An Integrated Approach to Instruction in Debugging Computer Programs

R. Chmiel, M. C. Loui

Research Question
Can instruction in debugging help students improve their program debugging skills?

Method
- Integrated several debugging activities into Spring 2003 offering of ECE 291
- Optional debugging exercises before programming assignments #2, #3, #4
- Of 116 students in the course, 27 participated in the debugging exercises, 89 did not
- No significant difference in aptitude between groups: average first exam scores were 70.7% for Treatment group (N = 27) 72.0% for Control group (N = 89)

Sample Debugging Exercise

```
; Factorial
; Factorial calculates the factorial of an input integer given in the AX register and returns the result in the AX register. Assumes input is nonnegative.
Factorial
PUSHA
; Save all registers on stack
MOV CX,AX
; Initialize loop counter
MOV AX,0
; Initialize result
CMP CX,0
; Check for zero case
JE .Done
.Factorialloop:
MUL CX
; AX = AX * CX
LOOP Factorial
; Decrement CX, jump if CX > 0
.Done:
POPA
; Restore all registers from stack
RET
```

Results
Differences in percentage of time debugging for assignments #2, #3, #4 are statistically significant at the $p < .002$ level

Conclusion
Students who are taught debugging skills will debug their programs more effectively

Supported by an Architecture for Change grant from the College of Engineering at the University of Illinois at Urbana-Champaign and by the National Science Foundation under Grant SES-0138309