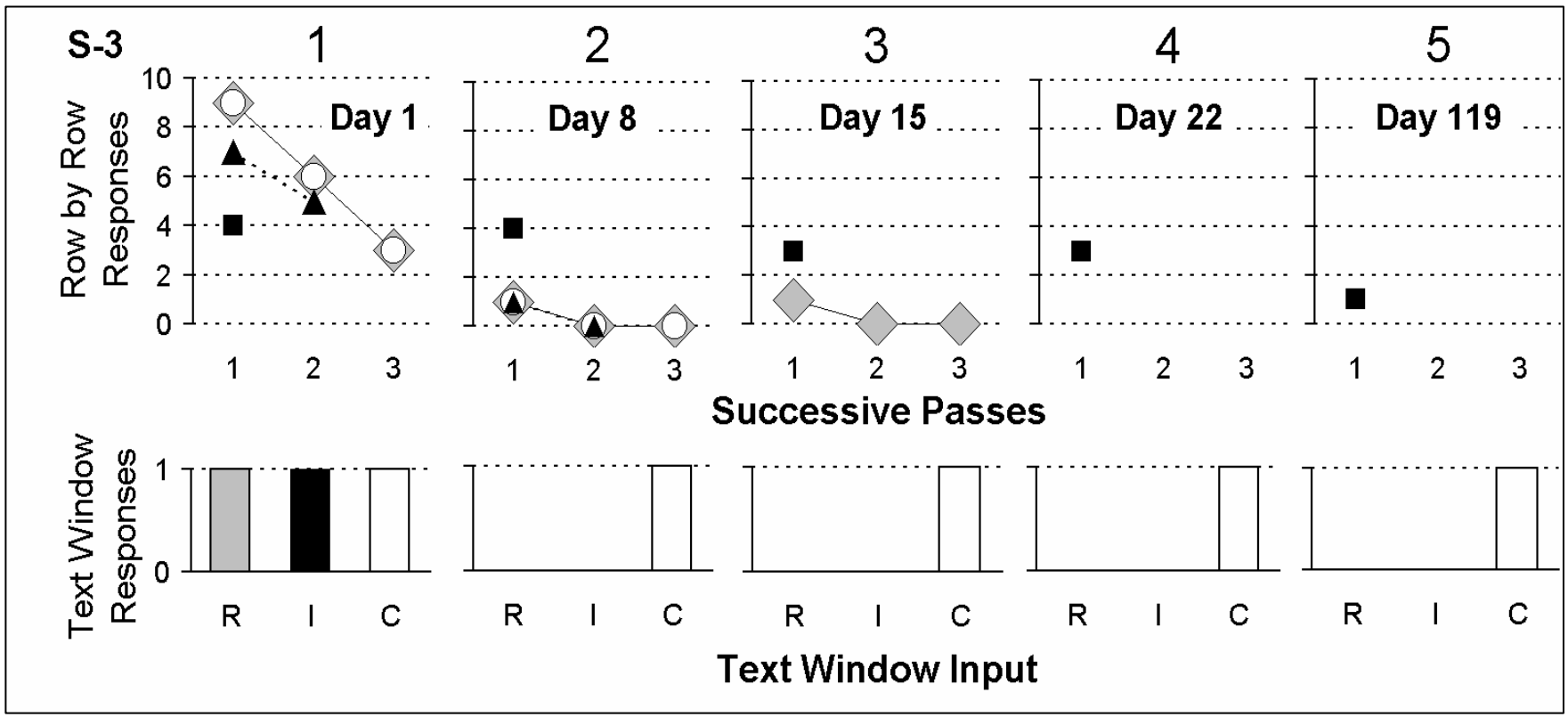
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Successive Passes
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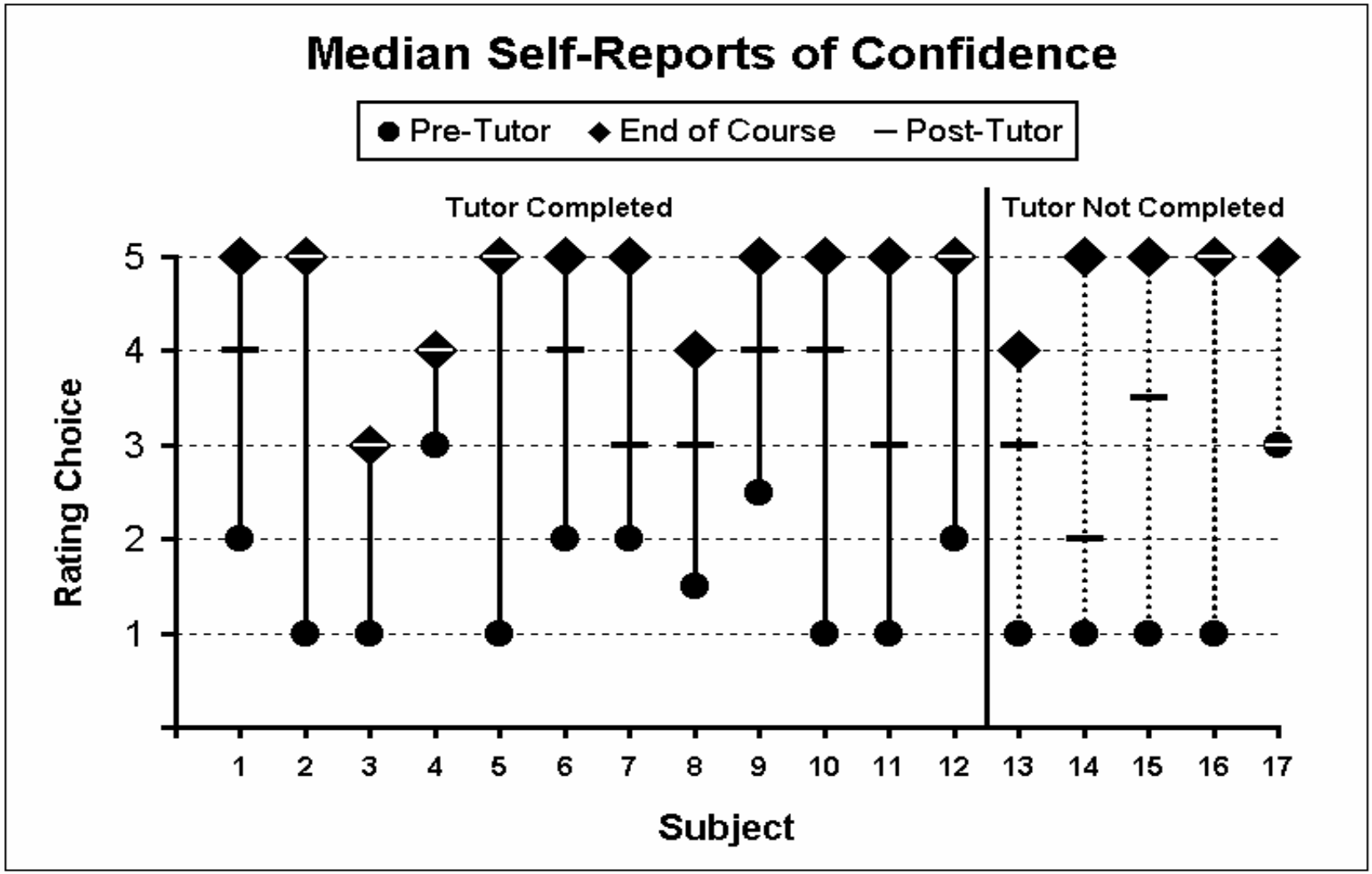
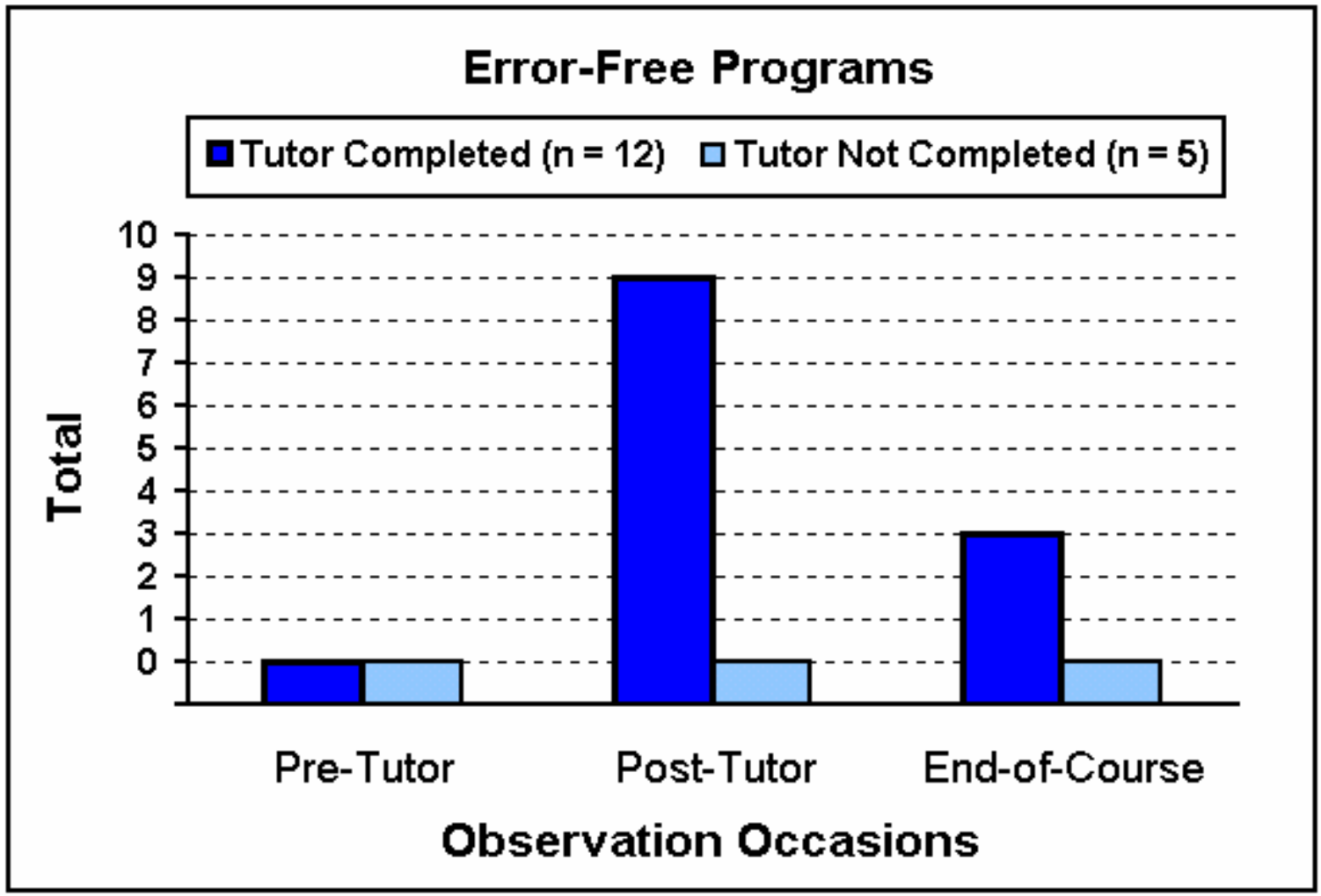
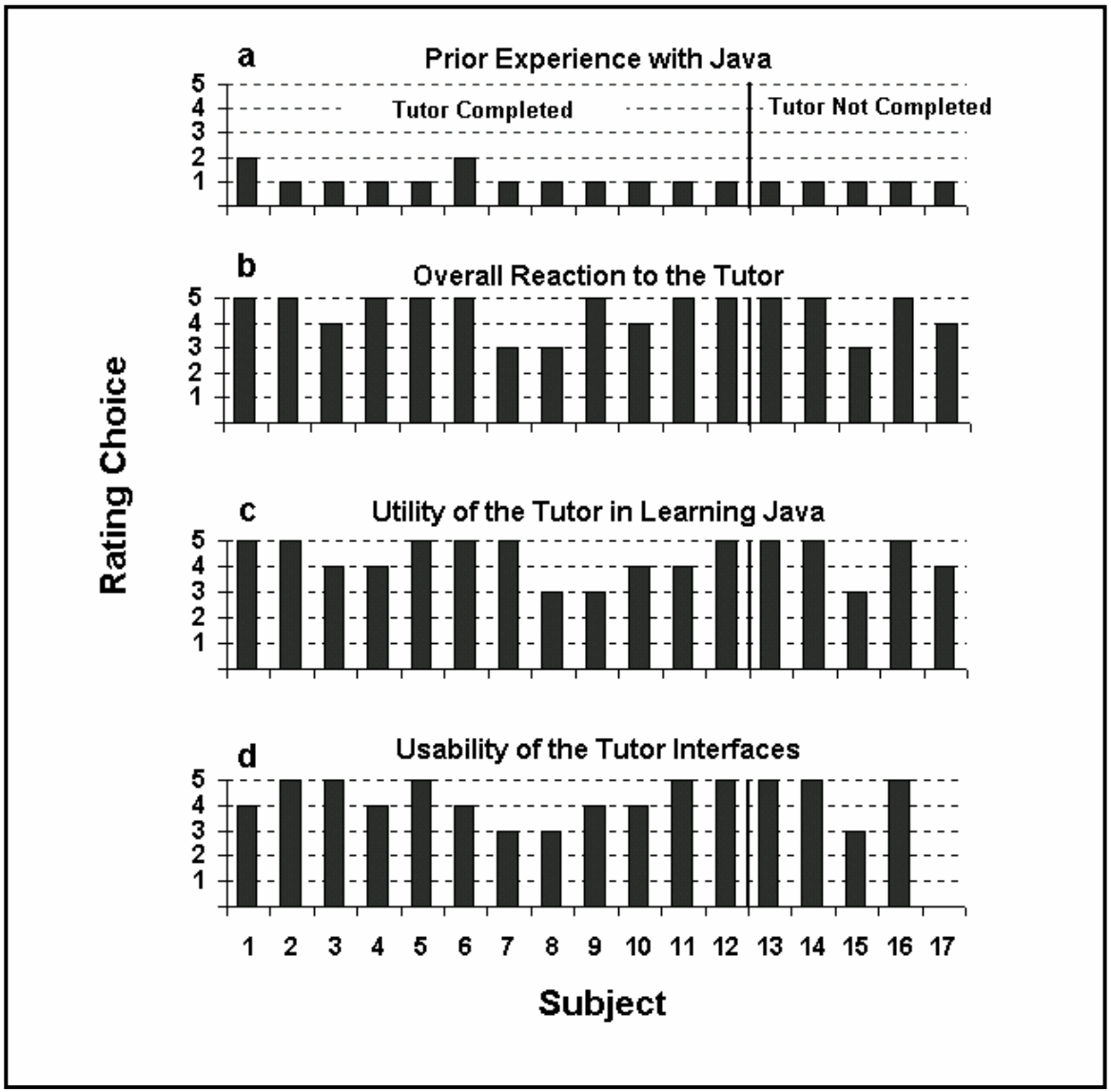
Classroom Survey: Summer 2000



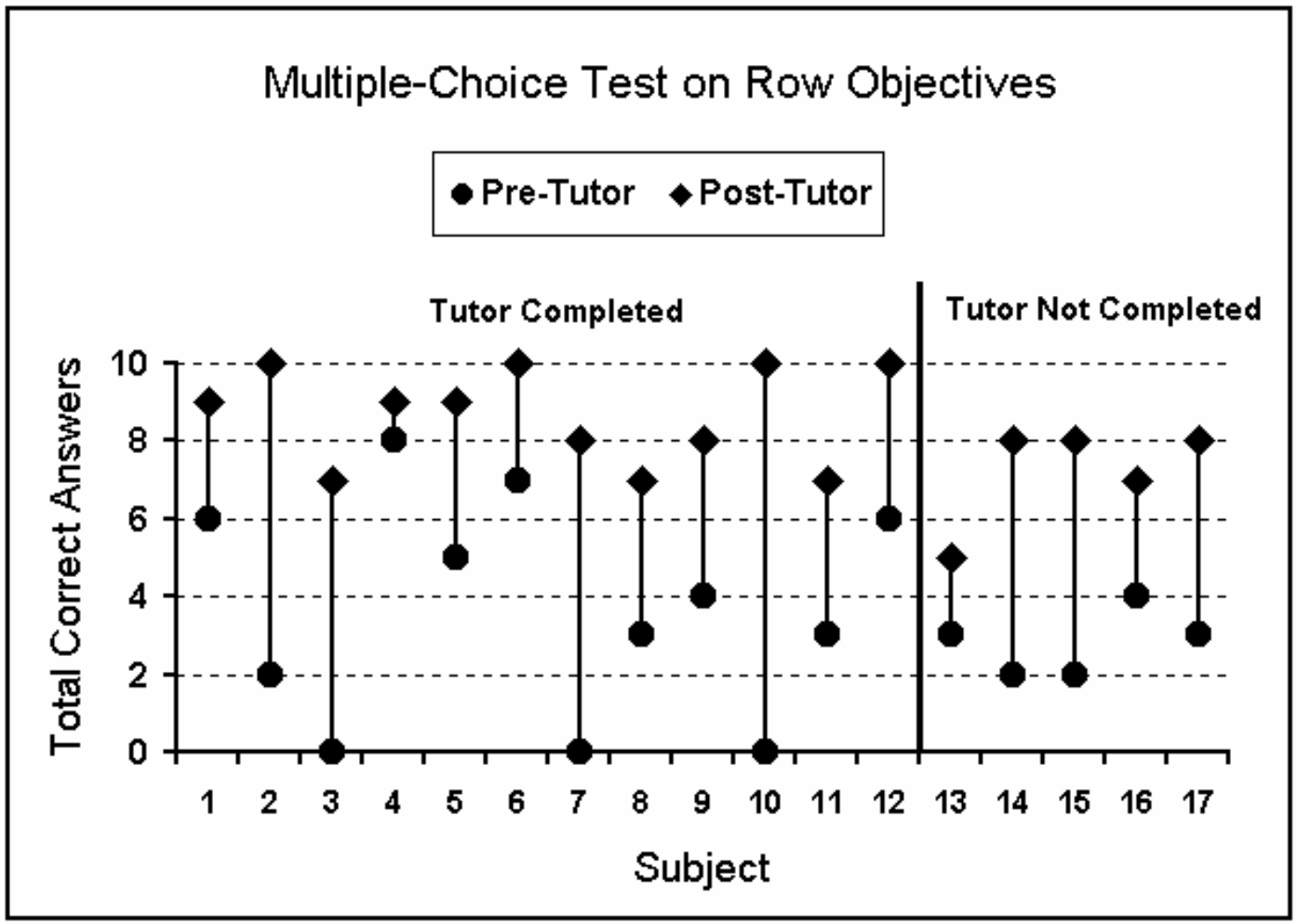
Classroom Survey: Summer 2000



Classroom Survey: Summer 2000



Classroom Survey: Summer 2000



Tutor Summary

- Generates and documents a history of symbol use
- Overrides individual differences
- Provides a sense of mastery to many students

Integrating Technology and Traditional Methods

- Keller's PSI
  - Unit perfection
  - Self-paced progression
  - Emphasis on written word
  - Repeated testing
  - Collaboration with peers
  - Collaboration with experts
  - Independent learning

Technology Advantages

- Learners like it.
  - Easy to access.
  - Removes some arbitrary constraints such as the time of a class.
  - Creates a virtual learning community that is continuous, not limited by time and distance constraints.

Technology Disadvantages

- Course preparation and maintenance
  - Requires content mastery
  - Requires mastery of delivery systems
  - Labor intensive
- Both students and teachers must have access to adequate hardware and software to accomplish pedagogical objectives.

Summary and Conclusions

- Information technology can do wonders for delivery of instructional systems, but students must still make an intense effort to learn. (*Correct...*) ***Practice makes perfect...***