Performance on a Web-Based Tutoring System for Java Training

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Objective

```
1.  import java.applet.Applet;
2.  import java.awt.Label;
3.  public class MyProgram extends Applet {
4.  Label myLabel;
5.  public void init() {
6.  myLabel=new Label("This is my first program.");
7.  add(myLabel);
8.  myLabel.setVisible(true);
9.  }
10. }
```

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Challenges

- ***Student Motivation***
  - Information Systems students are less keen to study computer programming than are computer science students.
- ***Student Preparation***
  - Information Systems students are less prepared to study computer programming than are computer science students.

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Our Values

- ***Rote memorization*** is fundamental to the acquisition of skills that set the occasion for "understanding."
  - Constructivism comes later.
- ***Disciplined study behavior*** is essential to acquire skill, and many, if not most students, do not know how to study.
- ***Repetition*** and overlearning are essential to the learning process.
- ***Feeling good about yourself*** after hard work sustains enthusiasm for learning.

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"Regurgitation" and Beyond...

- ***Regurgitation is Good***
  - Mindful, intentional, informed, purposeful, and accurate regurgitation.
- ***General Rules***
  - Within the context of the interactive tutor, **frames of information** about general syntax and semantics are presented.
  - **Multiple-choice tests** based on these frames are embedded throughout the tutor.

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How it all started (circa 1987)

```
1.      program circle
2.            real r, area
3.     c   This program reads a real number r and prints
4.     c    the area of a circle with radius r.
5.            write (*,*) 'Enter the radius r = '
6.            read (*,*) r
7.            area = 3.14159*r*r
8.            write (*,*) 'Area = ', area
9.            stop
10.           end
```

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What I used to do:

- ***Lecture***
  - Write the code on the blackboard and explain it.
- ***Exhort***
  - Tell the students to learn a program for a test.
- ***Observe***
  - Individual differences in test performance.
- ***Neglect***
  - I did not teach students how to learn.

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Enlightened Approach

```
1.  import java.applet.Applet;
2.  import java.awt.Label;
3.  public class MyProgram extends Applet{
4.  Label myLabel;
5.  public void init(){
6.  myLabel=new Label("This is my first program.");
7.  add(myLabel);
8.  myLabel.setVisible(true);
9.  }
10. }
```

- Programmed instruction
- Personalized System of Instruction
- Successive approximations to mastery

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Programmed Instruction

- A set of ***structured interactions*** between a learner and the material to be mastered.
- Structures study behavior that is focused on the ***individual learner***.
- Manages the ***moment-by-moment interactions*** between a learner and a tutor.
- ***Step-wise progression*** from elementary knowledge units or facts to the achievement of a complex repertoire that is the objective of learning.

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Instructional Tactic

- Keller (1968): ***Personalized System of Instruction***
  - Unit Perfection
  - Self-paced progression
  - Focus on written word to communicate information
  - Repeated testing of concepts
  - Collaboration with peers and experts

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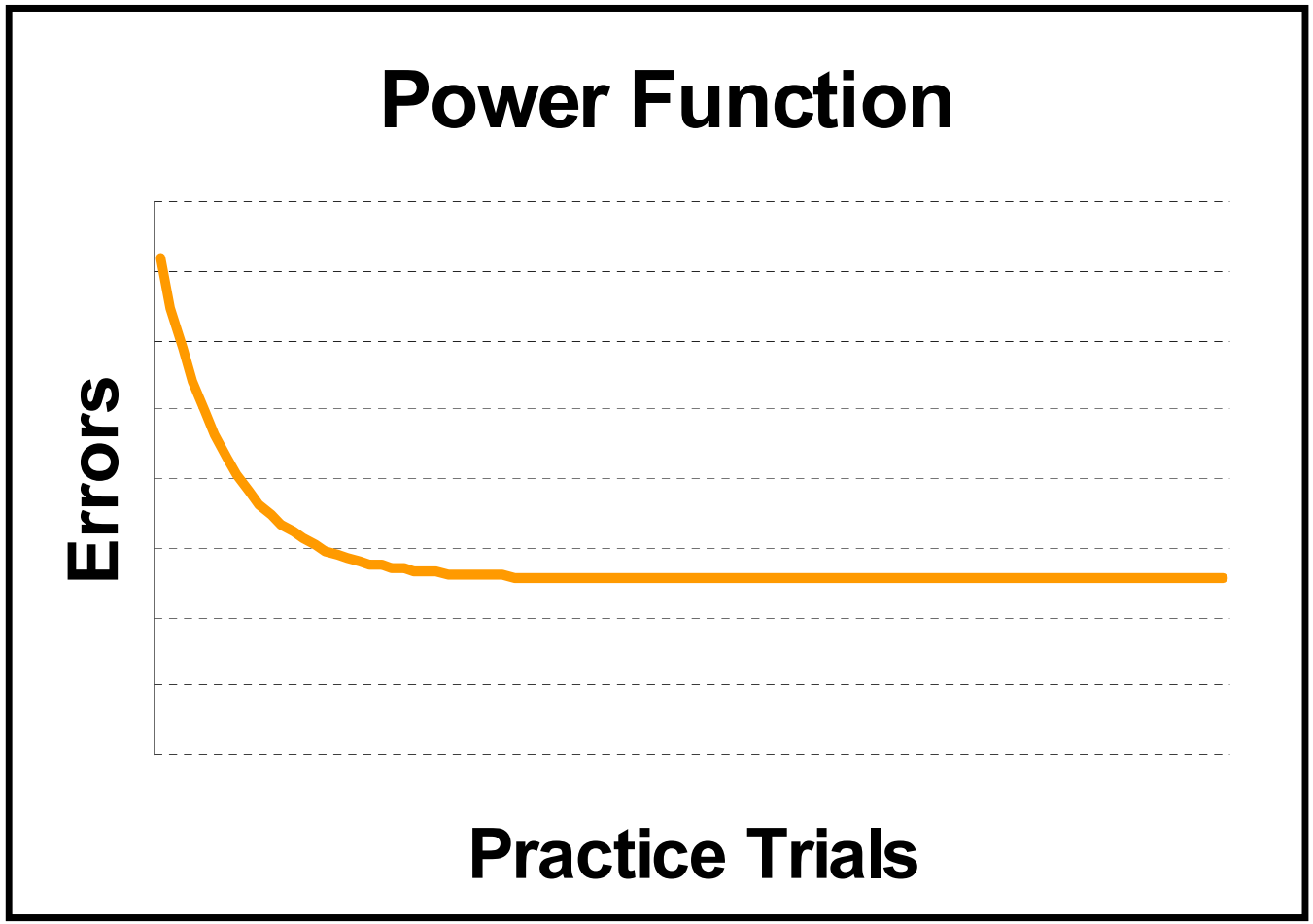
Acquisition Curve



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Spring 2002 Course Sections

- **Undergraduate class**
  - **13 F (median age = 22)**
  - **10 M (median age = 22)**
- **Graduate class**
  - **14 F (median age = 26)**
  - **9 M (median age = 28)**
- **Constraints**
  - Students rather than "subjects"
  - Fixed 2.5-hr class duration
  - 14 classes in the semester
  - Approach to the data

- **Class 1**
  - **Pre-tutor questionnaires**
    - **Java Experience**
    - **Confidence in Java**
  - **Run the tutor**
  - **Post-tutor questionnaires**
    - **Evaluate the tutor**
    - **Confidence in Java**
- **Class 2**
  - **Run the Applet**
- **Classes 3 – 14**
  - **Lectures, demonstrations, supervision**

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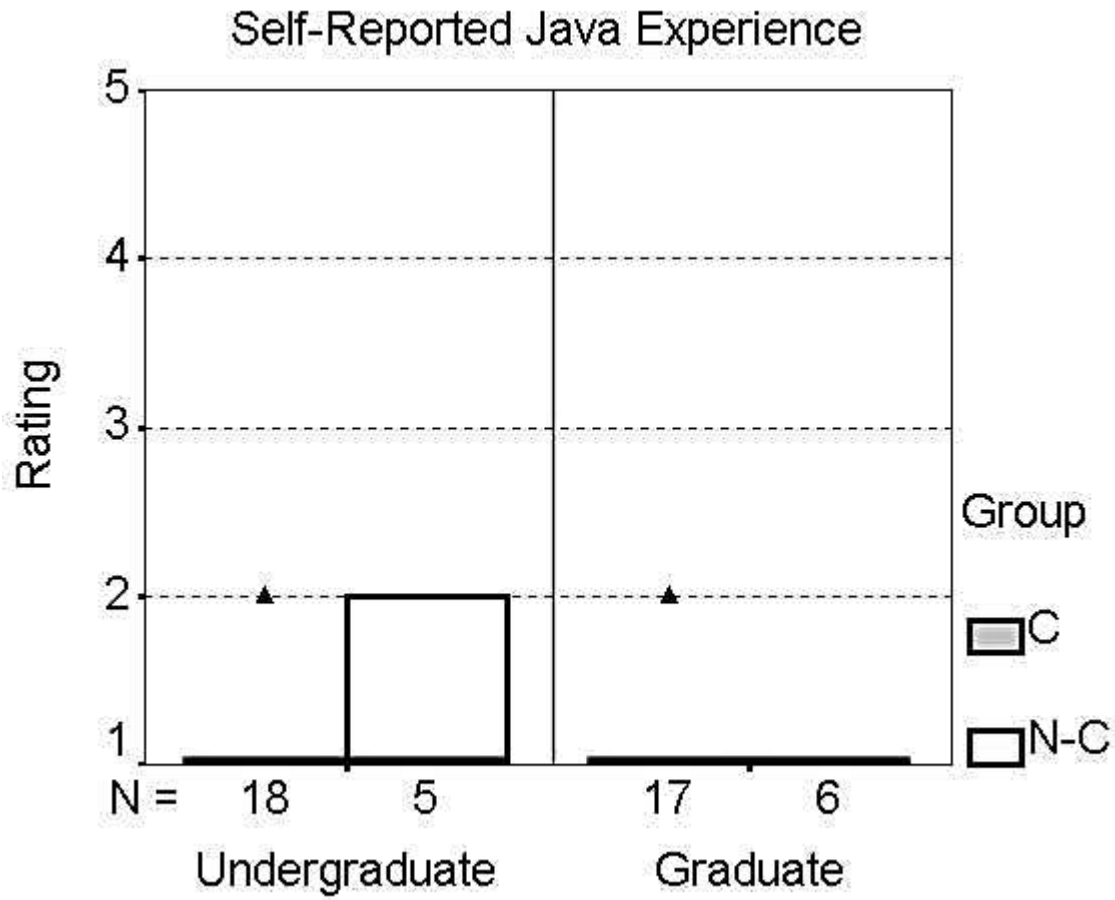
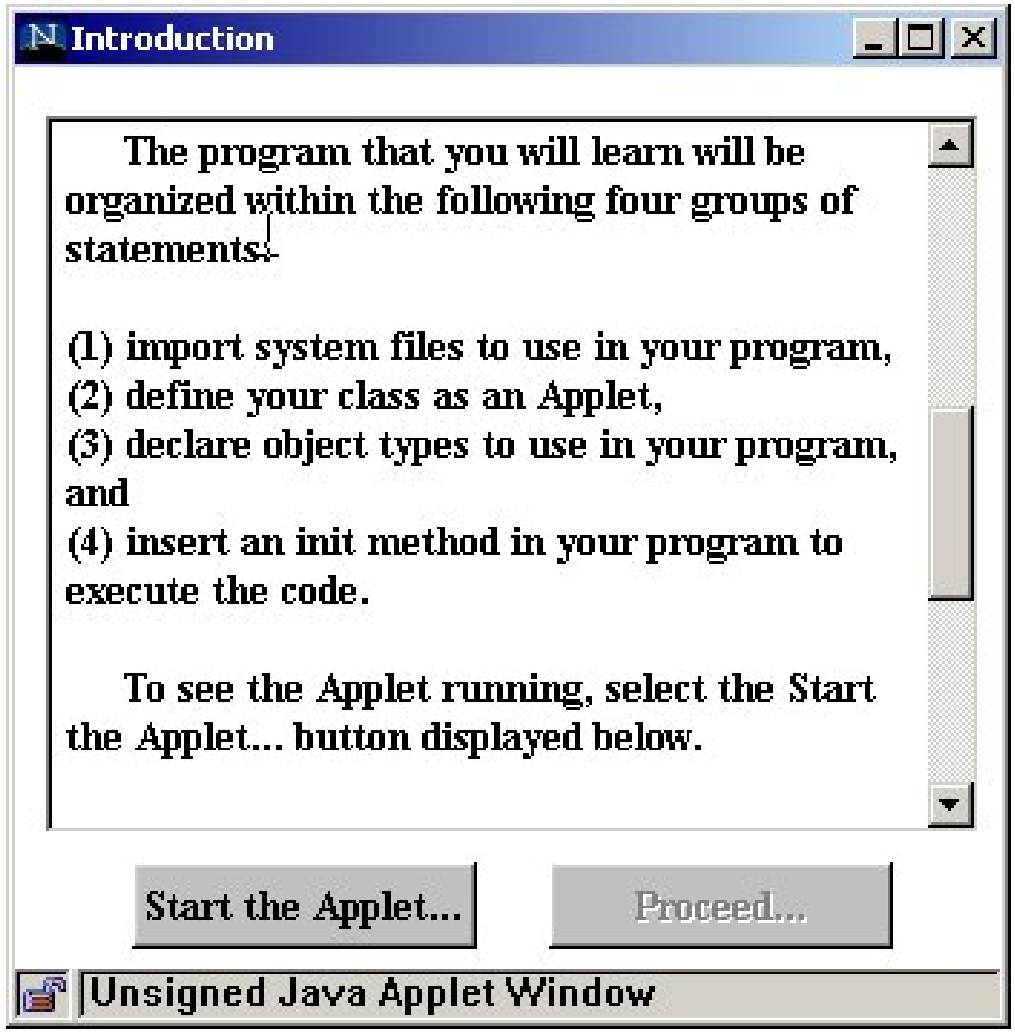
Prior Experience with Java



1 = No experience. (I am a novice in Java.)
5 = Extensive experience. (I am an expert in Java.)

Advanced Organizers



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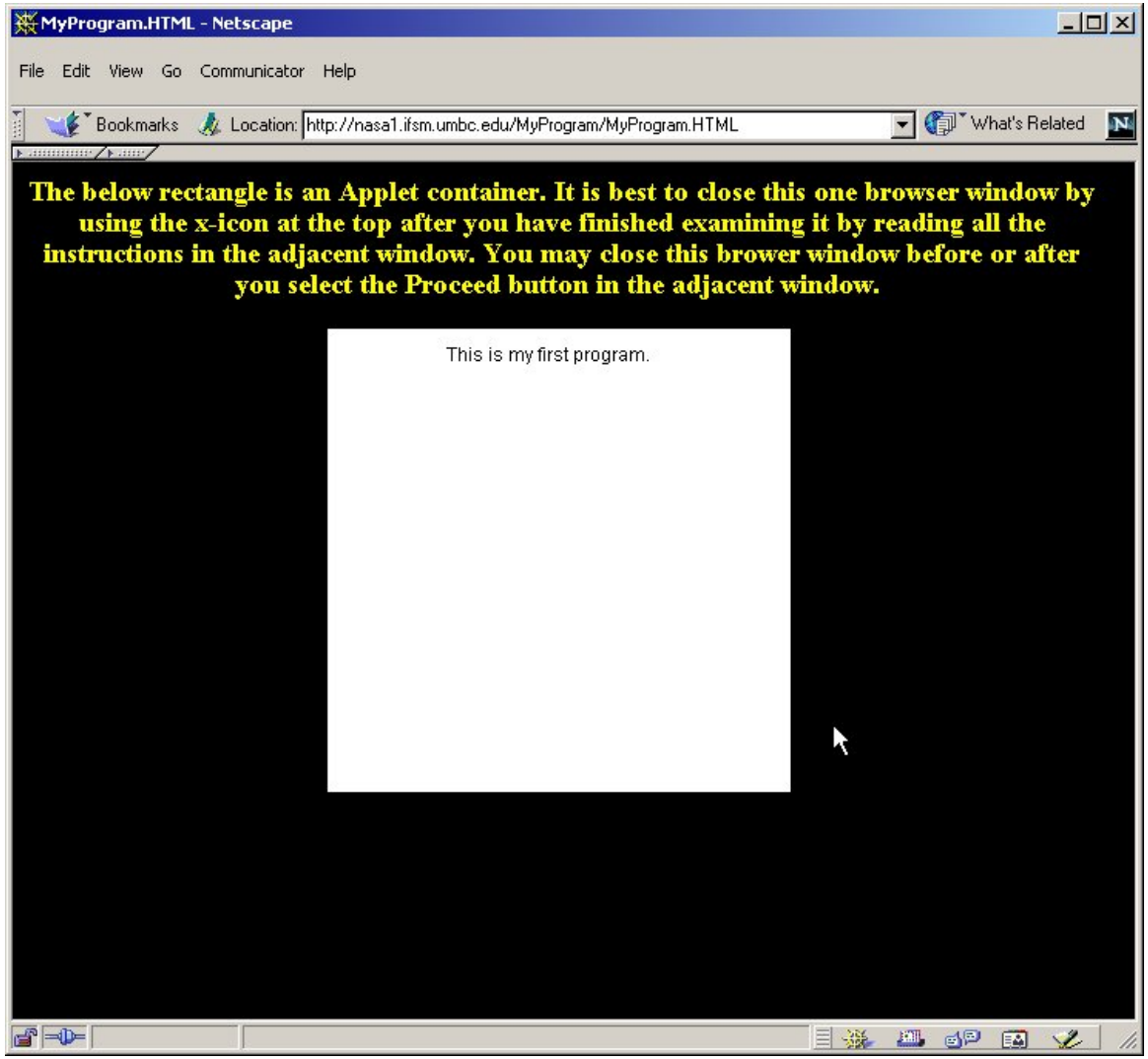
Run the Applet



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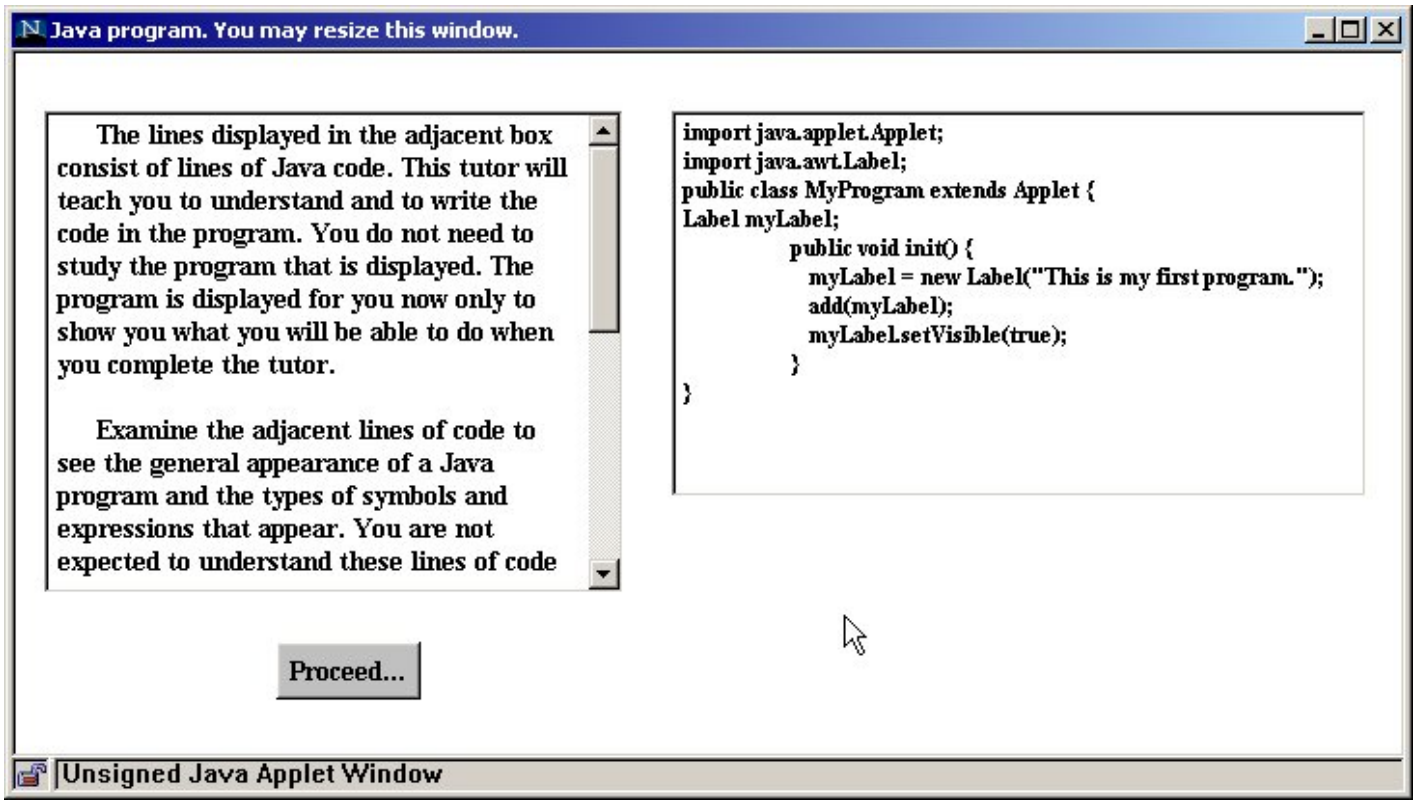
Program Overview



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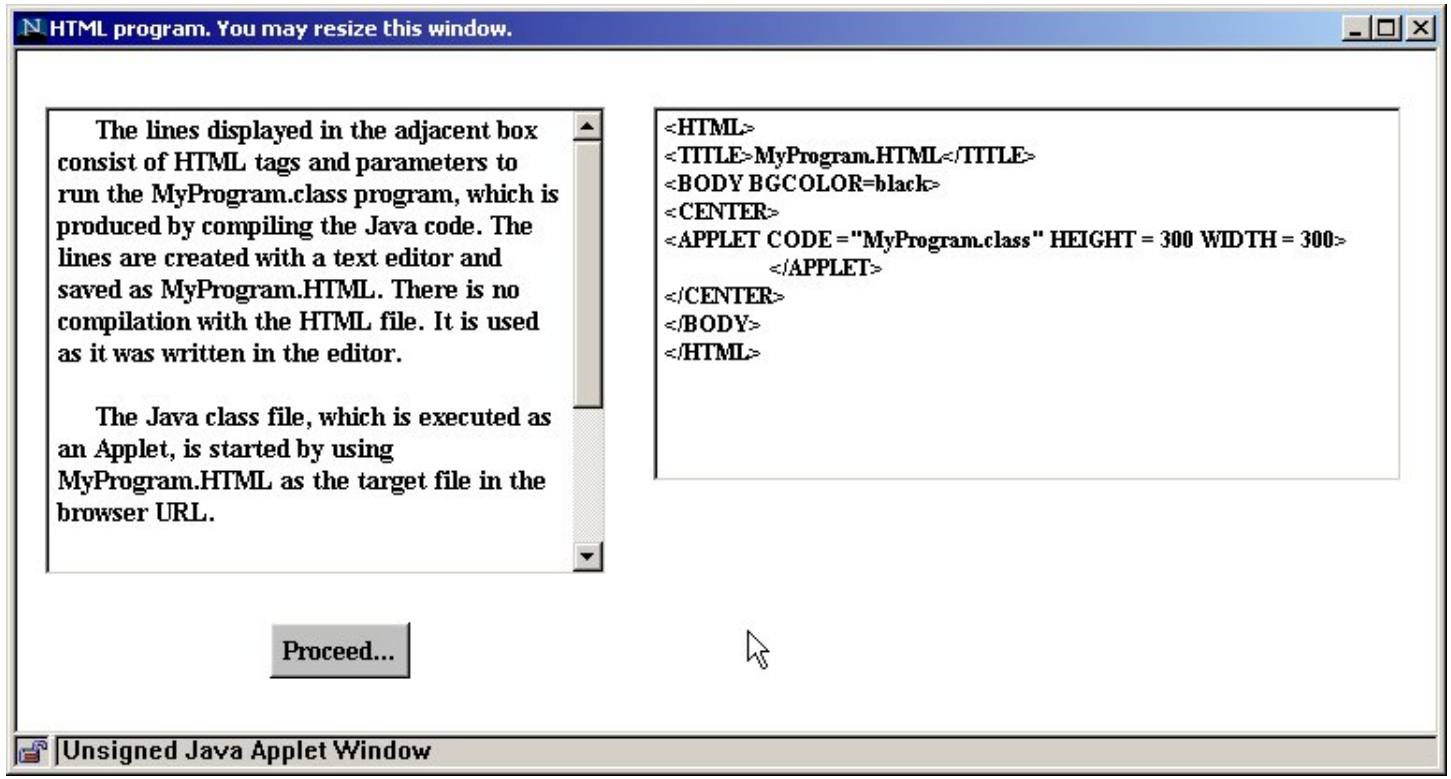
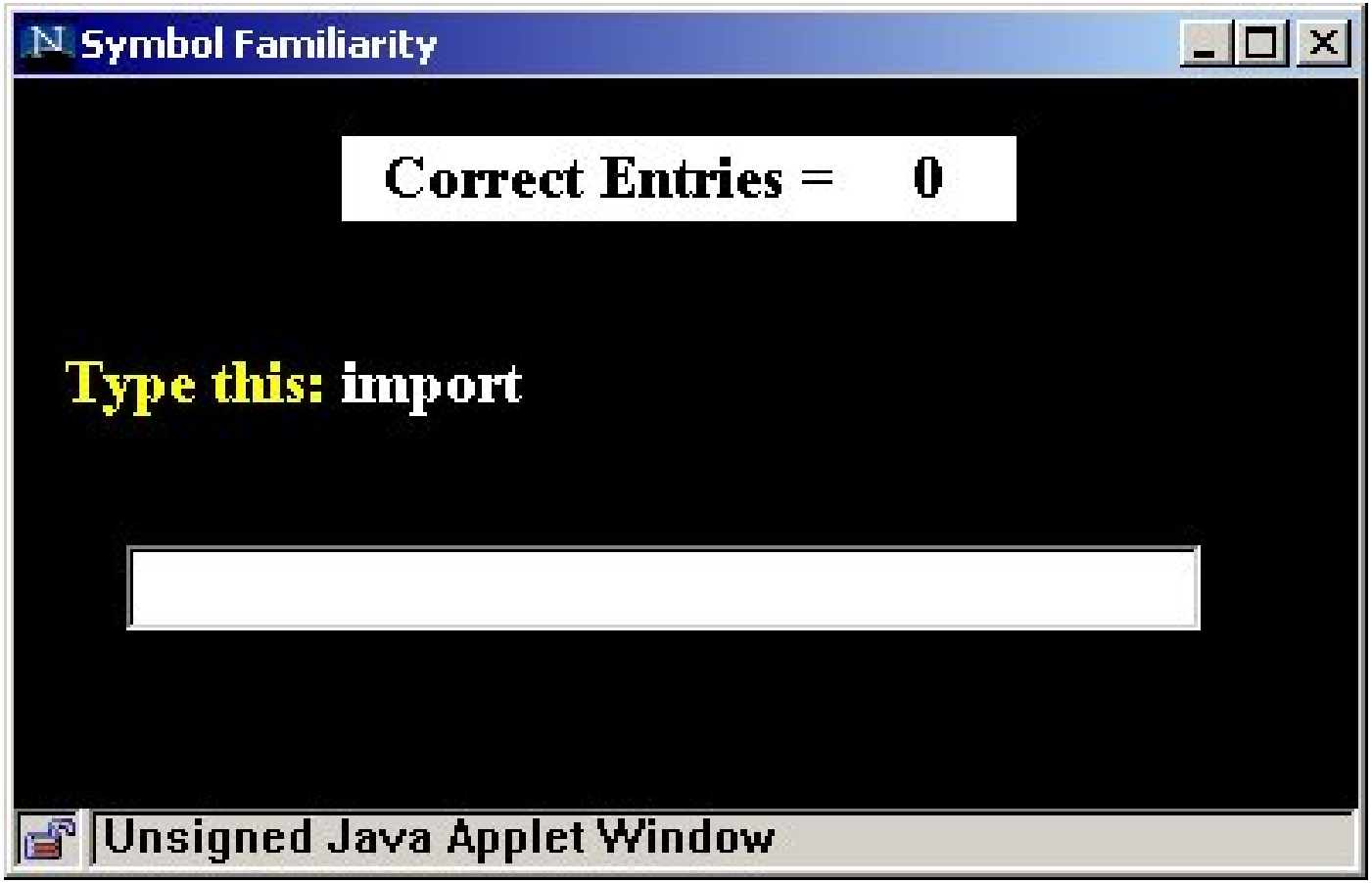
HTML Overview

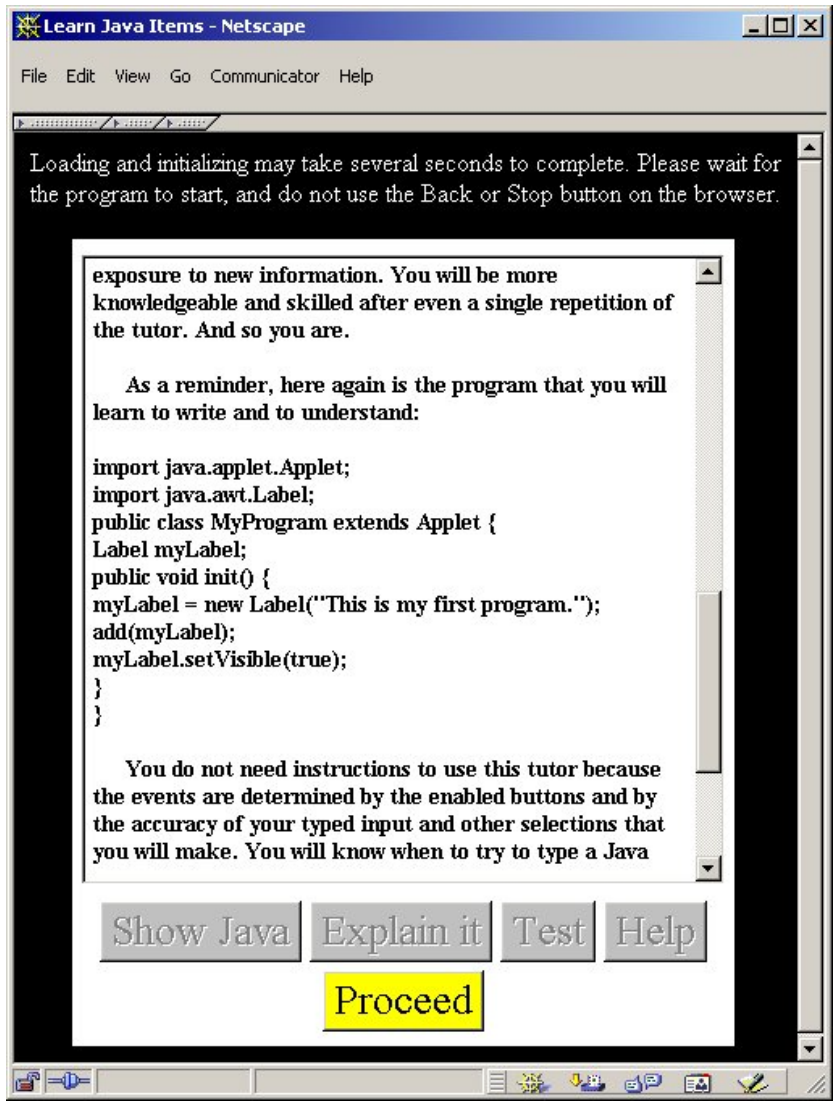


Item Familiarity



Item Identification

Item Learning



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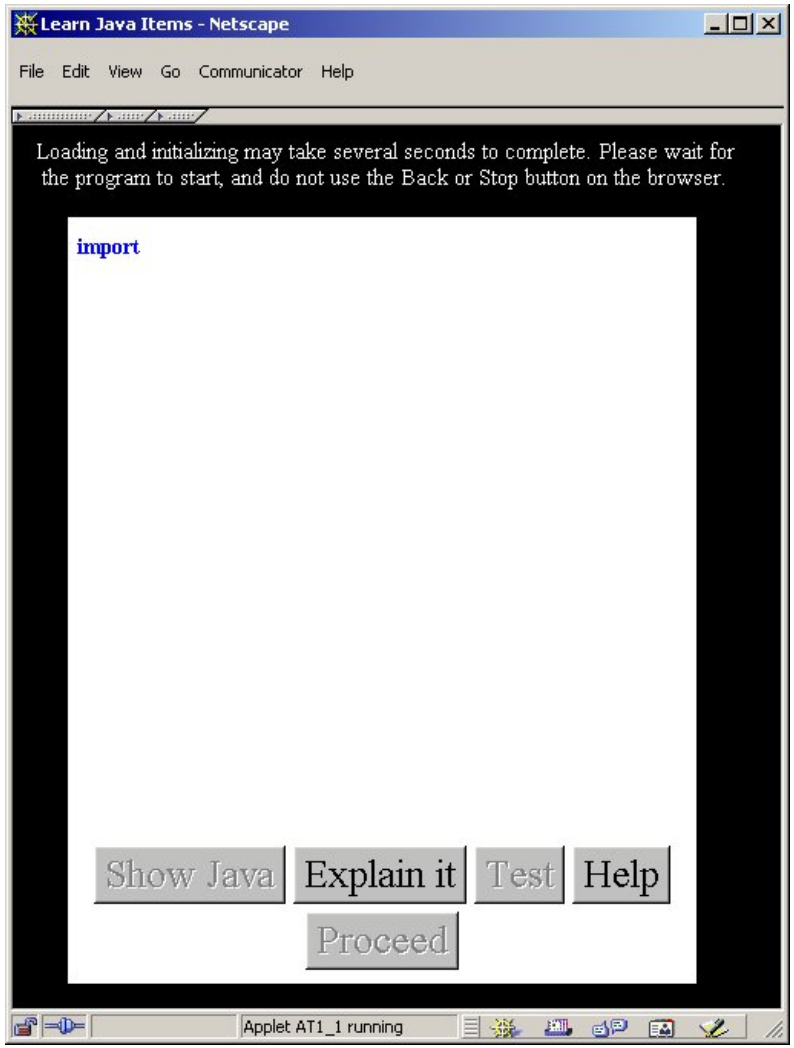
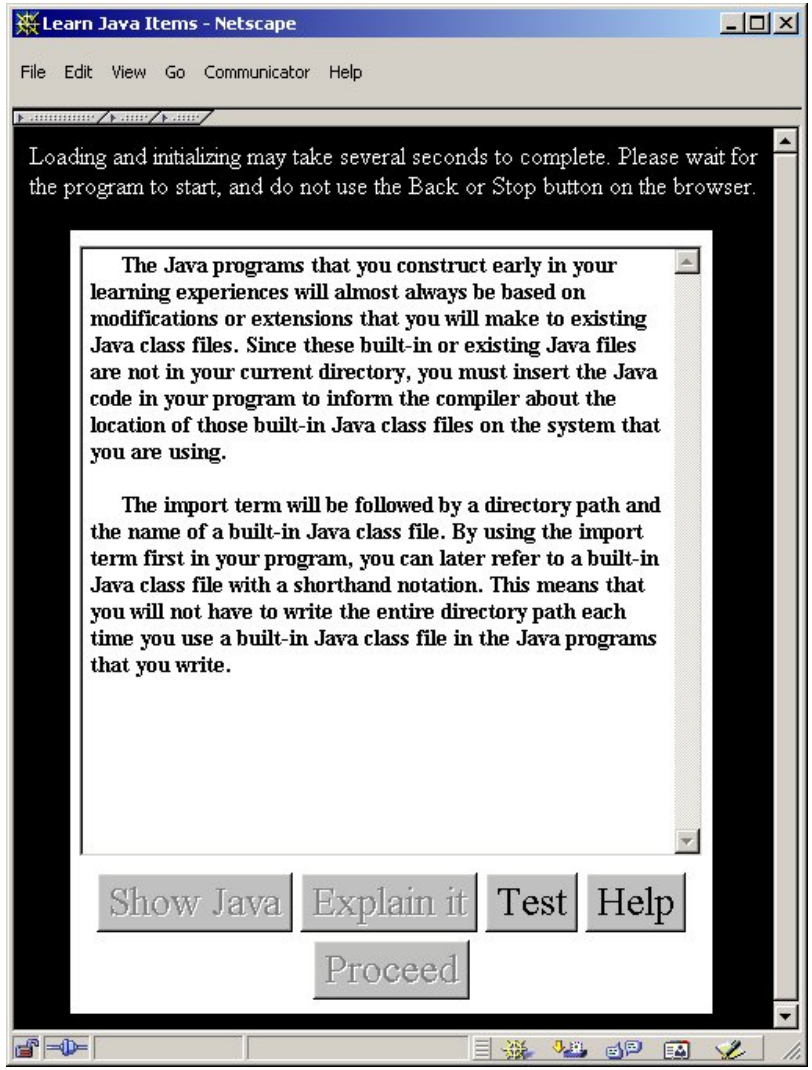
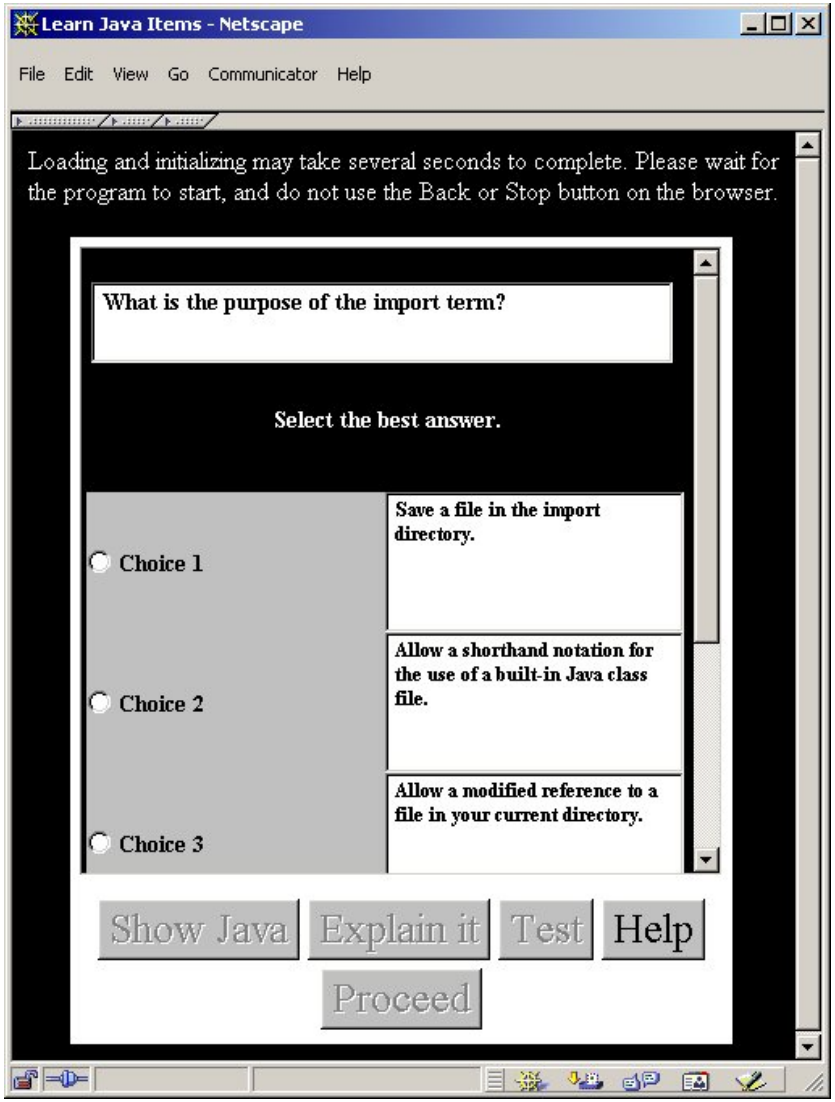
Observe the Item in Context



Read the Description (General Rules)



Multiple-Choice Test



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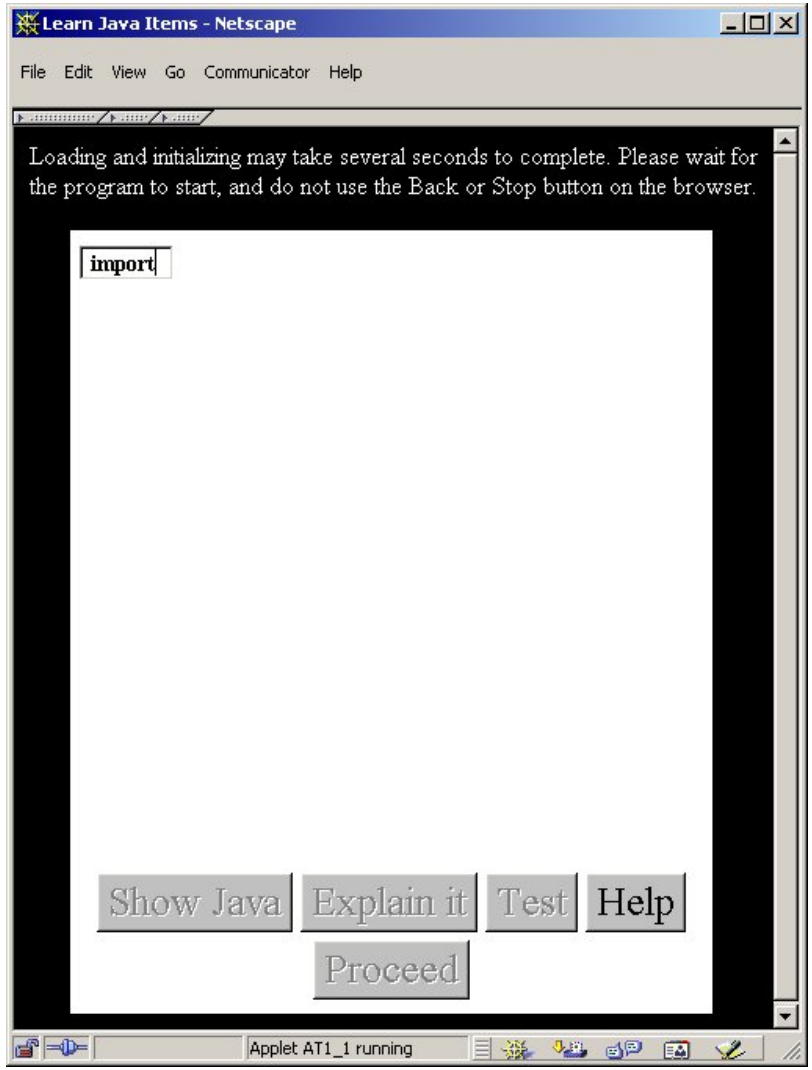
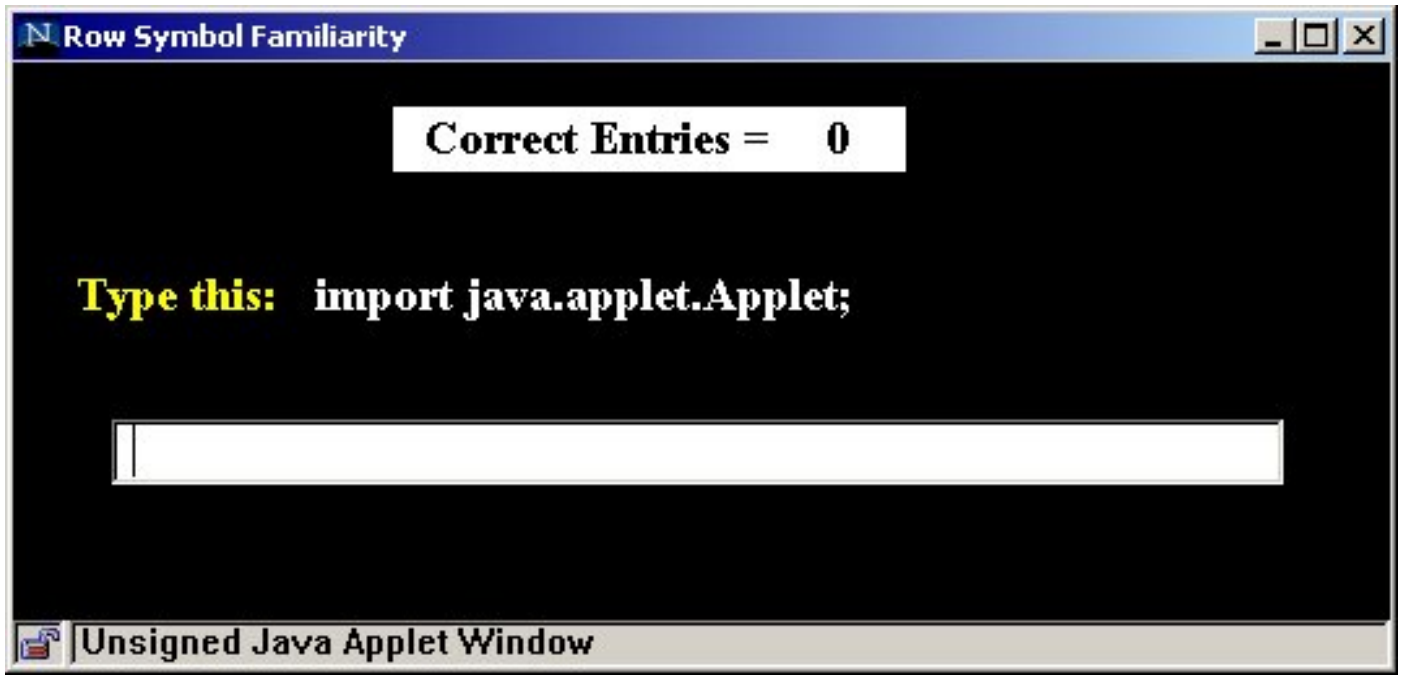
Input the Item from Recall

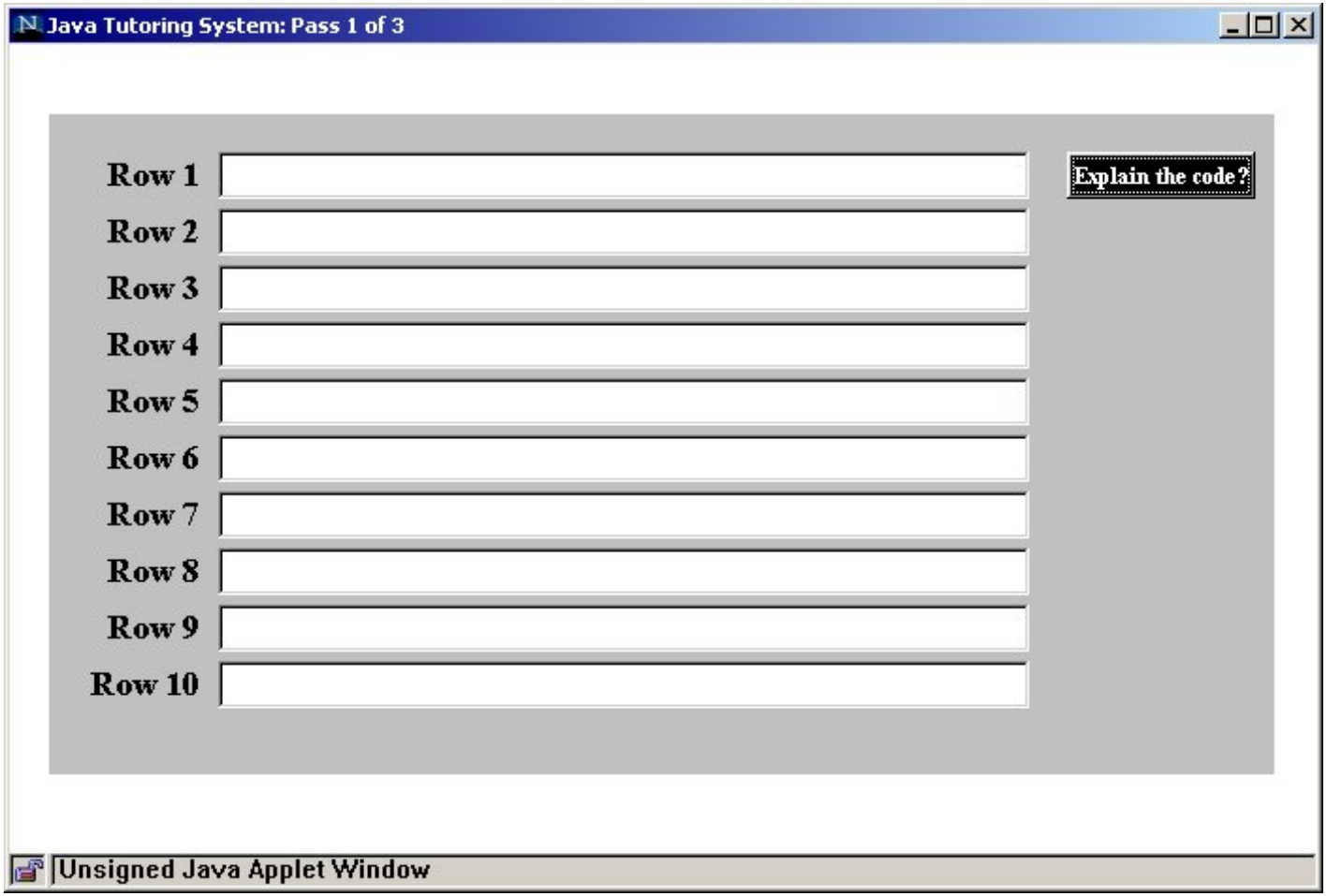


Row Familiarity



Row Identification

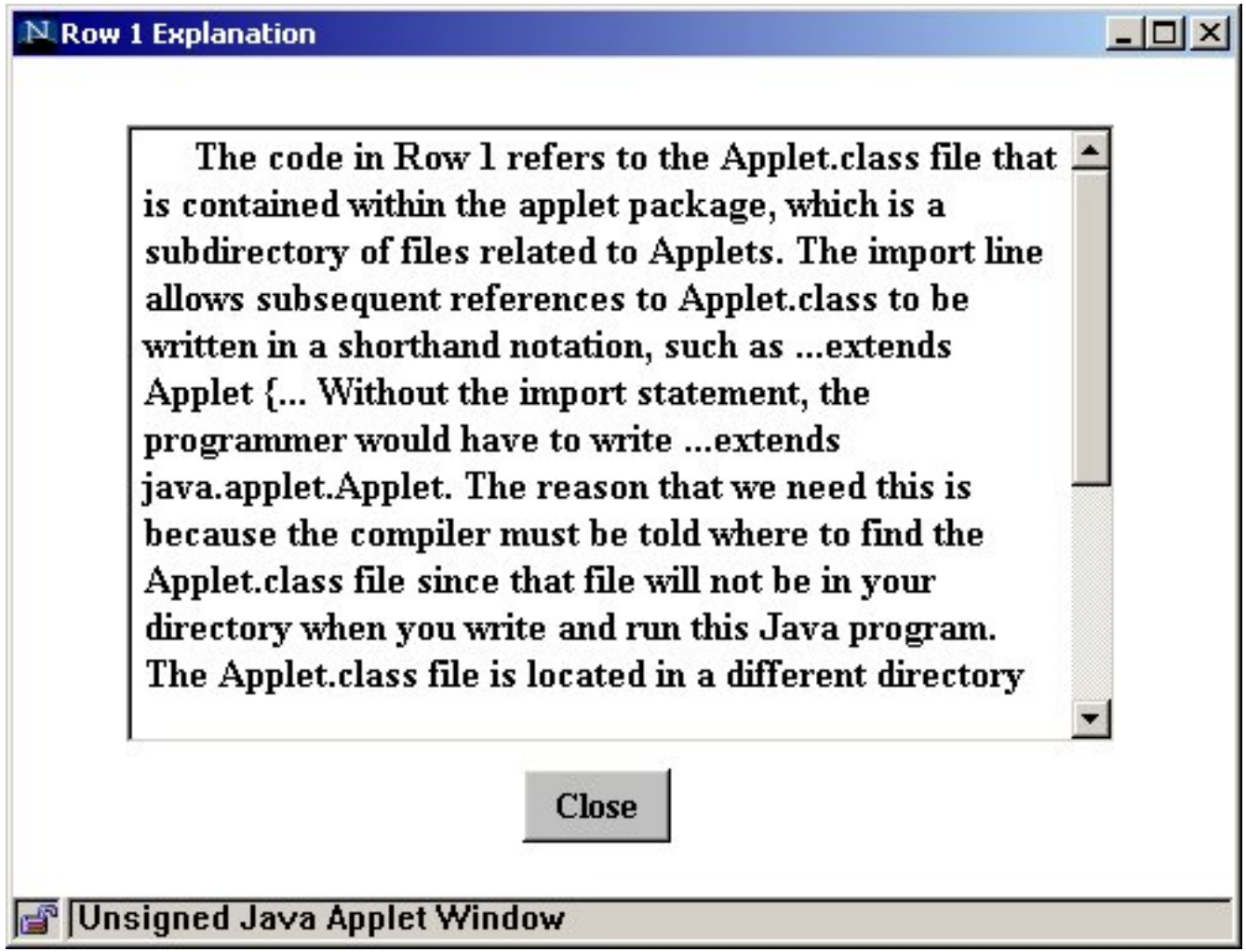
Row Interface



Row Interfaces

- **Pass 1**
  - Similar to Item interface
  - Observe the code
  - Read the meaning of a row
  - Take a multiple-choice test after correct input
- **Pass 2**
  - Observe the code
  - Repeat input until correct
- **Pass 3**
  - Whenever observe the code on a row, clear all rows, and start over

Explanation of a Row



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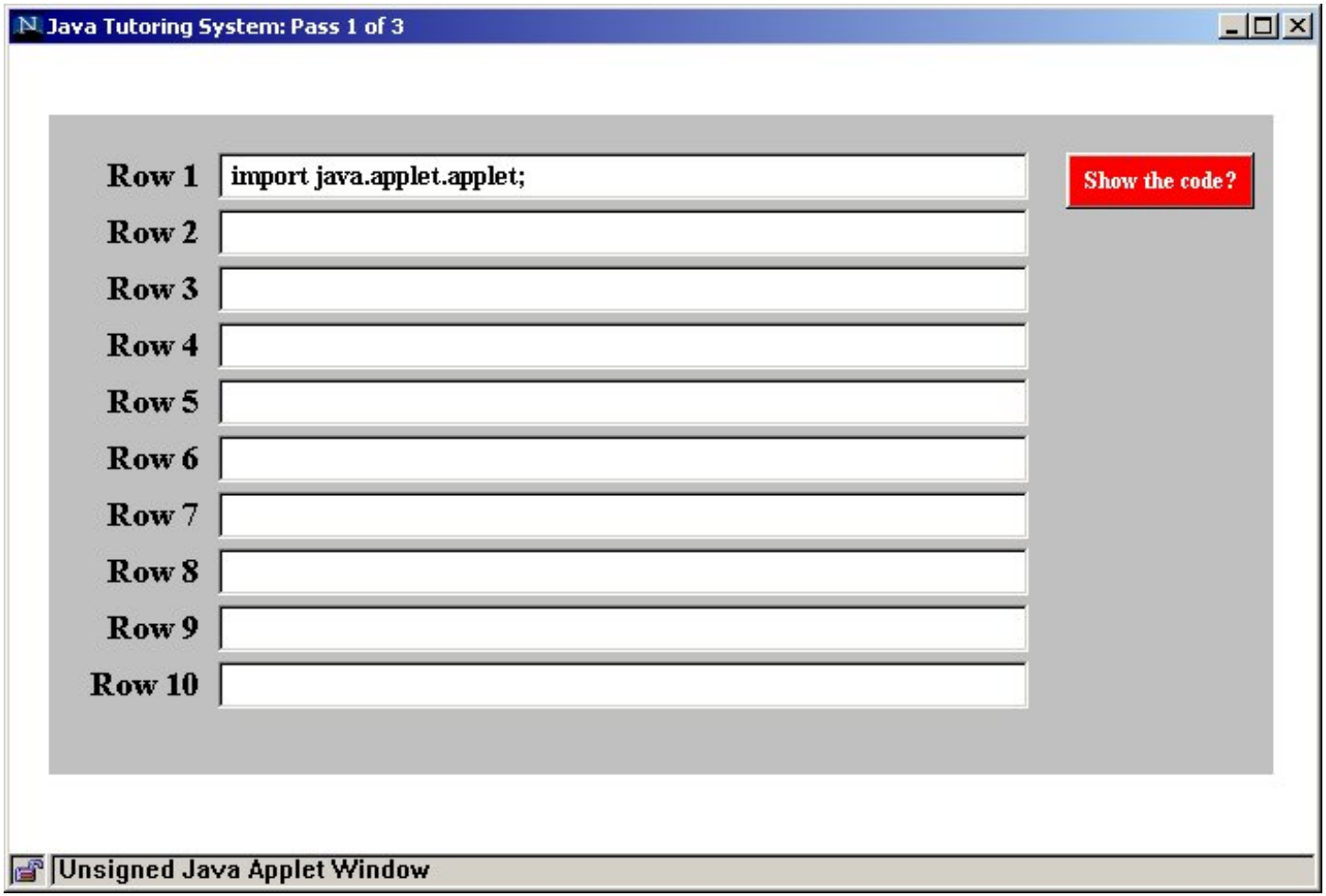
Observe the Code



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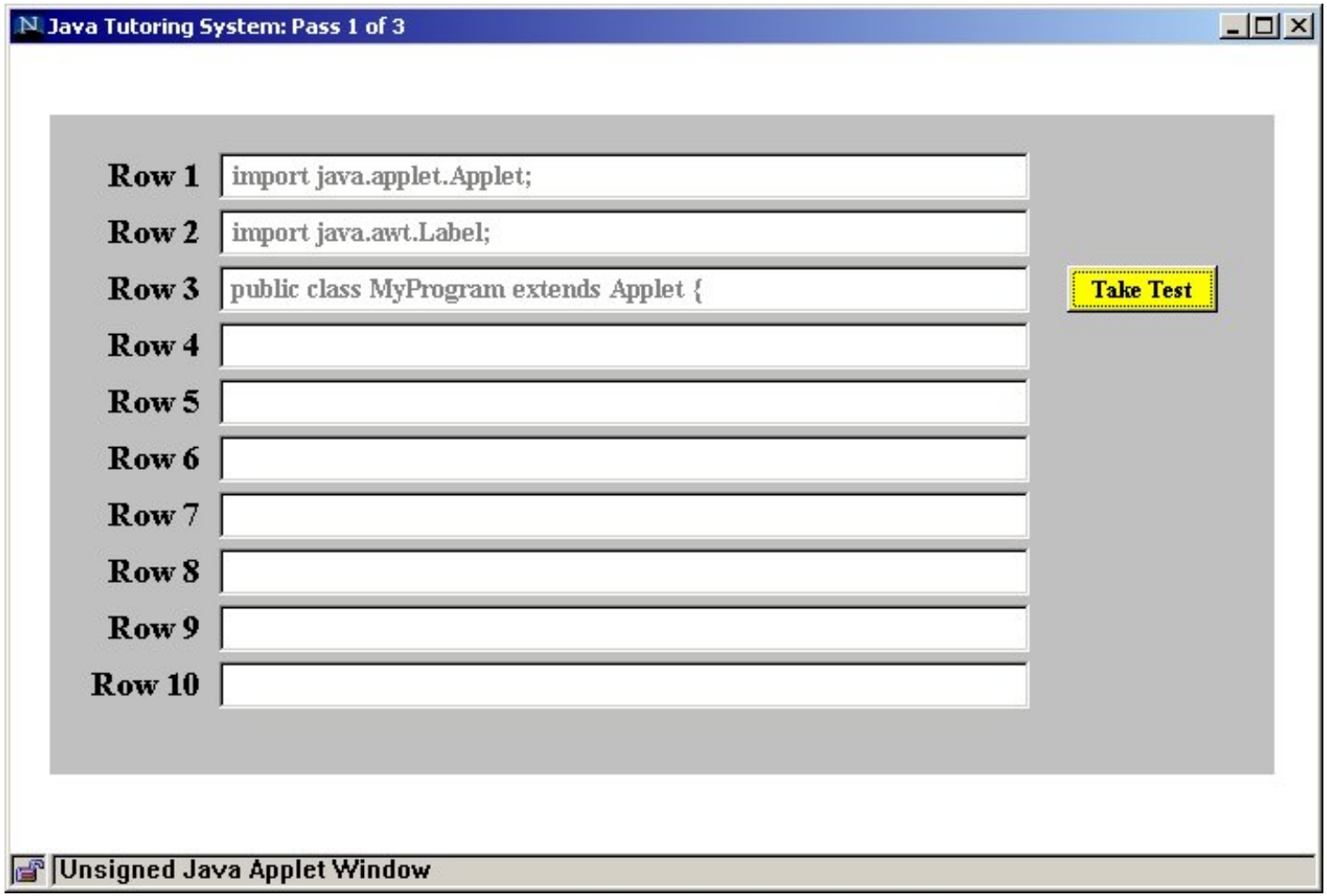
Take Test After Correct Input



Text Window

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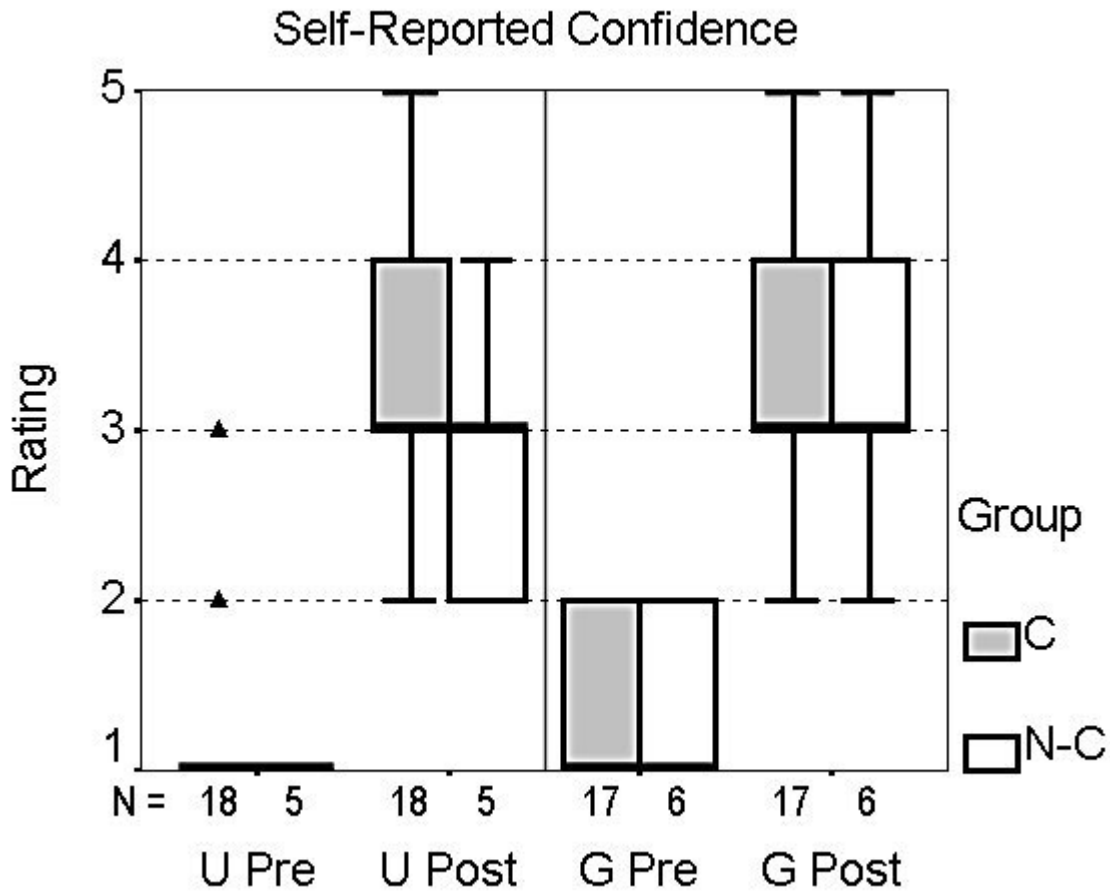
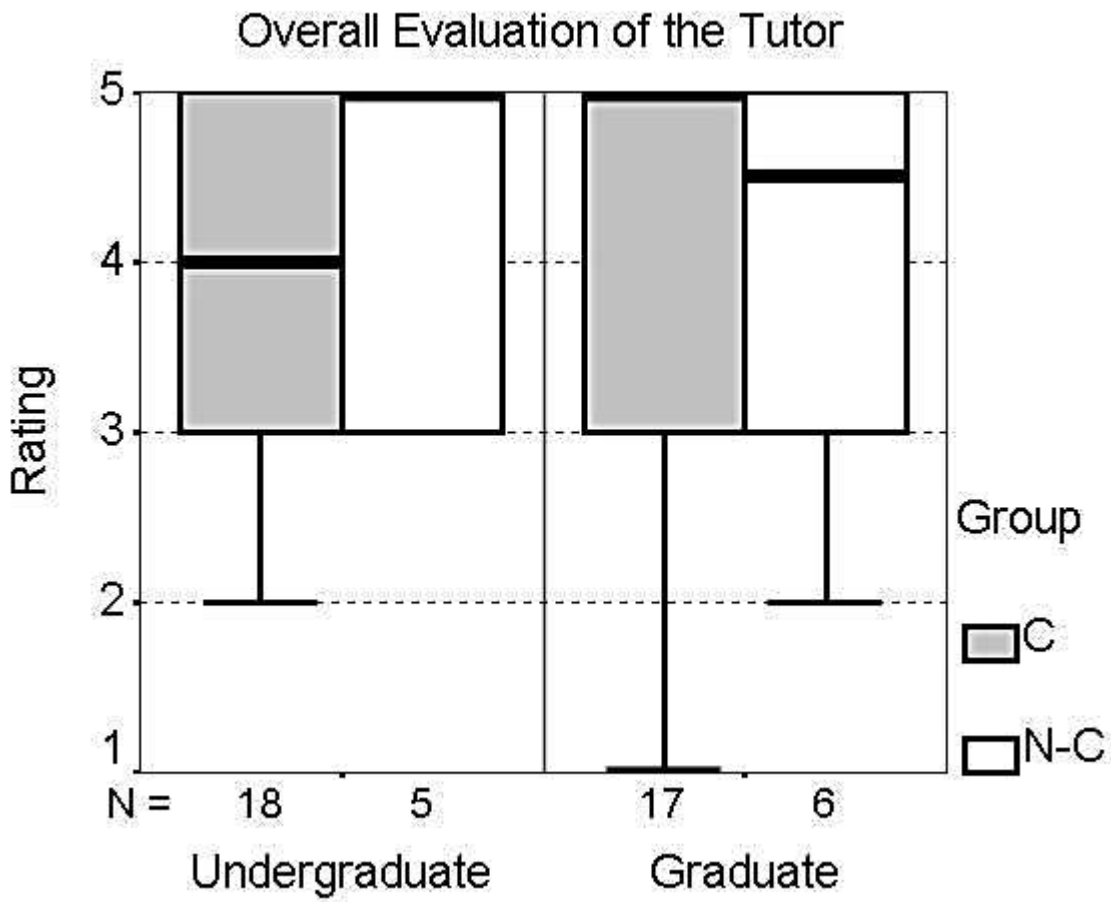
Confidence in Using the Items of Code



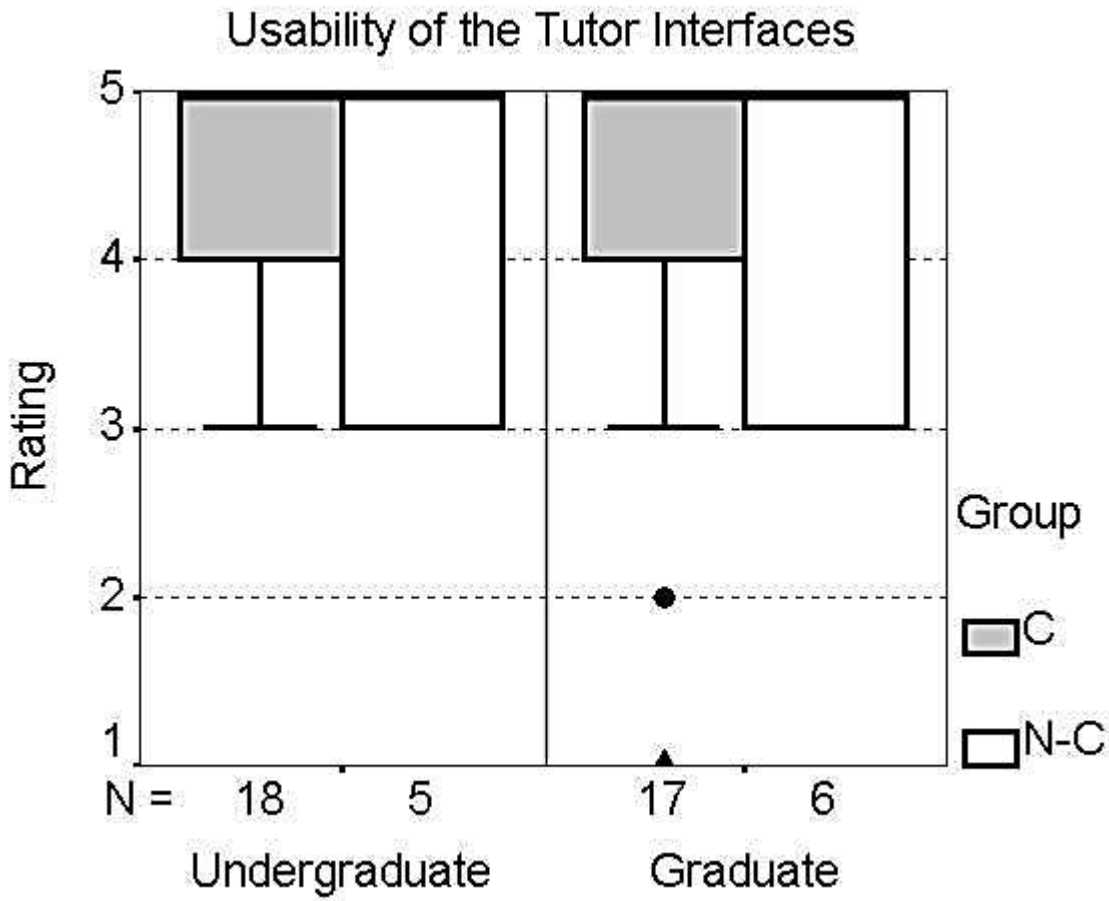
1 = Not at all confident. I do not know how to use the symbol.
5 = Totally confident. I know how to use the symbol.

Overall Evaluation of the Tutor



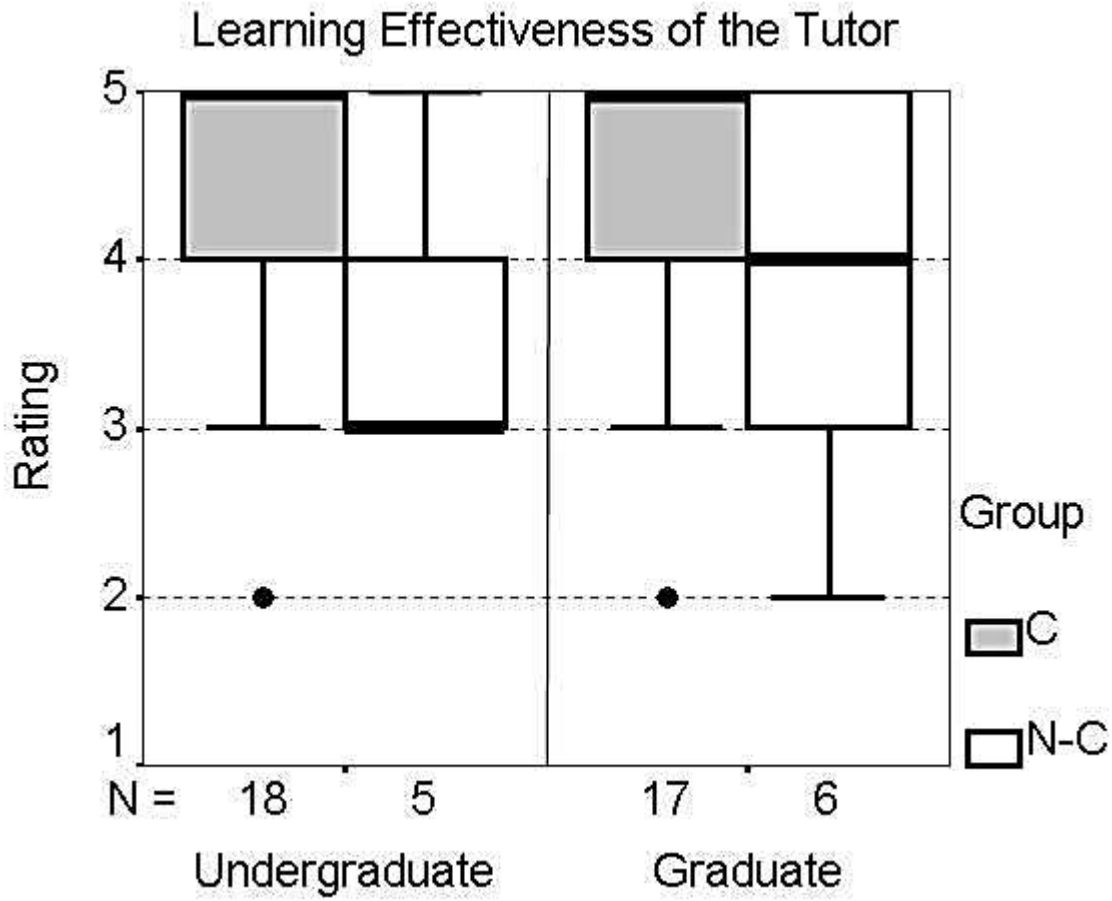
1 = Totally negative. I did not like the tutor.
5 = Totally positive. I liked the tutor.

Usability of the Tutor Interfaces



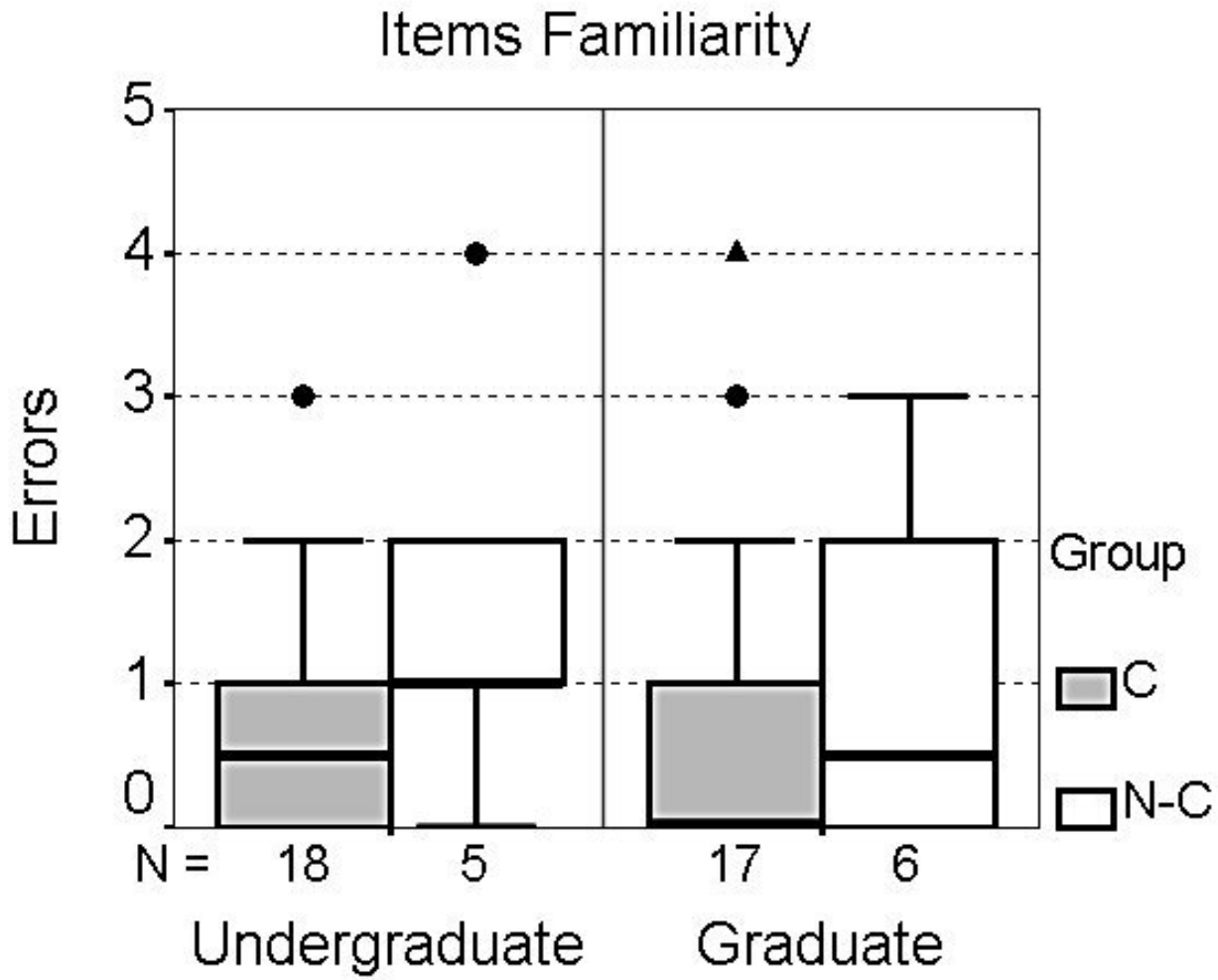
1 = Totally negative. The tutor was difficult to use.
5 = Totally positive. The tutor was easy to use.

Tutor Effectiveness to Learn Java



1 = Totally negative. The tutor did not help me to learn Java.
5 = Totally positive. The tutor did help me to learn Java.

Items Familiarity Performance



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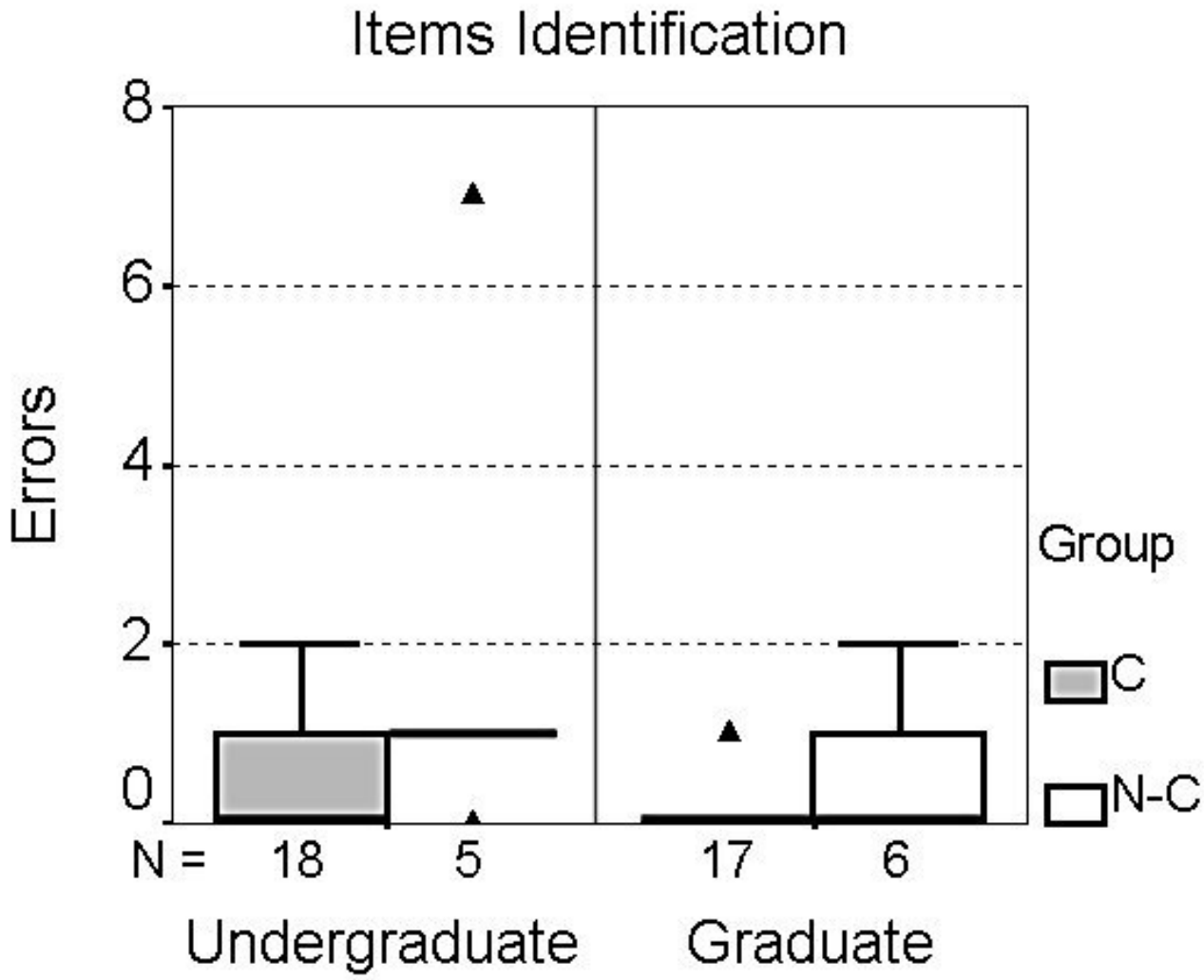
Items Identification Performance



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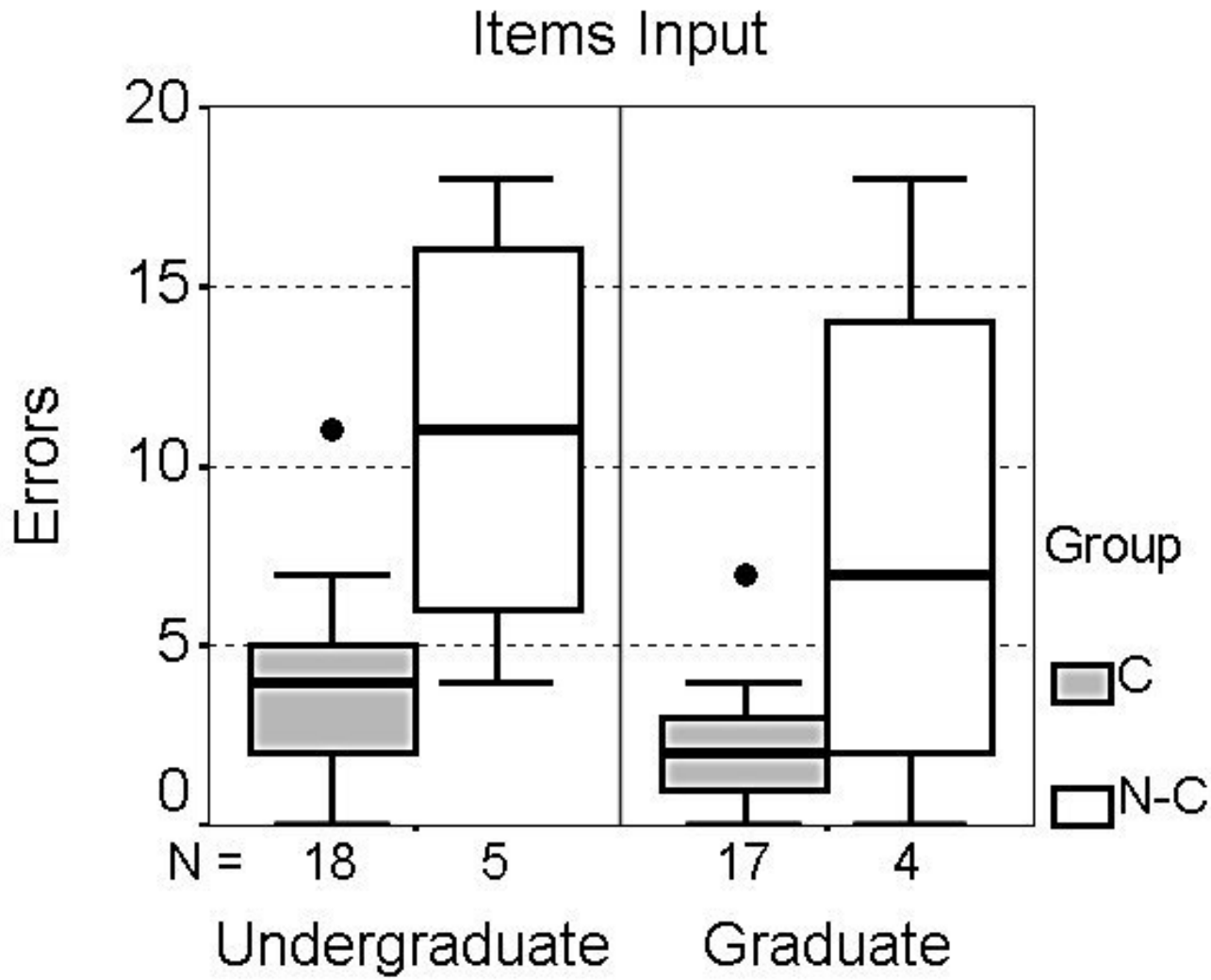
Items Input Performance (Errors)



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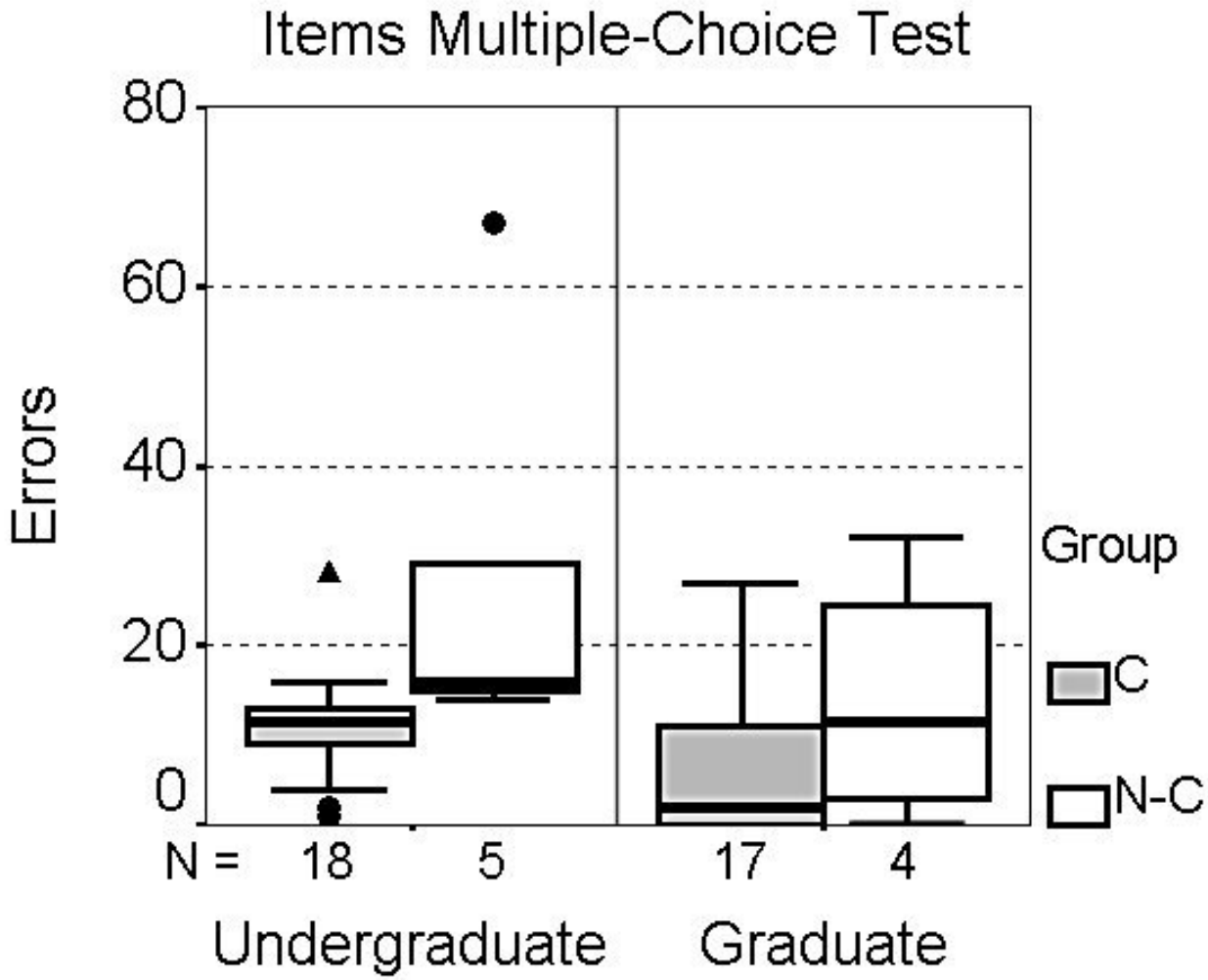
Items Test Performance (Errors)



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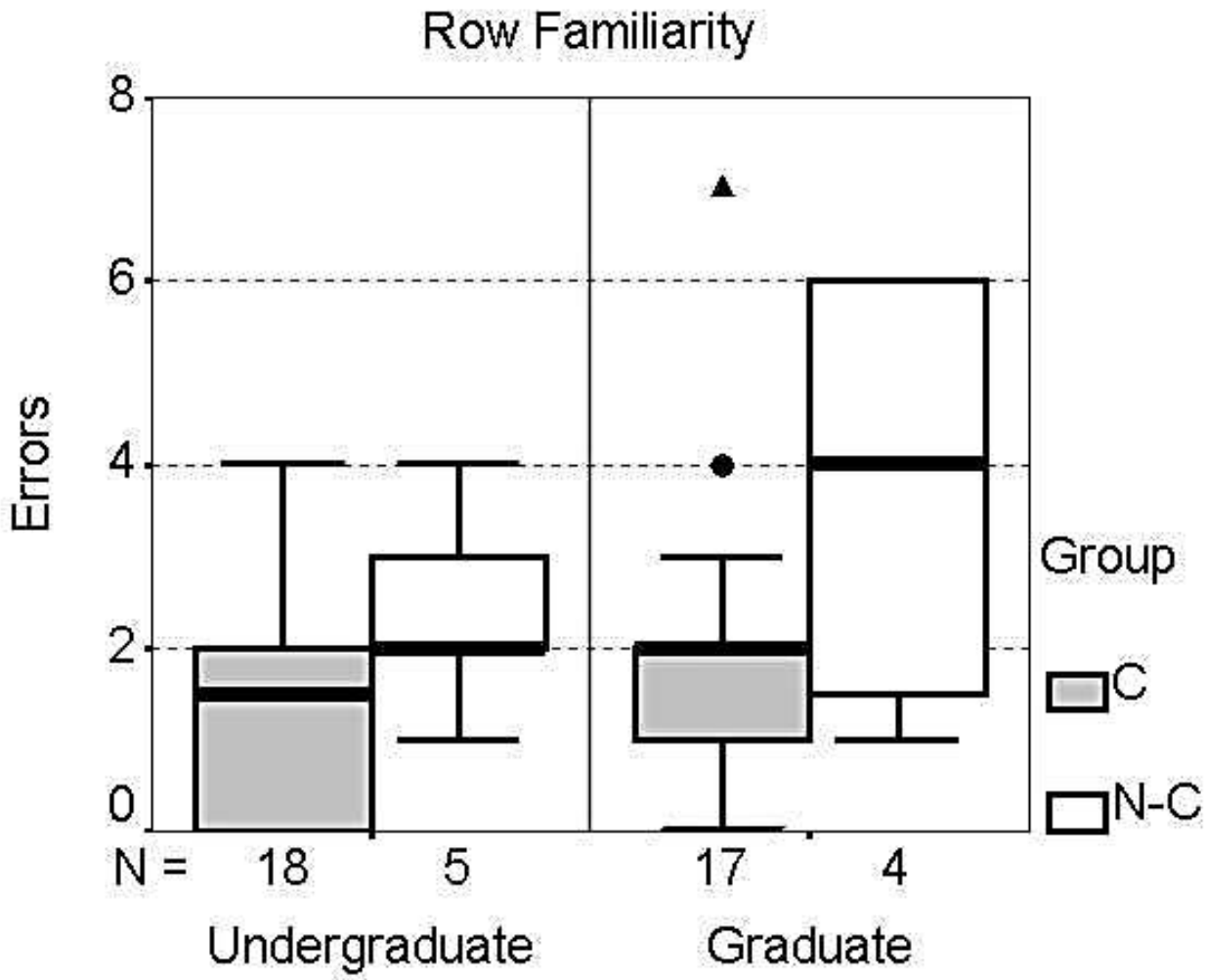
Row Familiarity



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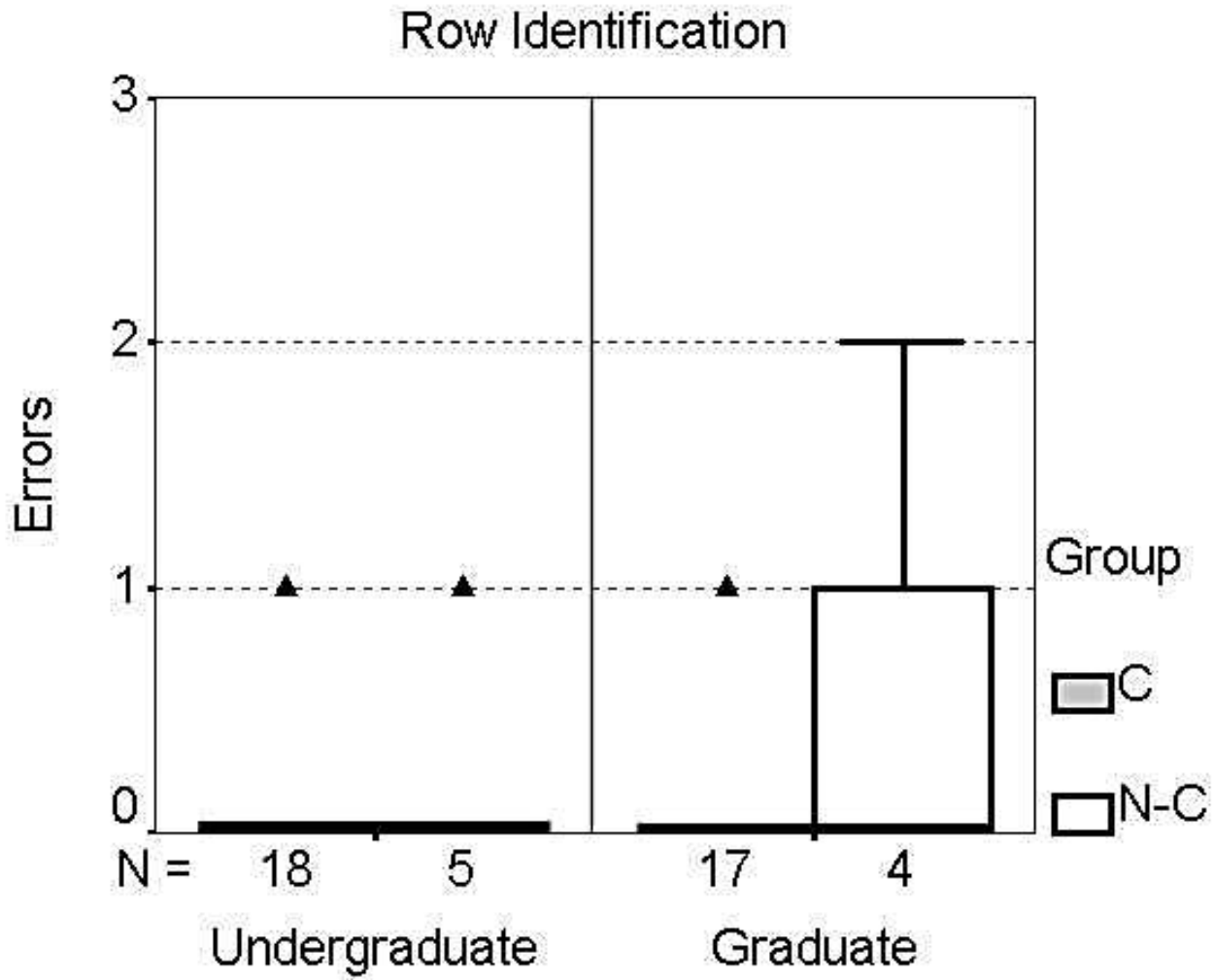
Row Identification



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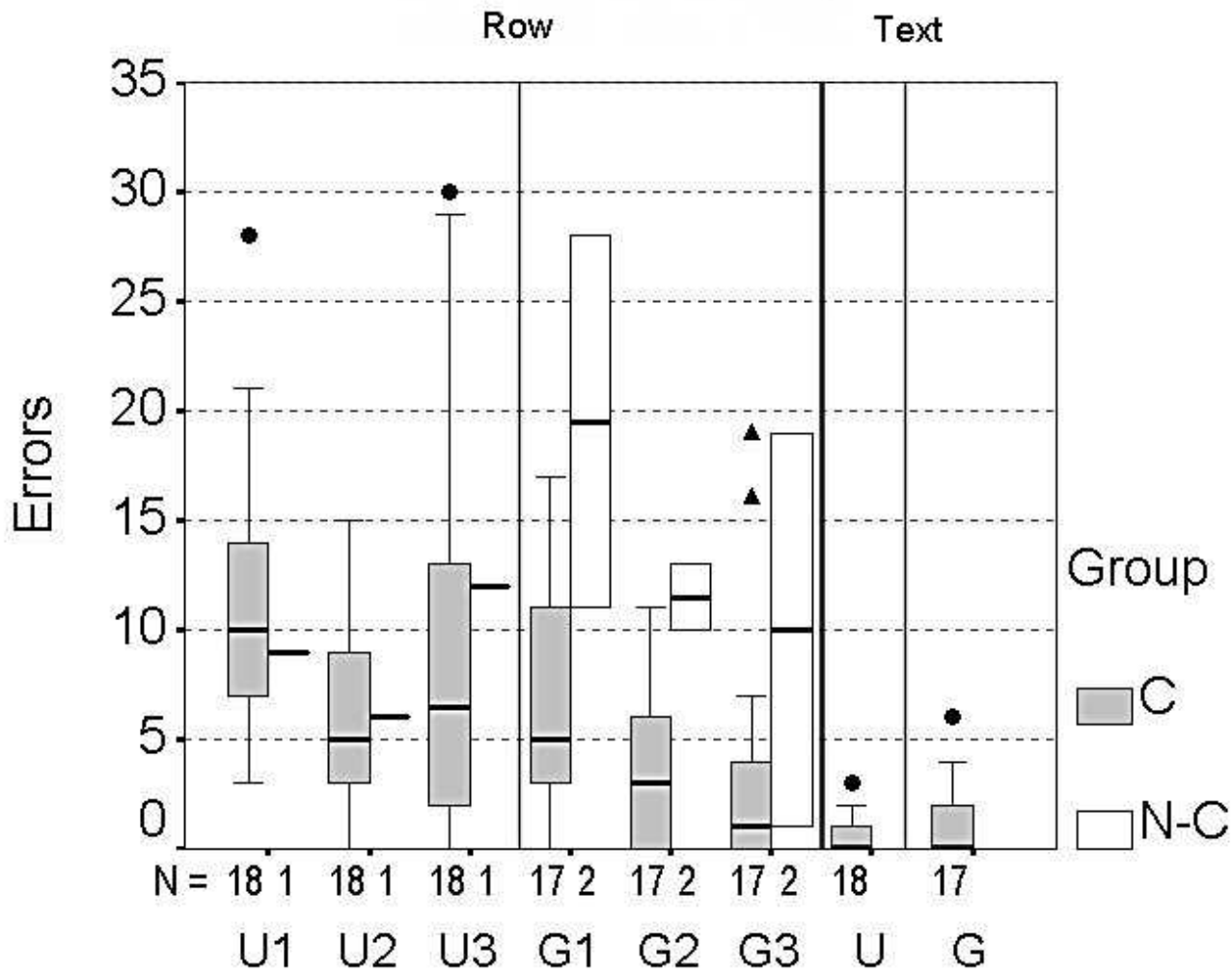
Row and Text Input Performance (Errors)



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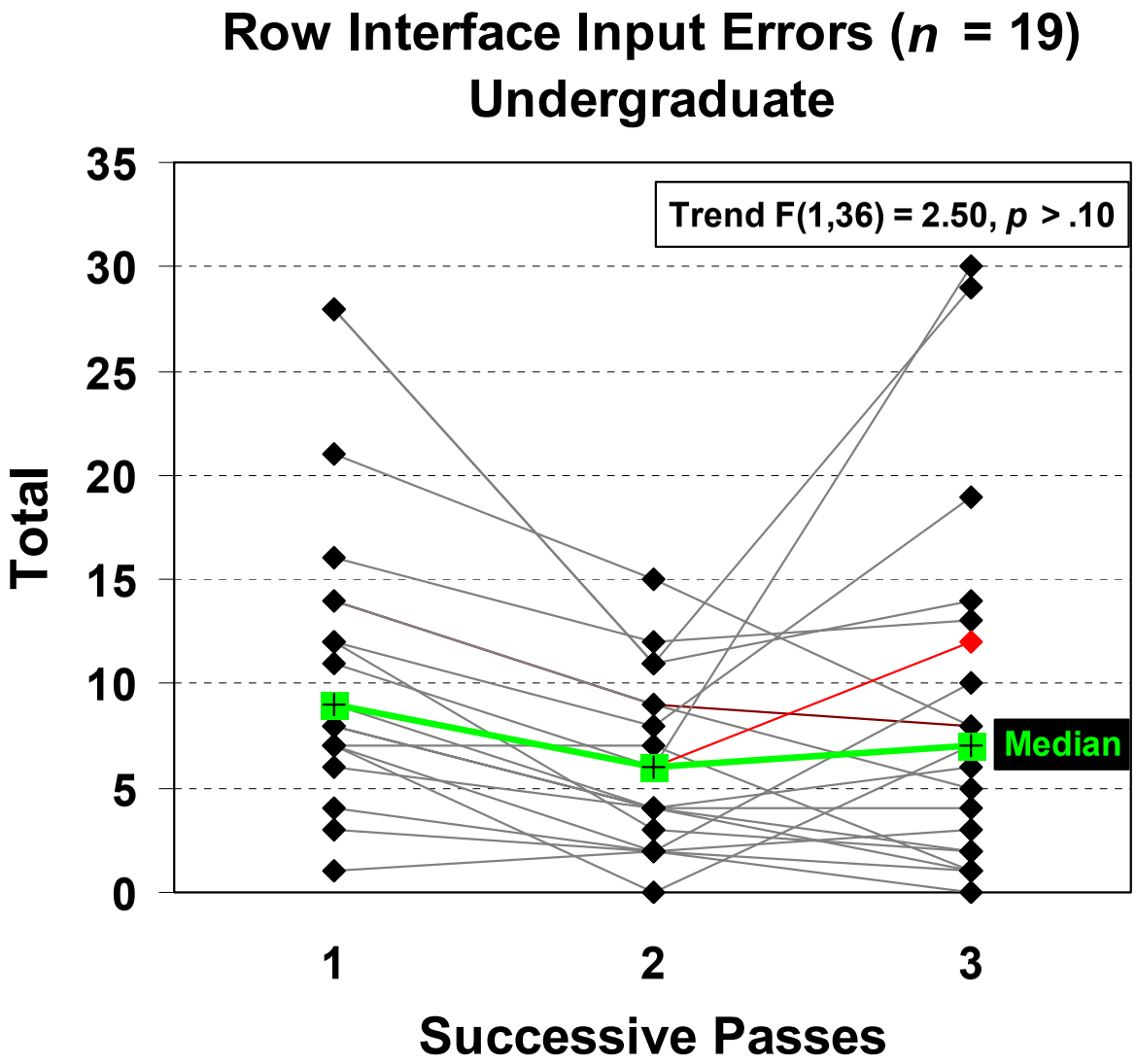
Row Input Errors: Undergraduate



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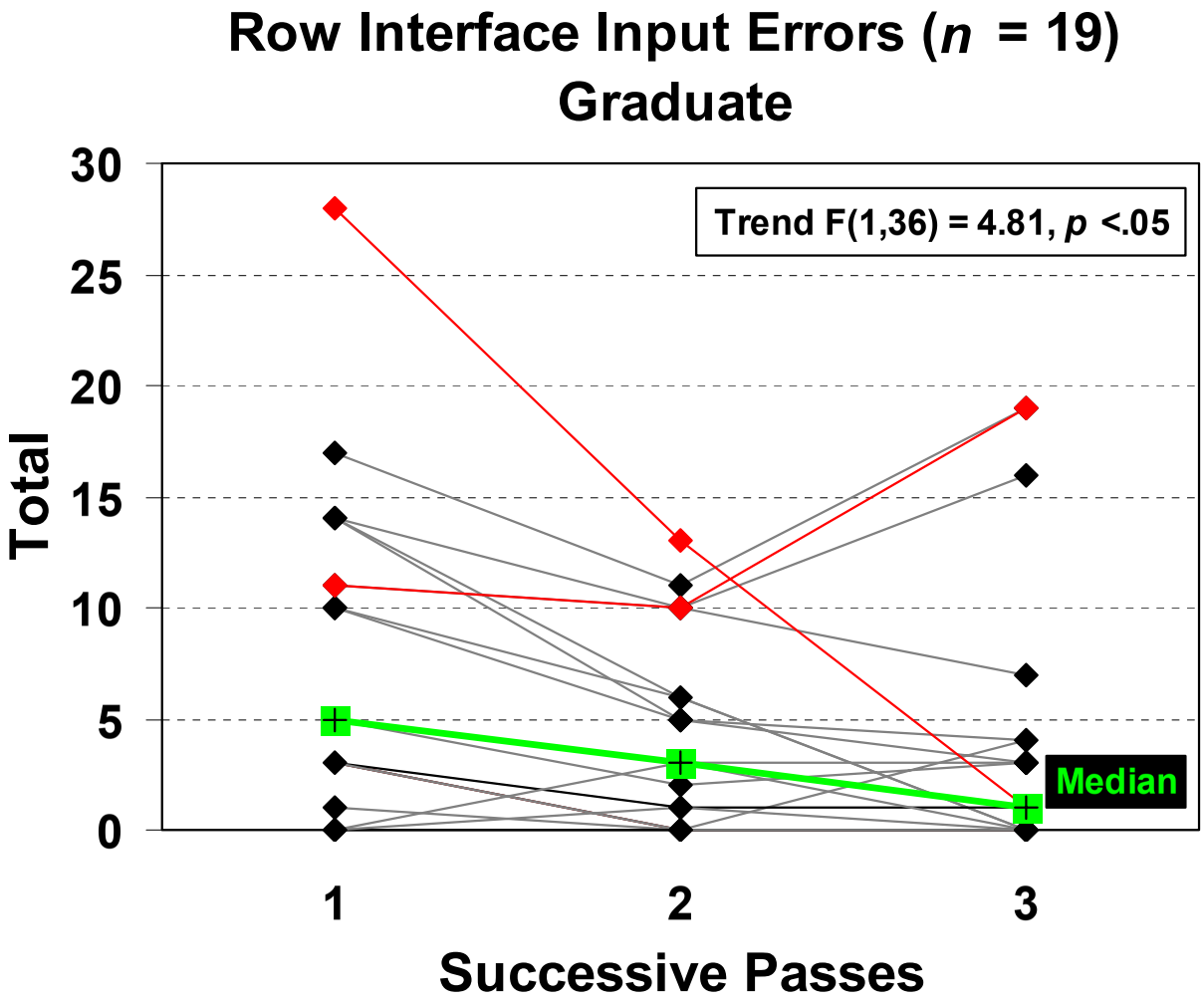
Row Input Errors: Graduate



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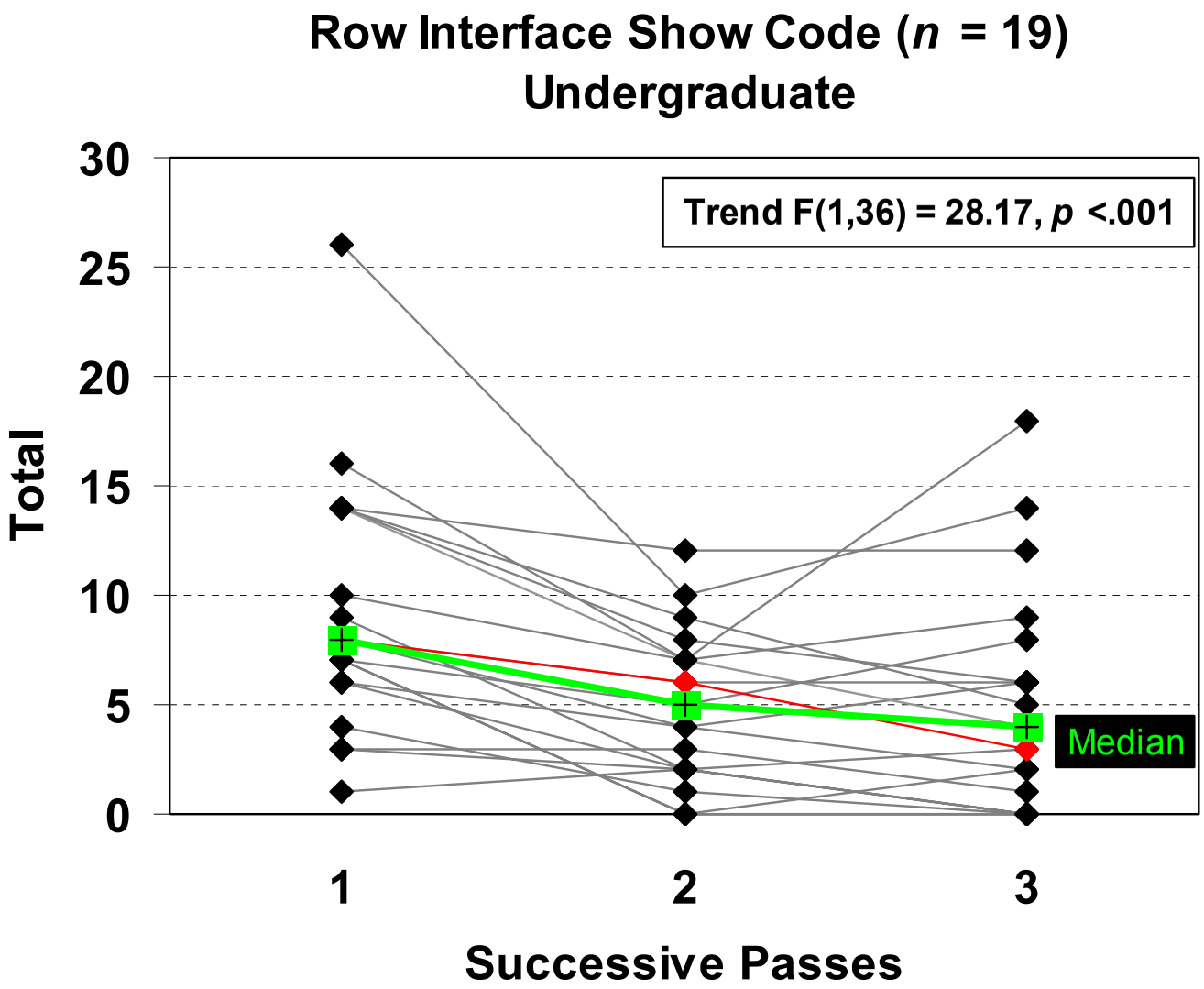
Show Code on a Row: Undergraduate



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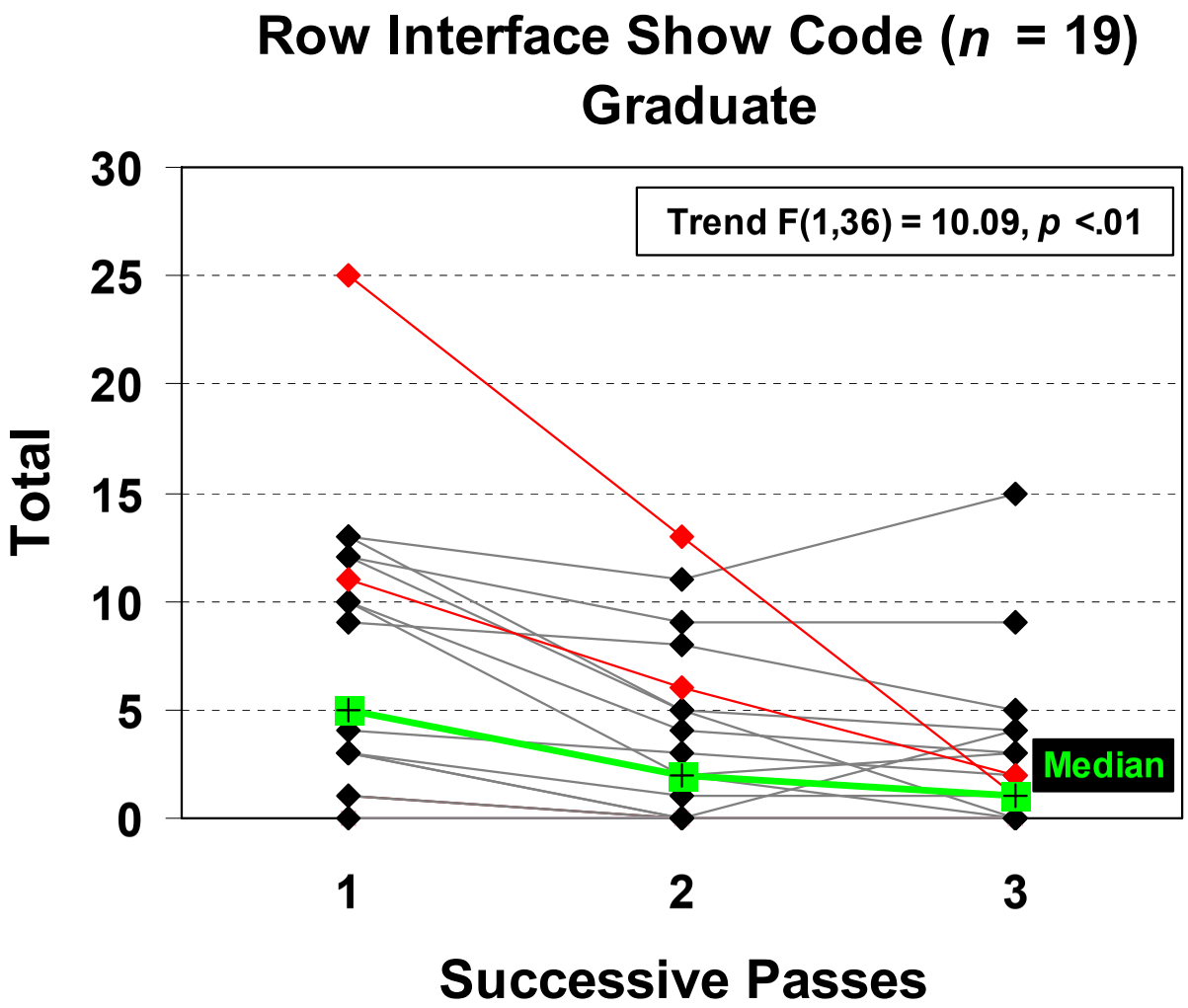
Show Code on a Row: Graduate



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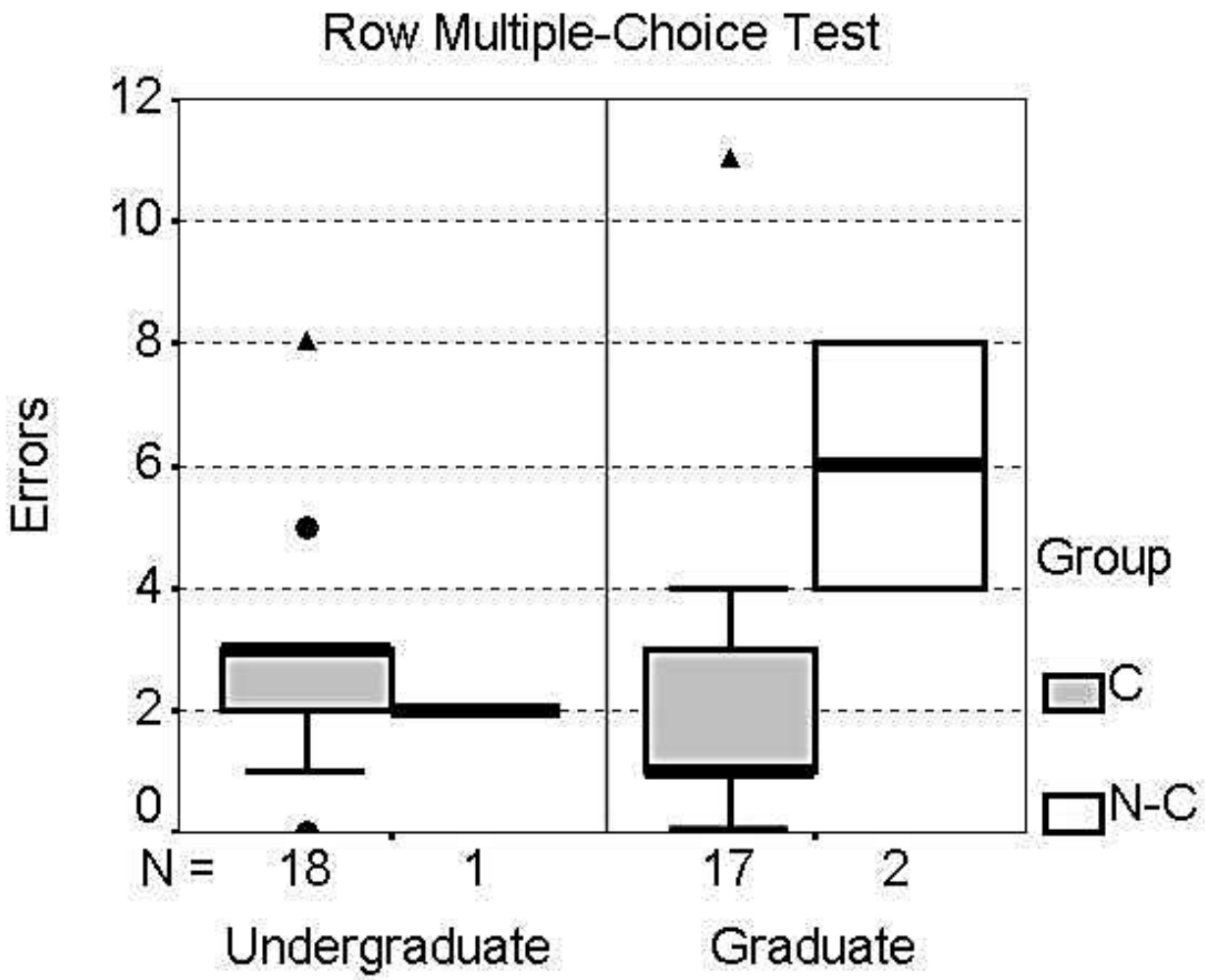
Row Multiple-Choice Test



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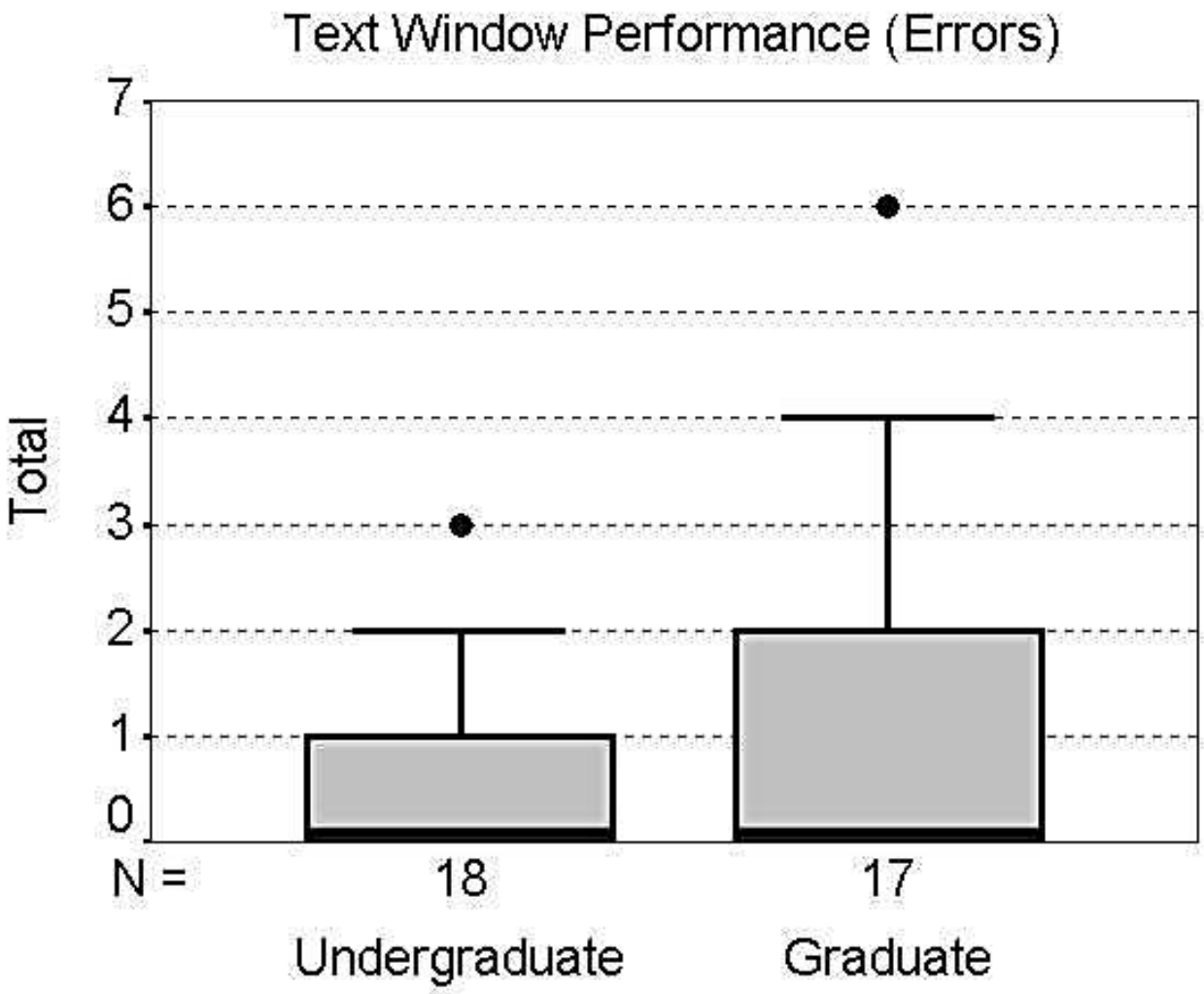
Text Window Performance



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Next class period

- Modified Personalized System of Instruction
  - Lecture
  - Collaboration
- Run the Applet

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Conclusions

1. **Structured rehearsal** is effective.
2. **Repetition** is an undervalued factor in learning and retention.
3. The tutor generated opportunities for **overlearning**.
4. Providing a **successful learning experience** early prepares and motivates the student to handle advanced programming techniques taught in conventional ways.

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Tutor URL

- http://nasa1.ifsm.umbc.edu/learnJava/tutorLinks/TutorLinks.html

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