EAGER: Peer Instruction for Cybersecurity Education

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Provoke deep conceptual thinking process for better learning

The objective of this project is to develop and evaluate the effectiveness of peer instruction methodology for cybersecurity education.

Results of Peer Instruction in Computer Science

- Current focus limited to theoretical and introductory programming courses
- 6% higher grades on final exams
- 61% reduction in failure rates
- 31% improvement in student retention

The project focuses on three cybersecurity courses
- Introduction to Computer Security
- Digital Forensics
- Network Penetration Testing

Covers introductory security concepts, and both defensive and offensive views of cybersecurity

Example Peer Instruction Question

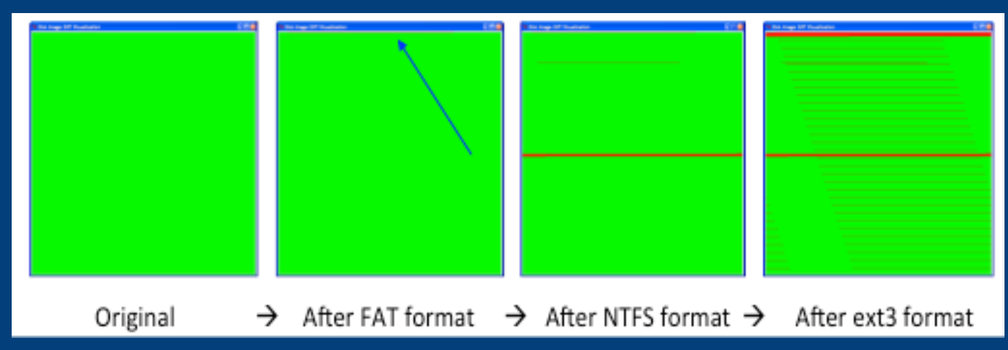


Figure 1: Results of formatting of a flash drive with different file system

Q. Estimate the fraction of disk blocks affected by formatting a hard disk:
- a) 100%
- b) 65%
- c) 20%
- d) Less than 5%

Peer Instruction Teaching Methodology

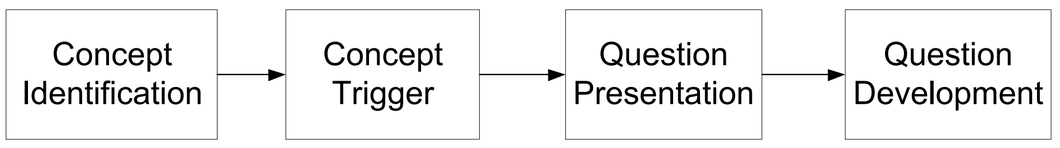
Pre-class preparation by students
- ***Reading material*** to gain basic understanding and concepts
- ***Quiz*** to ensure that students read the material

In Class, a topic is covered in following steps
1. A *conceptual* and *multiple-choice* question is asked to students
2. Two to three minutes for reply
3. Group discussion of students
4. Students reply to the question again
5. Instructor may further discuss the answers

Developing PI Questions - Challenges

- Quiz vs. Peer Instruction Questions
  - Should be conceptual
  - Should facilitate peer discussion
- Plausible Incorrect Answers
  - Creating incorrect answers for peer instruction questions that seem plausible

Question Development Methodology



Examples of Concept Triggers
- Deliberate ambiguity,
- Trolling for misconceptions,
- Omit necessary information

Development of PI Questions

- 172 questions for two cybersecurity courses
  - Introduction to Computer Security (93 questions)
  - Network Penetration Testing (79 questions)
- Identify concept triggers, and presentation types in the questions

Recent Publication

Johnson, W., Luzader, A., Ahmed, I., Roussev, V., Richard III, G., Lee, C., ***Development of Peer Instruction Questions for Cybersecurity Education***, USENIX Advances in Security Education Workshop (ASE'16), 25th USENIX Security Symposium, August 2016, Austin, TX

Interested in meeting the PIs? Attach post-it note below!

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