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Objectives and Goals

- Analyze how a novice programmer (DO21) reads and interprets short snippets of Java source code
- Use eye gaze measures such as fixation counts and their durations to help understand reading behavior in source code

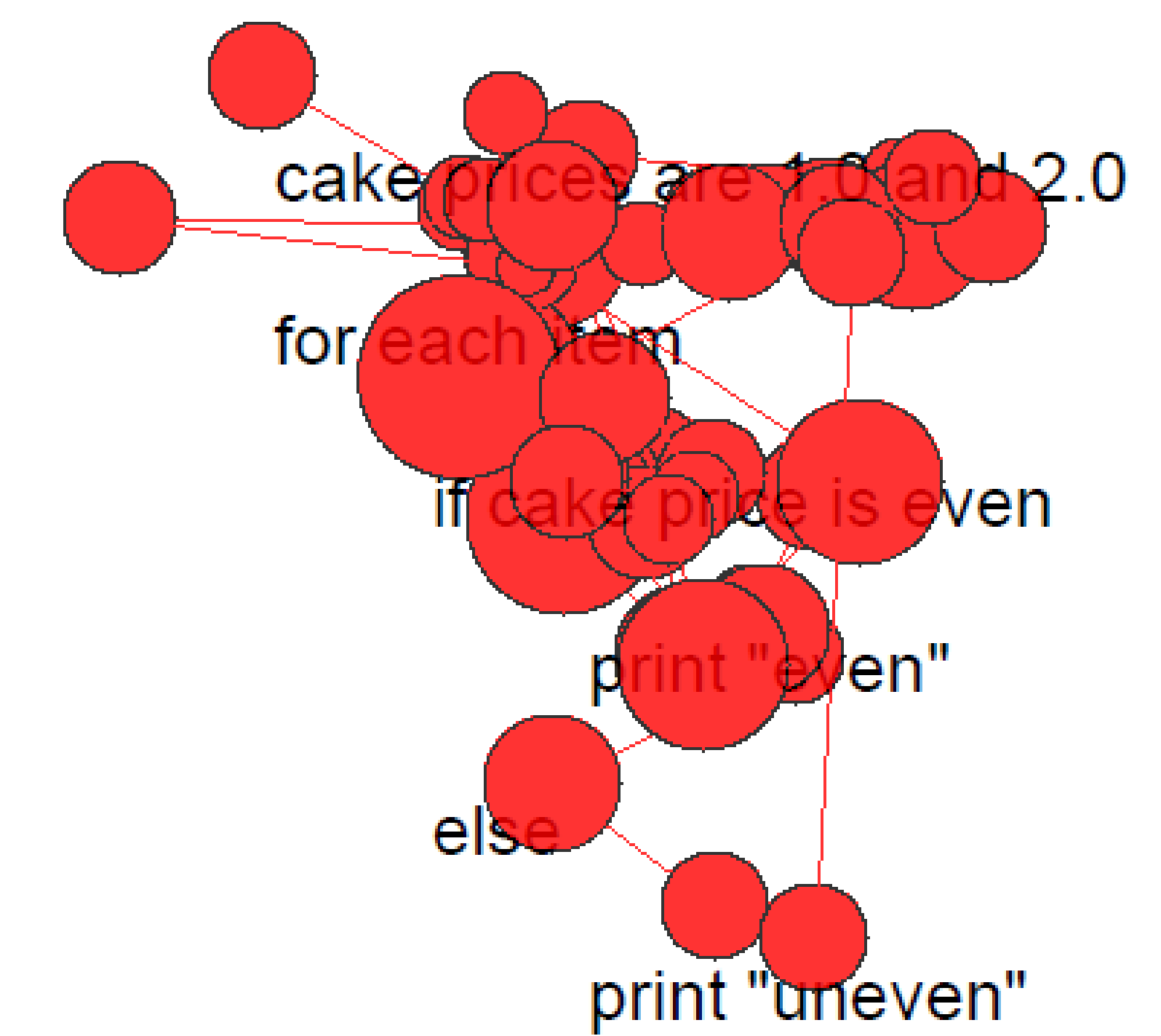
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Study Overview

- One novice programmer was studied while they did an online Java course for three months.
- Eye gaze data was collected after Lessons 1, 4, and 6
- Screen video and eye gaze data files were analyzed
- Measures: Fixation counts and their durations

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An Example: Fixation Counts and Durations

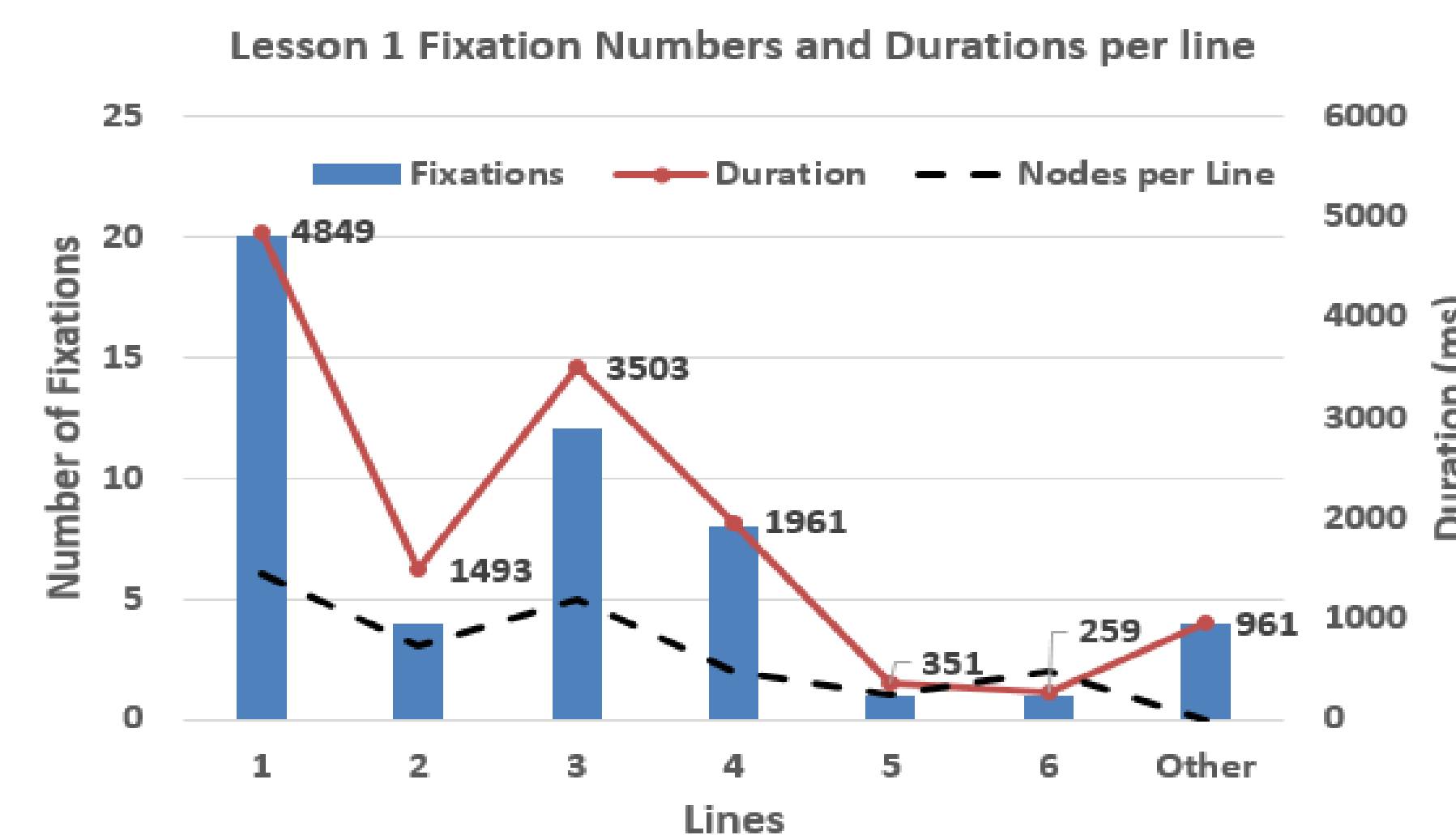


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Lesson 1

```
cake prices are 1.0 and 2.0
for each item
if cake price is even
print "even"
else
print "uneven"
```

- Read code similar to reading text
- Two total epics
- Time spent per line correlates with nodes per line

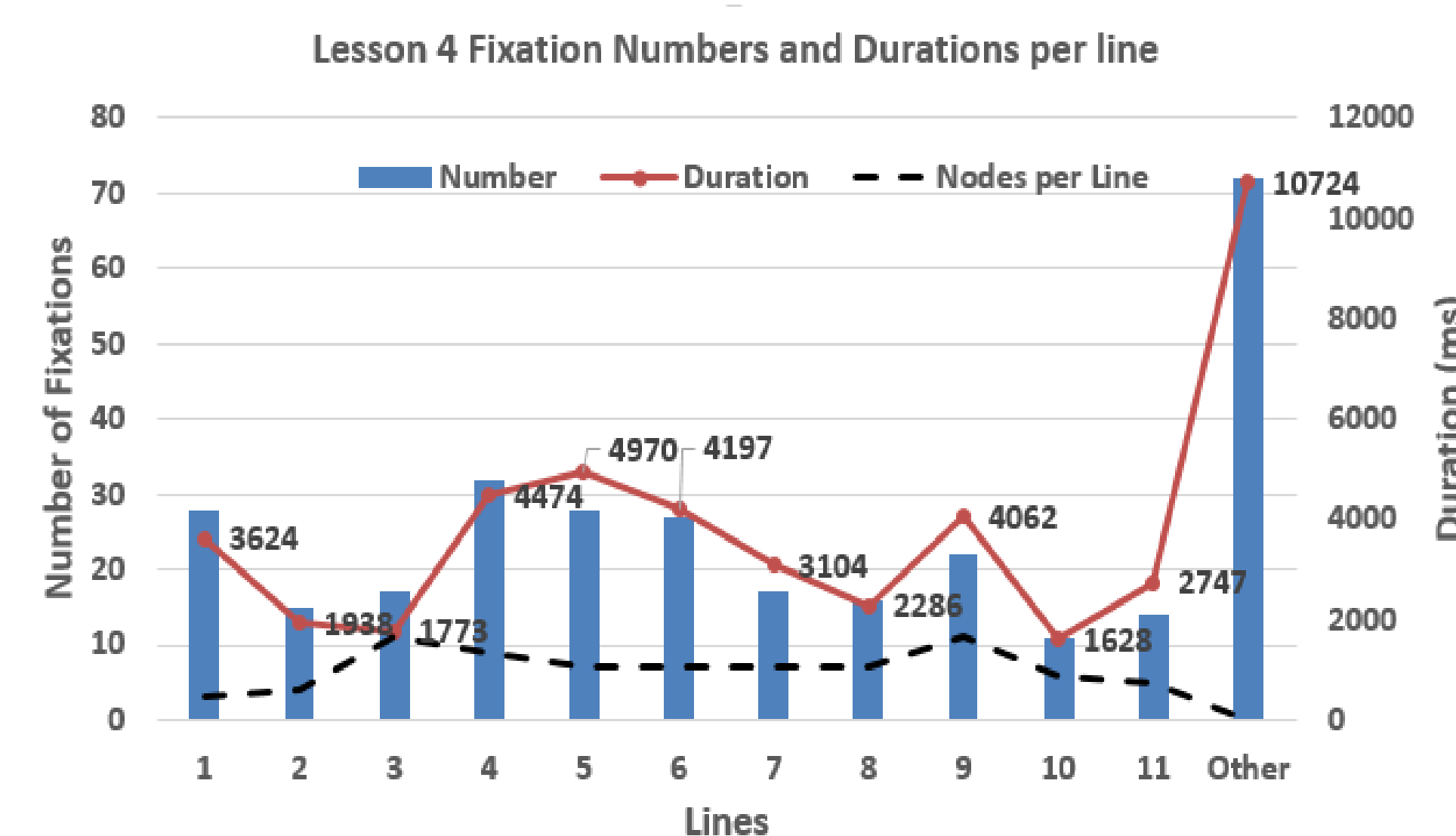


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Lesson 4

```
import java.util.Scanner;
public class CalculateAverage {
public static void main (String [] args) {
Scanner in = new Scanner (System.in);
System.out.print ("First number: ");
int num1 = in.nextInt();
System.out.print ("Second number: ");
int num2 = in.nextInt();
int average = (num1 + num2) / 2;
System.out.print ("Average: ");
System.out.print (average);
}
```

- Required more regressions for searching
- Two total epics
- Number of nodes and fixations per line do not correlate
- 72 fixations (10,724ms) did not fall on any line of code

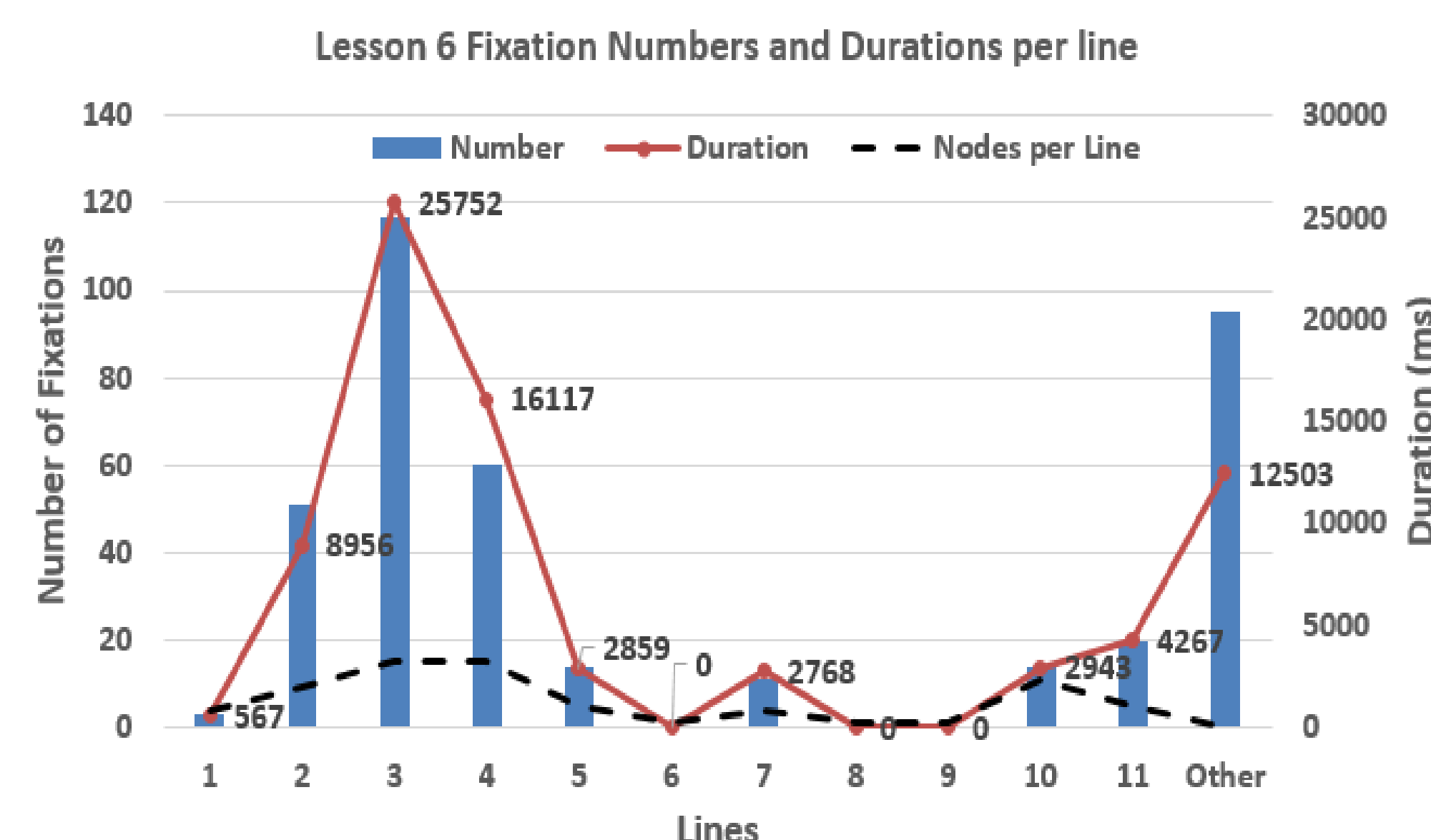


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Lesson 6

```
public class PrintPattern {
public static void printMethod (int numberOfRows) {
for (int row = 1; row <= numberOfRows; row++) {
for (int col = 1; col <= row; col++) {
System.out.print (" ");
}
System.out.println ();
}
}
public static void main (String [] args) {
PrintPattern.printMethod (8);
}
```

- Very little searching within the program
- Seven total epics
- Higher cognitive load because of higher task difficulty
- 95 fixations (12,503ms) did not fall on any line of code



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Main Results

- Initially predicted that eye gazes would become more structured – not particularly the case
- Many fixations fell on a blank space – DO21 thinking?
- Reading code and problem solving are both key skills in programming
 - Lesson 1: >Reading
 - Lessons 4 and 6: >Problem Solving
- Our conclusion states that DO21 was in the process of better understanding code

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Future Work

- The overarching goal of this research is to identify stages of development in programmers.
- Repeated measures (testing DO21) at a different points in time is needed to see a shift in understanding. This will help us determine when a novice eventually becomes an expert.