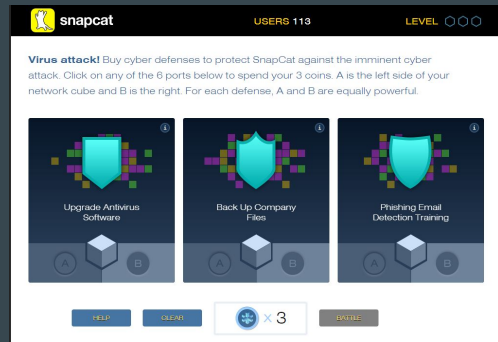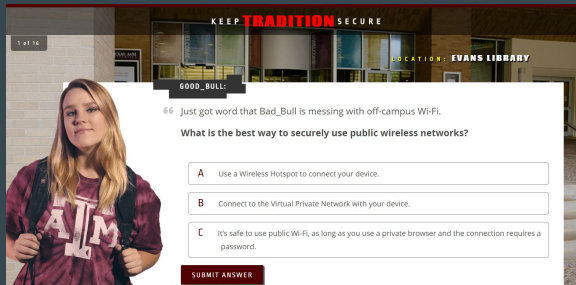# Firewall Educational Game

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Previous Work

- McAfee's Cybersecurity Game
  - Directed towards kids
  - Mission based game to secure documents using multi factor authentication
- PBS NOVA Cybersecurity Lab Game
  - Player must complete challenges to strengthen their defenses and thwart attackers
- CynjaSpace Cybersecurity Game App
  - Teaching children at an early age how to be safe online
  - Includes ISACA's cybersecurity guidance
- TAMU IT Cybersecurity Game- Keep Tradition Secure
  - Q and A based game

Goals for a Successful Educational Game

- Include details
  - Needs enough information to be equipped to choose the right action among many
  - Given enough time to process the information and then to proceed on to the game
- Have appropriate context
  - Gaming environment needs to capture the cues from the actual work environment of the learners to help them make the suitable connection between the environment of the game and the work environment
  - Include contextual details that players can recognize
- Balance between instruction and entertainment
- Adequate feedback
  - Immediate and continuous feedback
  - Encourage the player to feel more satisfied with their performance
  - Inform the player when something is done correctly or incorrectly with an explanation
- Appropriate challenging levels

Learning Objectives of the Game

- Understand what a packet is
- Understand the purpose of the Firewall
- How it works as a security measure to the computer
- Understand what information on the packet is the Firewall looking for in particular
  - Port
  - IP address
- Understand the different checks are required for packets with existing or new connections
  - State and Update Table
  - Security Policy
- Understand the gateway concept

Game Design

- The player acts as the Firewall
- Before each level
  - Informative screen on the concepts used in the level
  - Instructions on how to play the level
- Packets are coming down the vertical path
- Players have the time the packet enters the screen till it leaves the screen to determine if the packet is safe or a threat
- Using a drag and drop game mechanic to move the packets
- When packets are placed over certain boxes to check if they pass the policy, they turn either red or green, a threat or safe packet

Level Design

- 3 different levels
- Each level builds on the previous level
- Level 1- Packet Filtering
  - Port and IP address
- Level 2- Session Filtering
  - New vs. Existing connections
  - State and Update Tables
  - Security Policy
- Level 3- Gateway
  - IP address of outgoing packets
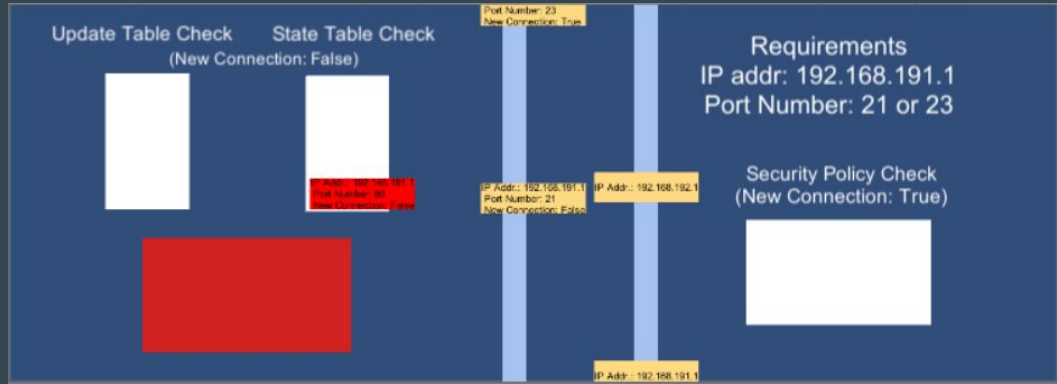
Gateway Level Screenshot

Improvements

- Include more educational information pertaining packets
  - What are they?
  - What information they carry?
  - How can a bad packet threaten the computer/internal network?
- Improve graphics
- Slow down the incoming packets
- Show the next packet and information before it appears on the screen
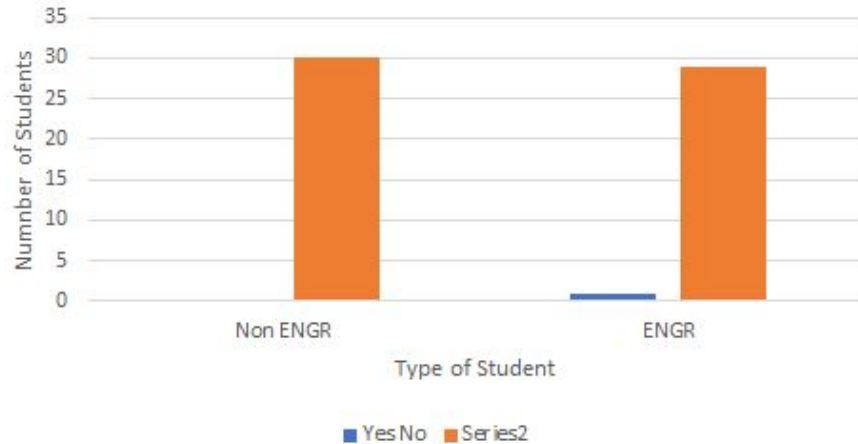 - Similar to tetris next piece game mechanic

User Study (Pre Survey)

- Y/N Questions
- Interviewed 30 engineering non computer science students and 30 non engineering students
- Questions
  - Have you taken a course in cyber security course?
  - Do you know what a firewall is? If so, what is it?
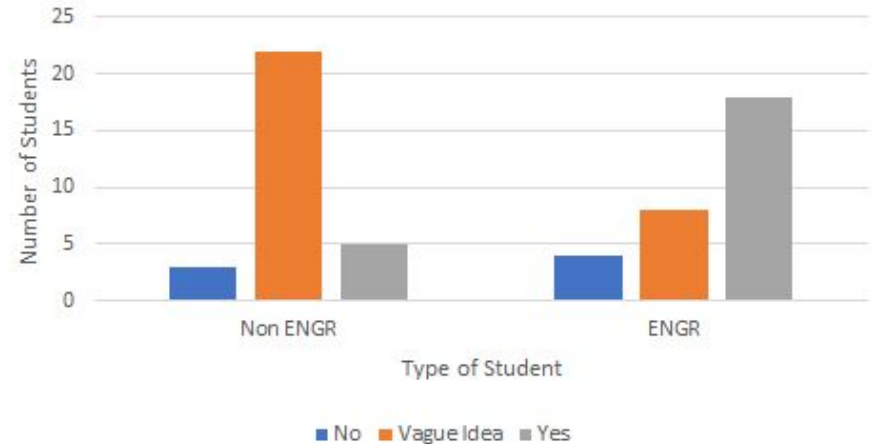 - Do you know how a firewall works? If so, how does it?
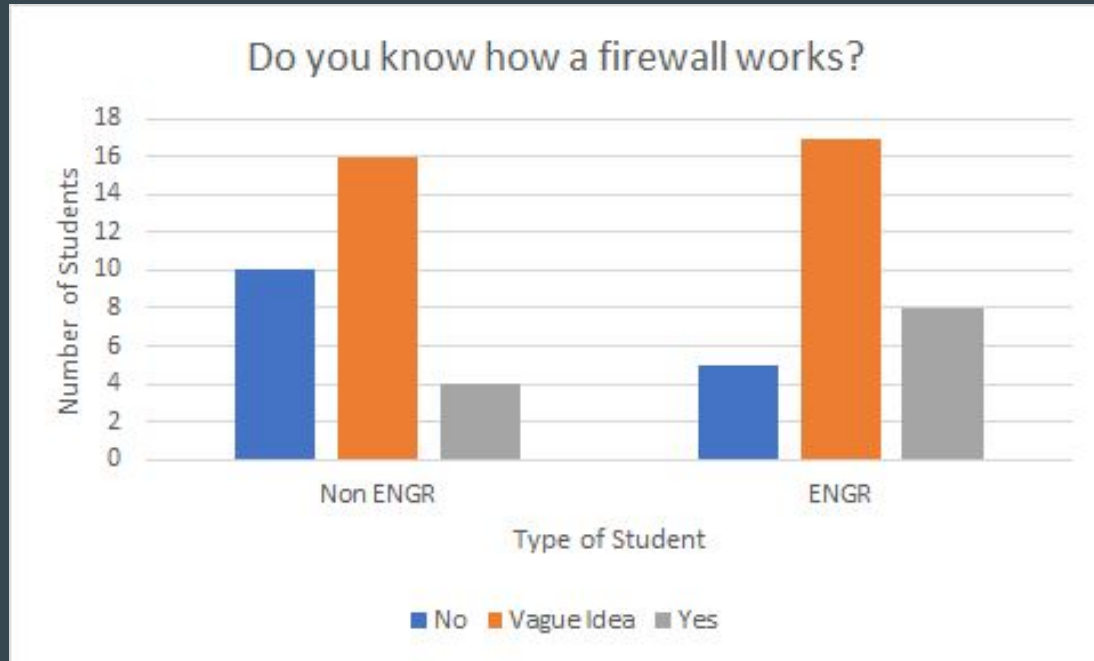
# Pre Survey Results

Pre Survey Results (cont.)

User Study (Post Survey)

- Sent them a Zipped file including the game, so they can easily download and play the game and a survey
- Open Ended Questions
- Likert Scale Questions
- Questions
  - Did this game accomplish the learning objectives?
  - Did you find this game entertaining?
  - On a scale of 1-5
  - Do you have any further suggestions to improve this game?
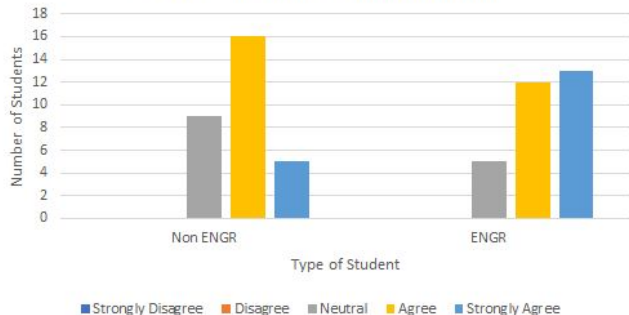
Post Survey Results

This game helped me understand the purpose of the Firewall.
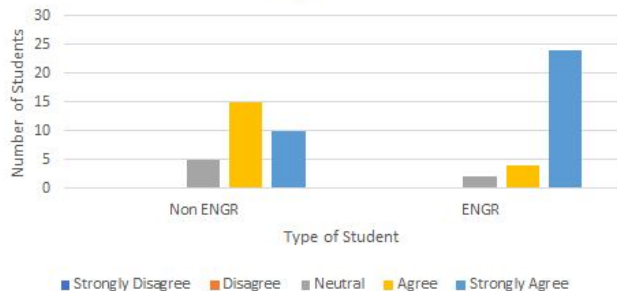
This game helped me understand how the Fireewall works as a security measure.
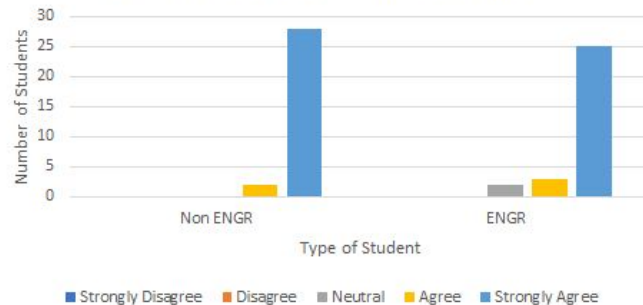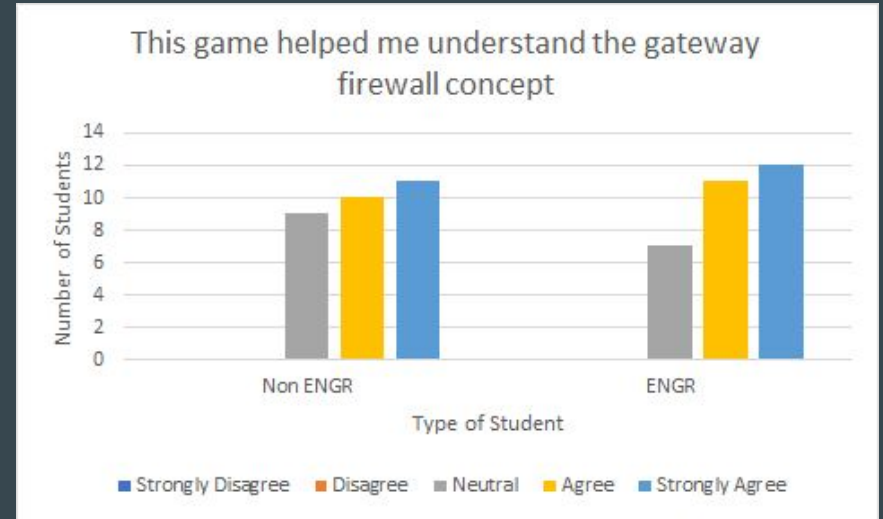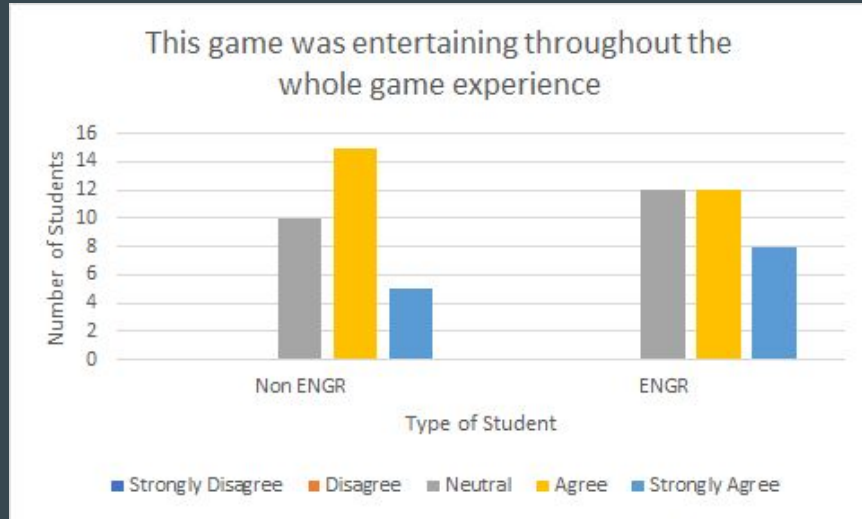

This game helped me understand what information the FIrewall is looking for in particular.

This game helped me understand the different cchecks that each packet are required to go thru.

Post Survey Results (cont.)

This game was entertaining throughout the whole game experience
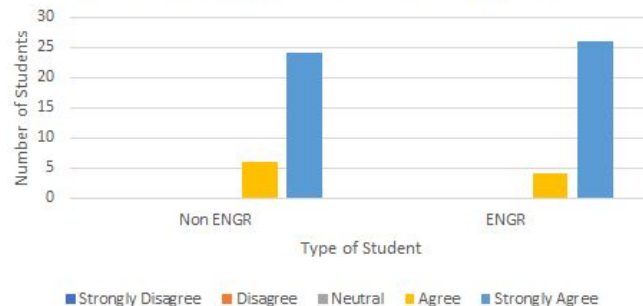
This game helped me understand the gateway firewall concept

Future Developments

- Add more games surrounding other cybersecurity topics
  - Buffer overflow
  - Viruses, worms, bots
  - Phishing
- Introduce to cyber security classes as a new way to teach students basic cyber security concepts

Citations

https://www.classcraft.com/blog/news/mcafee-cyber-security/

https://kamu.pbslearningmedia.org/resource/nvcy-sci-cyberlab/nova-cybersecurity-lab/#.WueG2YjwY2w

https://security.tamu.edu/Cyber_Security_Games.php