

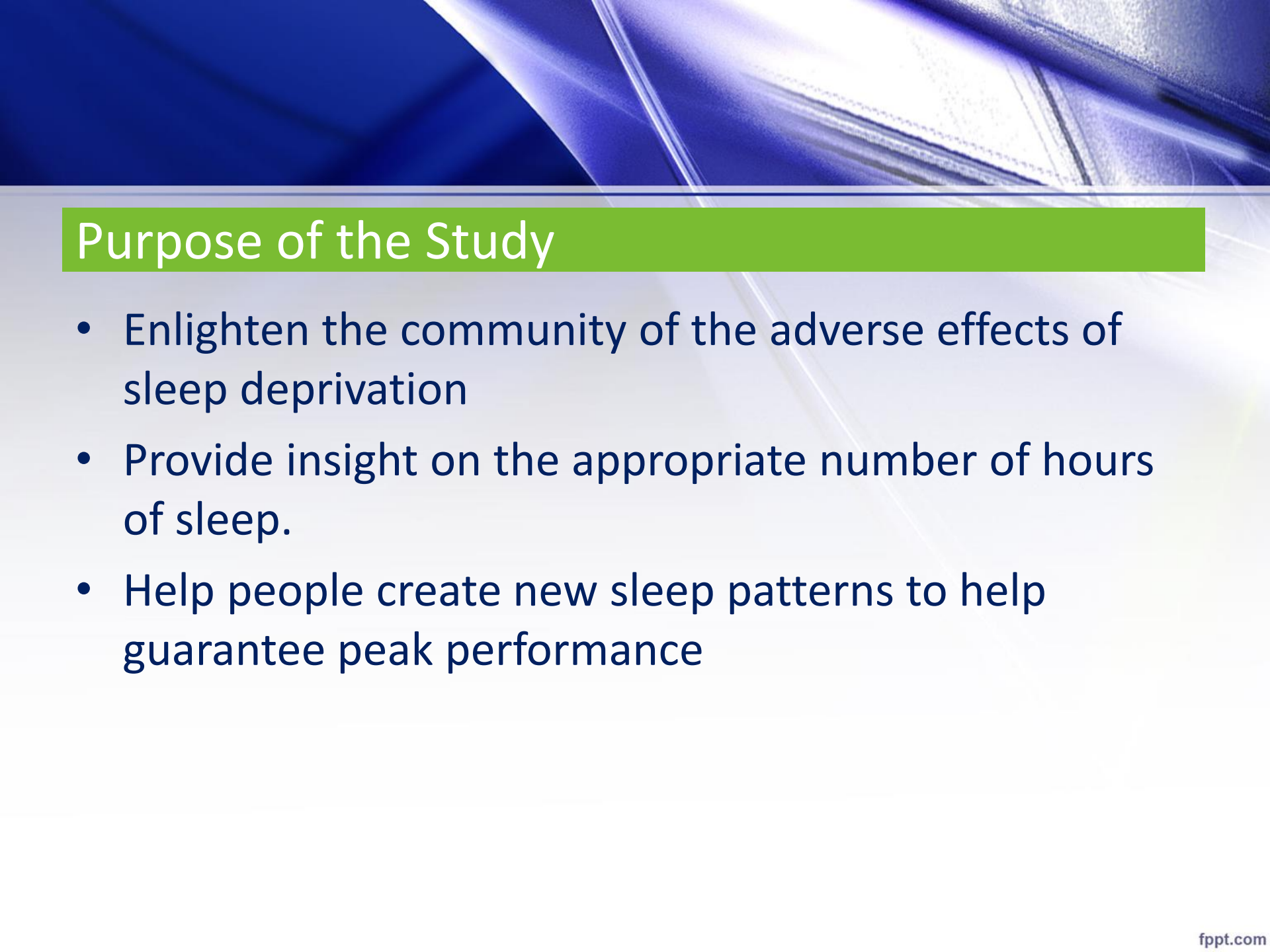
The Effects of Sleep Deprivation on Memory,
Problem Solving and Critical Thinking
An Ex-Post Facto Experimental Study

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Psychology 211

Research Methods for the Behavioral Sciences
Northern Virginia Community College, Loudoun
Campus

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Purpose of the Study

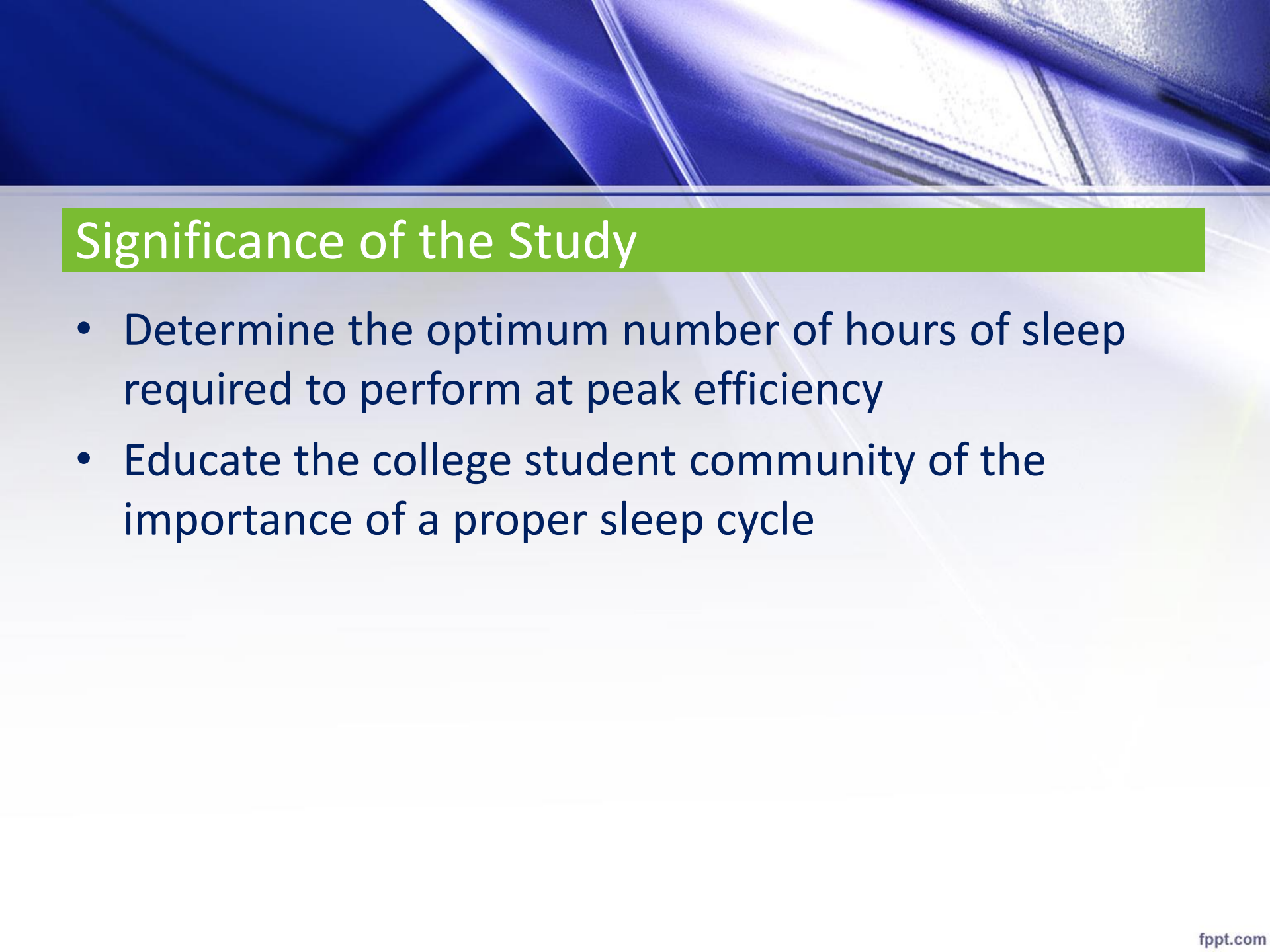
- Enlighten the community of the adverse effects of sleep deprivation
- Provide insight on the appropriate number of hours of sleep.
- Help people create new sleep patterns to help guarantee peak performance

Questions

- Major
 - How does a lack of sleep impact memory, problem solving and critical thinking skills amongst college students?
- Minor
 - What are the differences between genders?
 - What age group will be most affected by sleep deprivation?
 - Is there a point where the skills stagnate after a certain number of hours of sleep?

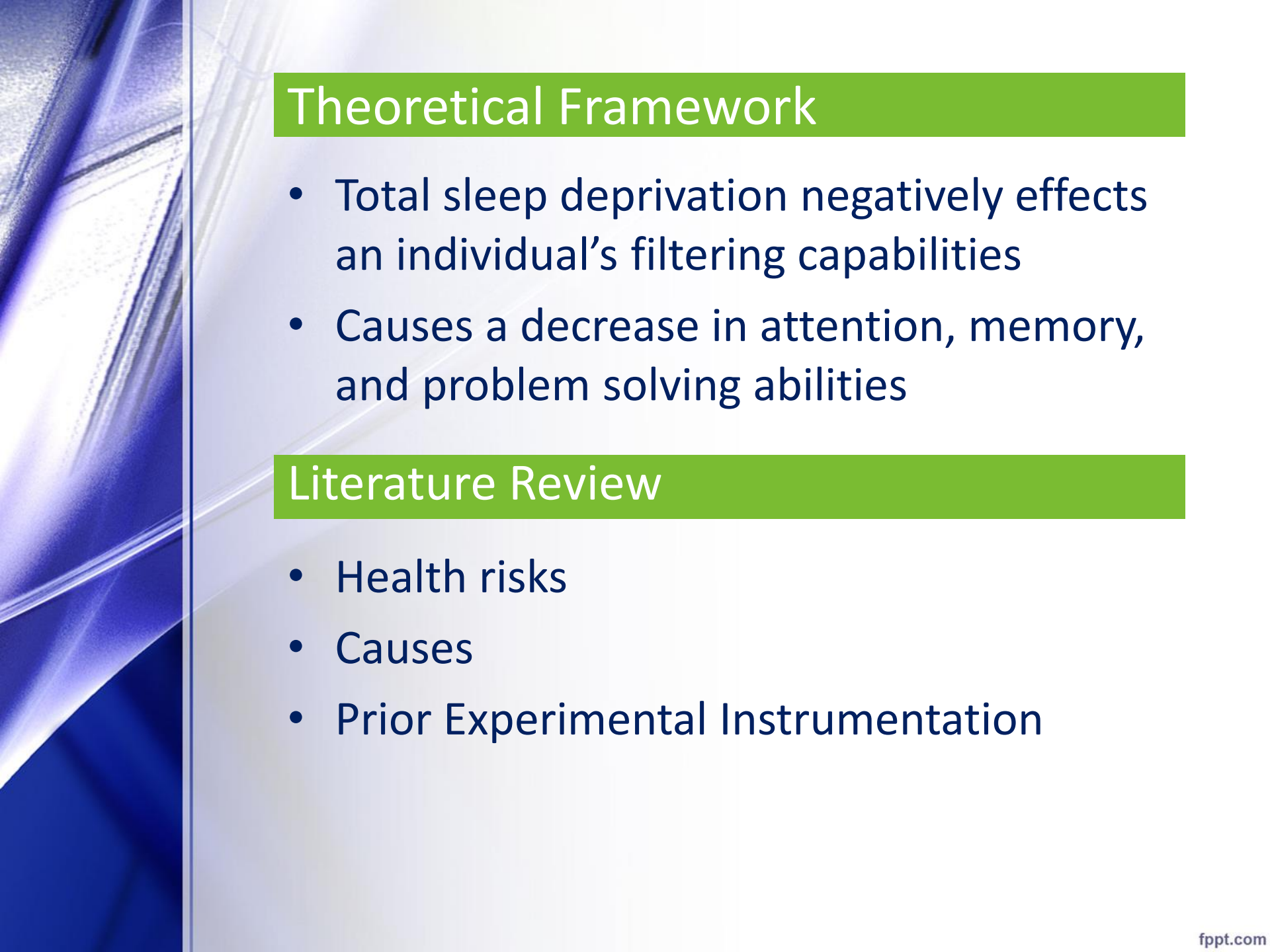
Hypothesis

- College students that obtain between seven to eight hours of sleep each night will achieve higher scores on the Cognitive Function Abilities Assessment administered than those who receive six or less hours of sleep per night.



Significance of the Study

- Determine the optimum number of hours of sleep required to perform at peak efficiency
- Educate the college student community of the importance of a proper sleep cycle

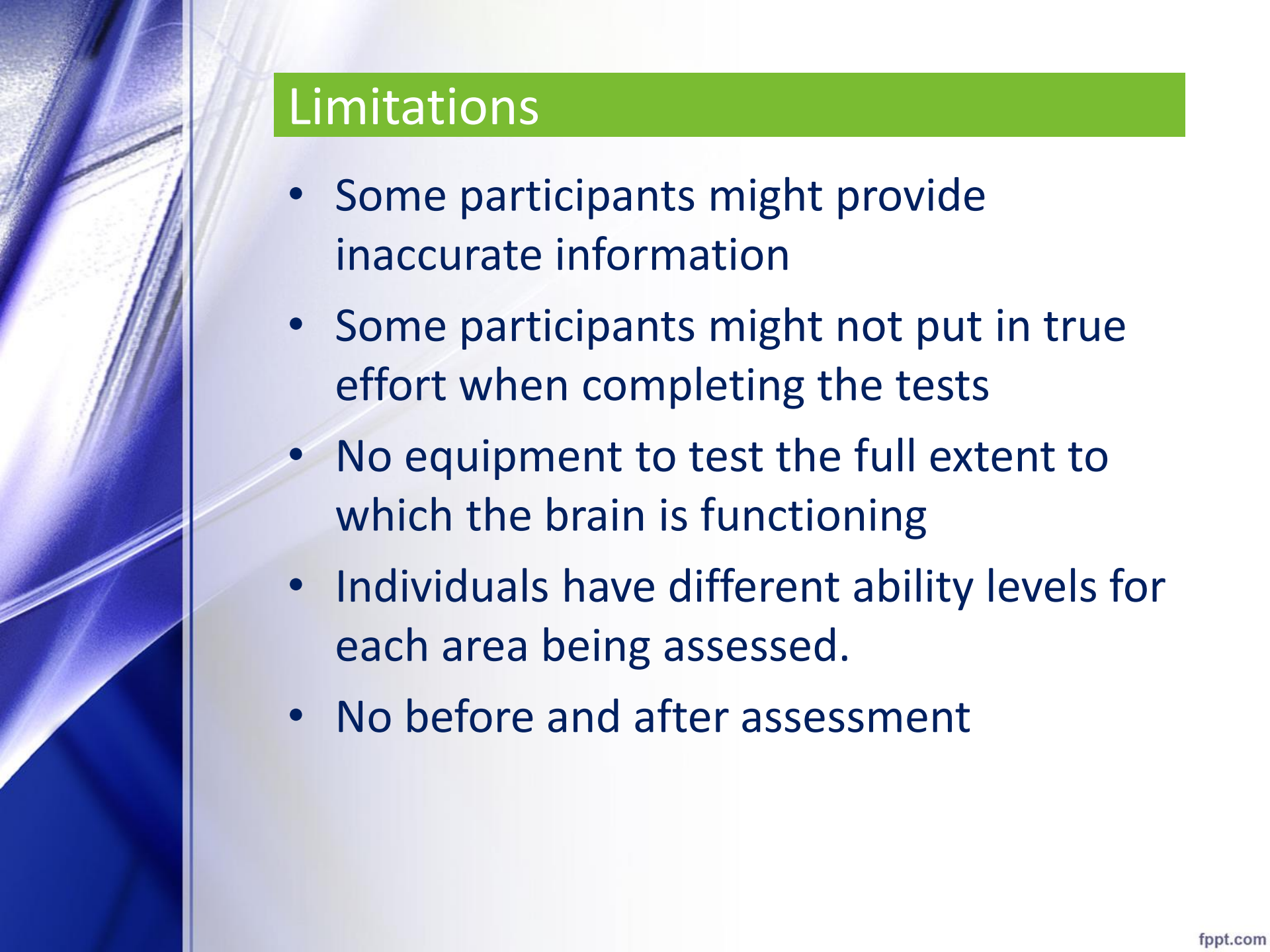


Theoretical Framework

- Total sleep deprivation negatively effects an individual's filtering capabilities
- Causes a decrease in attention, memory, and problem solving abilities

Literature Review

- Health risks
- Causes
- Prior Experimental Instrumentation



Limitations

- Some participants might provide inaccurate information
- Some participants might not put in true effort when completing the tests
- No equipment to test the full extent to which the brain is functioning
- Individuals have different ability levels for each area being assessed.
- No before and after assessment

Delimitations

- Study is based at the Loudoun Campus of Northern Virginia Community College
- Students in this study are eighteen years of age or older
- All subjects receive the exact same assessment

Methodology

- Ex post facto design method: quasi-experimental design which compares two groups with a preexisting independent variable and compares the effects on a single dependent variable.

EX POST FACTO DESIGNS

• Simple Ex Post Facto Design

Group	Time →	
	Prior events	Investigation period
Group1	Exp	Obs
Group2	----	Obs

- Similar to the static group comparison
- In this case the "treatment" occurred long before the study
- Experience instead of treatment

(Rahimi, 2014)

Sampling Design

- Simple stratified random sampling on the Northern Virginia Community College Loudoun Campus
 - 25 males
 - 25 females

Data Collection

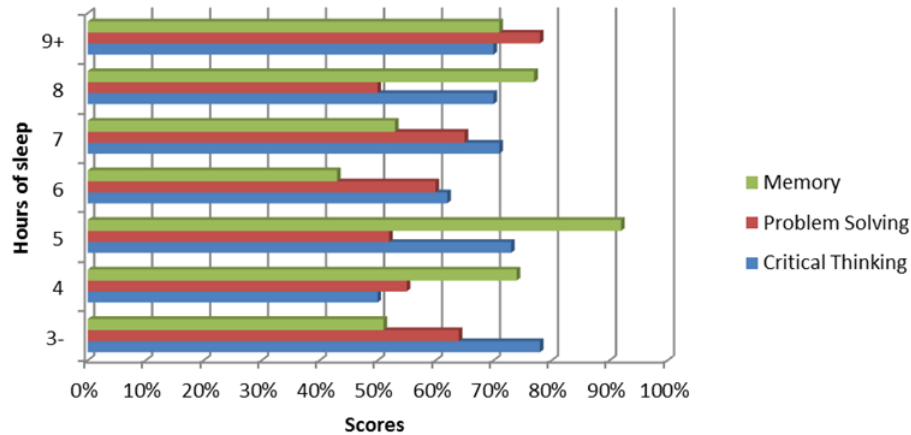
- Cognitive Function Abilities Assessment
 - Memory: Eric H. Chudler, Ph. D.
 - Problem Solving: PSAT questions
 - Critical Thinking: College of Forestry at Oregon State University Graduate School
- Signed informed consent form

Data Analysis

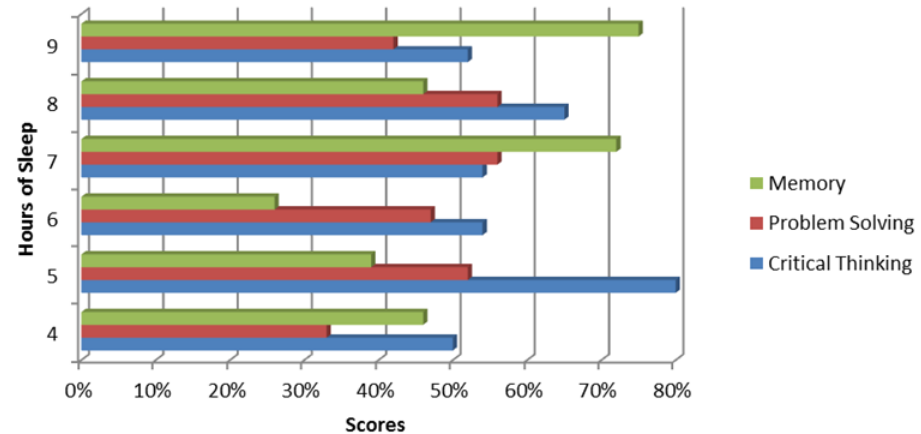
- Mean scores were compared from each section based on gender.
- T-test used to determine if there is significant difference between males and females in each area assessed
- Correlation determined by:
$$r = \frac{\sum((X - M_y)(Y - M_x))}{\sqrt{(SS_x)(SS_y)}}$$

Male v. Female Test Scores

Male Test Scores

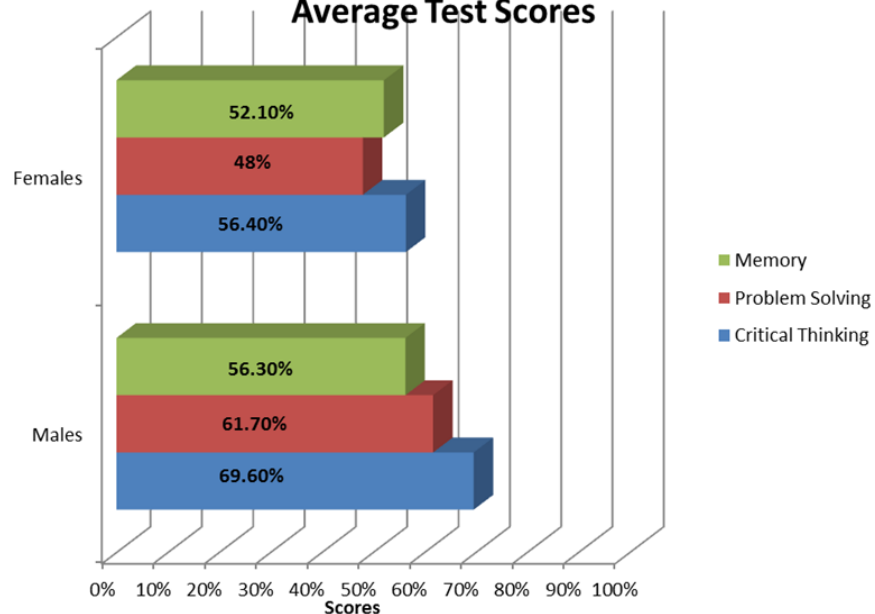


Female Test Scores

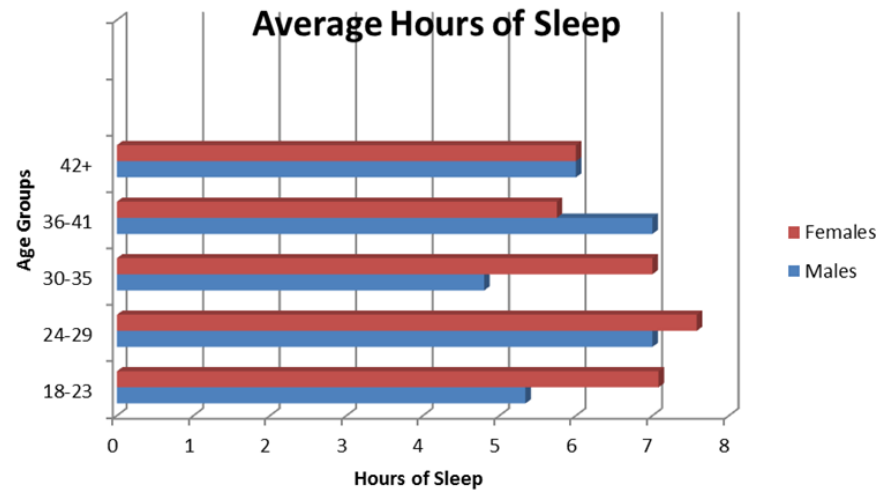


Scores and Sleep

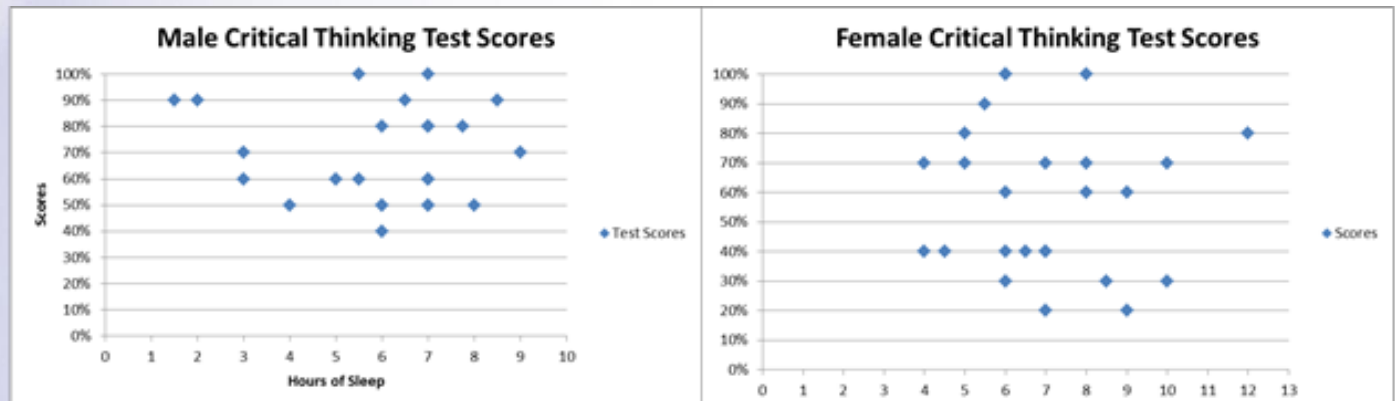
Average Test Scores



Average Hours of Sleep



Critical Thinking



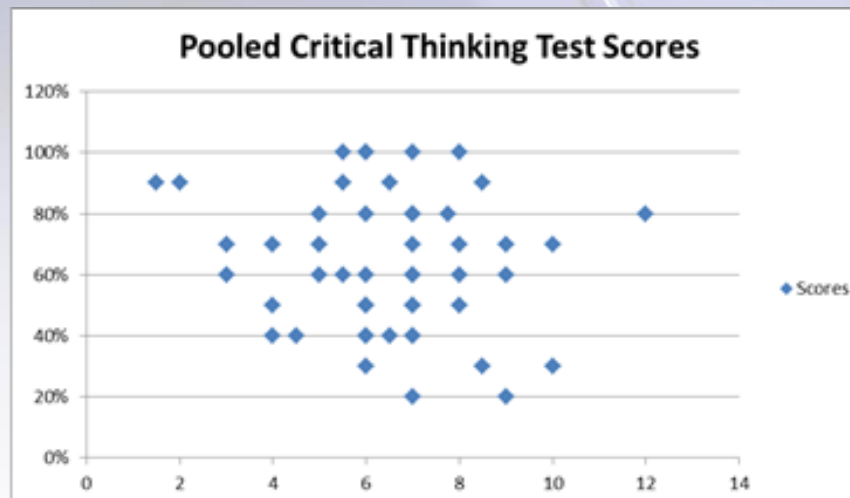
P value = 0.353537; Results prove insignificant at $P < 0.05$

Standard Deviation = 32.86071

$t = 1.877891$; Failed to reject the null hypothesis. In doing so, it has shown that neither gender is more affected by sleep deprivation than the other.

Critical Thinking	
Calculating t	
$n_1 = 25$	$n_2 = 25$
$df_1 = 24$	$df_2 = 24$
$M_1 = 0.696$	$M_2 = 0.6$
$SS_1 = 0.77$	$SS_2 = 1.52$
$S_1^2 =$	$S_2^2 = 0.06$
$S_p^2 = 0.0477$	
$S_{(M1-M2)} = 0.06$	
$t = 1.877819$ Null Hypothesis Not Rejected	

Critical Thinking Cont.



X Values

$$\Sigma = 324.25$$

Mean = 6.485

$$\Sigma(X - M_x)^2 = SS_x = 199.551$$

$$r = \Sigma((X - M_x)(Y - M_y)) / \sqrt{(SS_x)(SS_y)}$$

$$r = -0.1319$$

Y Values

$$\Sigma = 3190$$

Mean = 63.8

$$\Sigma(Y - M_y)^2 = SS_y = 24578$$

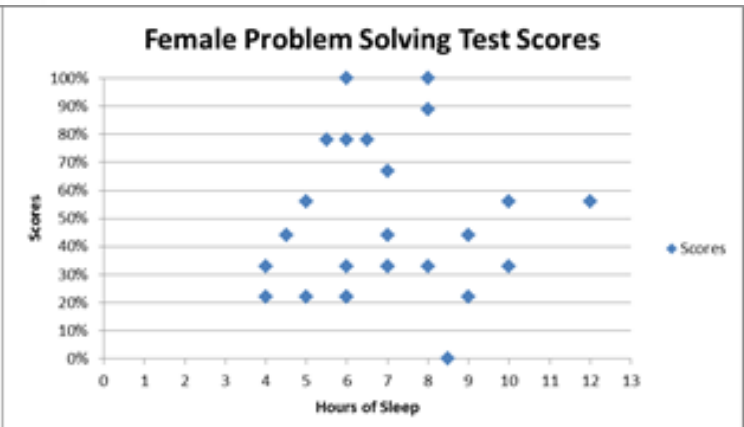
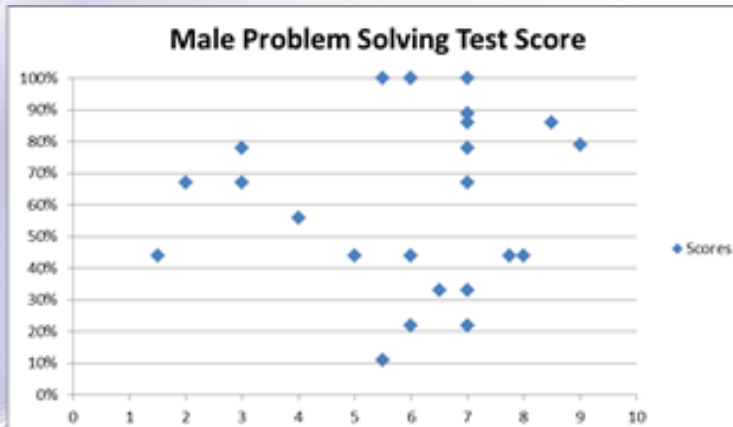
X and Y Combined

$$N = 50$$

$$\Sigma(X - M_x)(Y - M_y) = -292.15$$

Although there is technically a negative correlation, it is weak and very close to 0.

Problem Solving



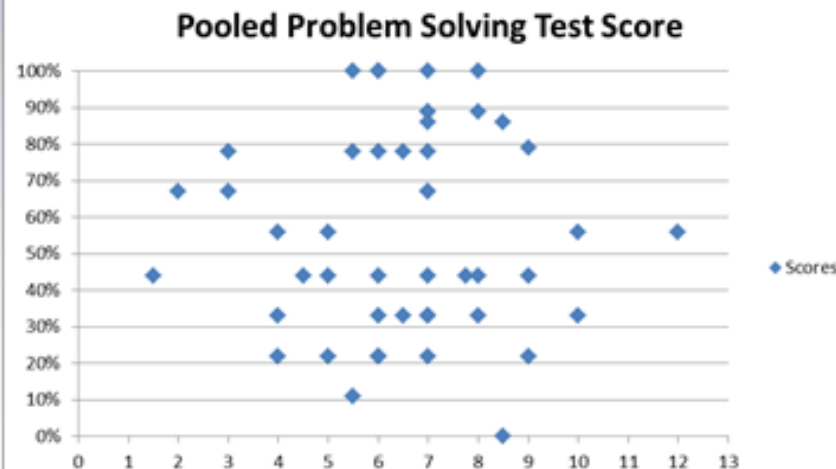
P value = 0.989002; Results prove insignificant at $P < 0.05$

Standard Deviation = 31.6709

$t = 1.994199$; Failed to reject the null hypothesis. In doing so, it has shown that neither gender is more affected by sleep deprivation than the other.

Problem Solving	
Calculating t	
$n_1 = 25$	$n_1 = 25$
$df_1 = 24$	$df_1 = 24$
$M_1 = 0.6332$	$M_1 = 0.5$
$SS_1 = 1.84$	$SS_1 = 1.74$
$S_1^2 =$	$S_1^2 = 0.07$
$S_p^2 = 0.074544$	
$S_{(M1-M2)} = 0.08$	
$t = 1.994199$	Null Hypothesis Not Rejected

Problem Solving Cont.



X Values

$$\Sigma = 324.25$$

$$\text{Mean} = 6.485$$

$$\Sigma(X - M_x)^2 = SS_x = 199.551$$

Y Values

$$\Sigma = 2781$$

$$\text{Mean} = 55.62$$

$$\Sigma(Y - M_y)^2 = SS_y = 38745.78$$

X and Y Combined

$$N = 50$$

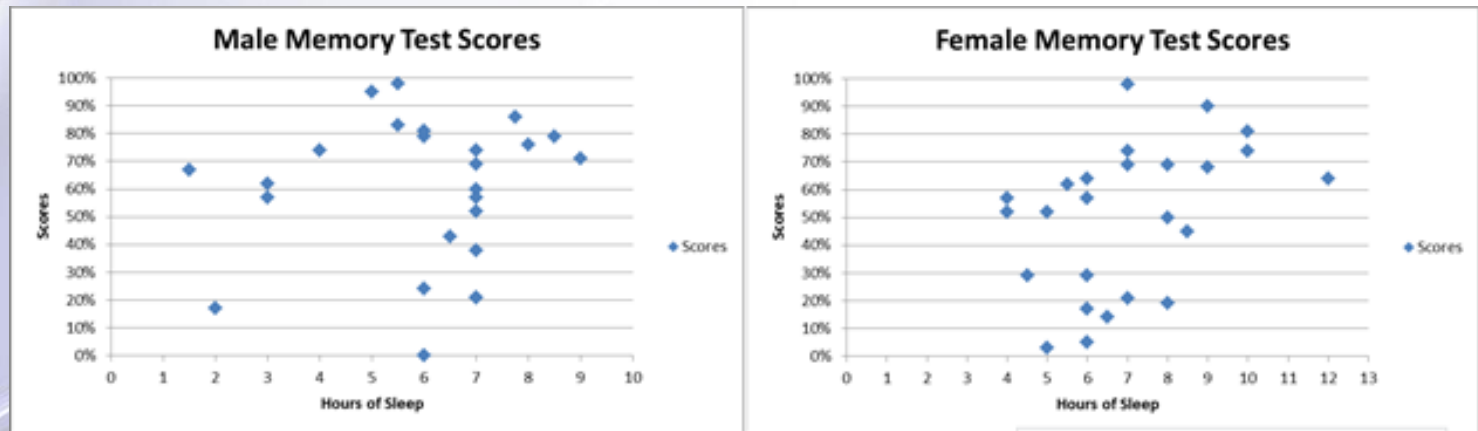
$$\Sigma(X - M_x)(Y - M_y) = -6.785$$

$$r = \Sigma((X - M_y)(Y - M_x)) / \sqrt{(SS_x)(SS_y)}$$

$$r = -0.0024$$

Although there is technically a negative correlation, it is weak and very close to 0.

Memory



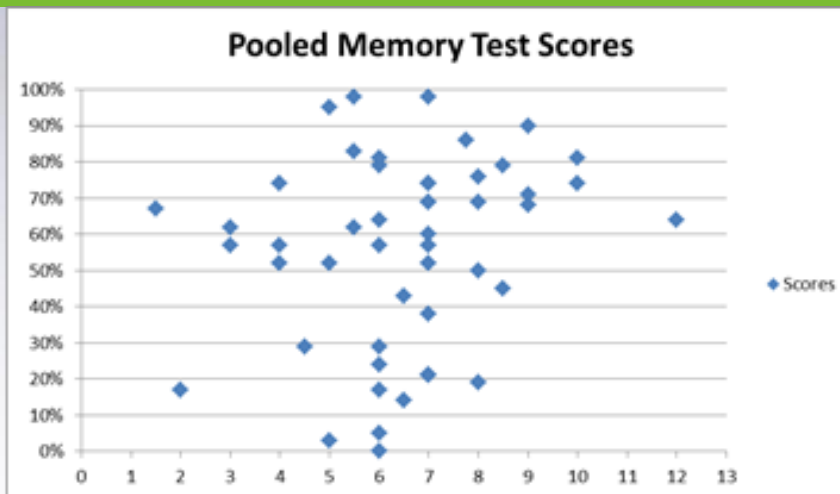
P value = 0.609543; Results prove insignificant at $P < 0.05$

Standard Deviation = 30.73116

$t = 1.18133$; Failed to reject the null hypothesis. In doing so, it has shown that neither gender is more affected by sleep deprivation than the other.

Memory	
Calculating t	
$n_1 = 25$	$n_2 = 25$
$df_1 = 24$	$df_2 = 24$
$M_1 = 0.5936$	$M_2 = 0.5$
$SS_1 = 1.66$	$SS_2 = 1.70$
$S_1^2 =$	$S_2^2 = 0.07$
$S_p^2 = 0.069996$	
$S_{(M_1 - M_2)} = 0.07$	
$t = 1.18133$ Null Hypothesis Not Rejected	

Memory Cont.



X Values

$$\Sigma = 324.25$$

$$\text{Mean} = 6.485$$

$$\Sigma(X - M_x)^2 = SS_x = 199.551$$

Y Values

$$\Sigma = 2747$$

$$\text{Mean} = 54.94$$

$$\Sigma(Y - M_y)^2 = SS_y = 34574.82$$

X and Y Combined

$$N = 50$$

$$\Sigma(X - M_x)(Y - M_y) = 522.205$$

$$r = \Sigma((X - M_x)(Y - M_y)) / \sqrt{(SS_x)(SS_y)}$$

$$r = 0.1988$$

Although there is technically a positive correlation, it is weak and very close to 0.

Future Research

- Larger sample size
- Use of functional Magnetic Resonance Imaging machine, Electroencephalogram, or an Electromyography machine
- Before and after assessment

Conclusion

- Findings failed to support the hypothesis
- Recommend a repeat of the research

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