

# Bacon Brains: Video Games for Teaching the Science of Addiction

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# Presentation Overview

- Substance Use in Adolescence
- Prevalence and Benefits of Gaming
- Health Games
- Substance Abuse Education Games
- Gender Differences
- Development of the Program
- Evaluation of the Program
- Future Directions

## Introduction

- Adolescent Substance Use
  - 40% drink alcohol
  - 23% use marijuana
- Correlates of Use
  - future abuse
  - health issues
  - school failure
  - mental health problems

# Introduction

- Substance Use Interventions
  - Popular programs sometimes ineffective
    - DARE, Take Charge of Your Life
  - Some are quite effective
    - Amazing Alternatives
    - Combination of education & life-skills
  - Long history of using technology

# Prevalence of Gaming

- Children & Adolescent Media Use
  - 7 hours/day
  - multiple types of devices
- Game play
  - 85% of top 700 most popular apps are games
  - 97% play an hour a day
  - \$25b in yearly revenue

# Problems of Gaming

- Potential Deleterious Effects
  - pathological use
  - sexist attitudes
  - violence
  - impulsivity

# Benefits of Gaming

- Potential Benefits Effects
  - cognitive enhancement
  - social connection
  - motivation
  - education

## Benefits of Gaming

- Games as Education
  - “gamification”
  - “Serious Games”



# Health Games

- Can lead to improved outcomes
  - Cancer
    - Improved knowledge, more adherent to treatment
  - HIV prevention
    - Increased self-efficacy
  - Dancetown
    - Coordination, Cholesterol decrease
  - RWJ Foundation

# Substance Abuse Education Games

- Early examples of prevention games
  - Say No With Donny
  - Life Moves
- Structured Interventions
  - Refuse to Use
- NIDA-supported work
  - Reconstructors

# Gender Differences

- Typically not evaluated when looking at Substance Abuse Education interventions
- Boys & Girls do learn differently
  - deductive vs. inductive reasoning
  - communication style
  - sensitivity to group dynamics
  - preference for collaborative vs. competitive activities

# Gender Differences & Video Games

- Boys typically spend more time playing
- Boys and girls have different preferences
  - girls like social and educational games
  - boys like sports and violence

# Gender Differences & Science

- Stereotype that science is a “male” endeavor
- Evident even in early years
- Impact of stereotype
  - influences classes taken
  - influences career choices

# Overview

- Middle school is ideal time to intervene
- Previous approaches have had mixed results
- Our focus is solely on science education
- Tradition of using technology

# Intervention

- Created a series of video games
- Designed to teach substance abuse curriculum

# Hypotheses

- Knowledge scores: Intervention > Control
- Gains at Interim, Post, and Follow-up
- Girls improve more with collaborative play
- Boys improve more with competitive play



# Development of the Intervention

- Funded by NIDA R-25 award
- Began by creating core curriculum
- Review by
  - Substance Abuse Researchers
  - Educators
  - Students
- Detailed design document
- Hired independent contractor

## Description of the Intervention

- Series of six interactive video games
- Flash technology deployed on web
- Cross platform capable

# Description of the Intervention

1. Brain Structure and Function – Racing Game
2. Neurotransmission – Racing Game
3. Brain Reward System – Arcade-Style Game
4. Addiction is a Disease – Maze Game
5. Genetics of Addiction – Arcade-Style Game
6. Treatment for Addiction – Maze Game

# Bacon Brains Racing Games

- Guide robotic pig through track
- Collect brain parts
- Install correct part for a given mission
  - e.g., hippocampus to improve memory

# Bacon Brains Arcade Games

- Primary action occurs in the “arena”
- Use ray to release objects from grid
- Collect objects in bucket
- Brain Reward System Module
  - collect reinforcers (e.g., veggies, sundaes, etc.)
- Genetics of Addiction Module
  - collect nucleus, chromosomes, and genes

## Bacon Brains Maze Games

- Guide pigs through movie studio basement
- Collect audio / video clips
- Interspersed with matching games
- Proceed to editing room to apply audio and visual effects
- View entire animated content

# Bacon Brains Teaser Video

# Bacon Brains Evaluation

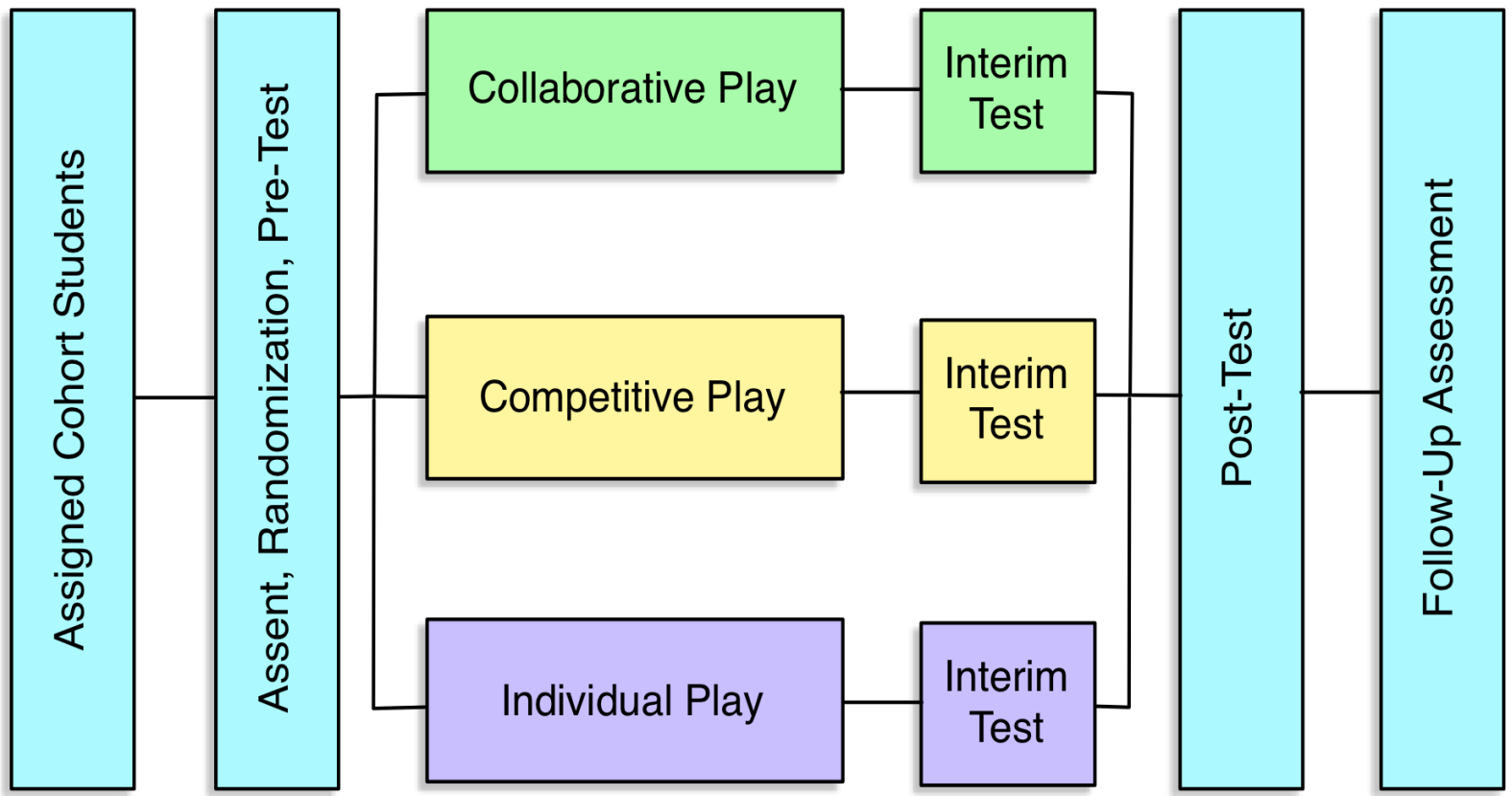
- After five years of development
- Secured agreement with charter school
- Restructured elective period
- All students invited to participate
- Consent gathered at beginning of year
- 12 ten-day cohorts



## Participants

- Random assignment to cohort
- Approximately 25 per group
- Mixed gender and grades

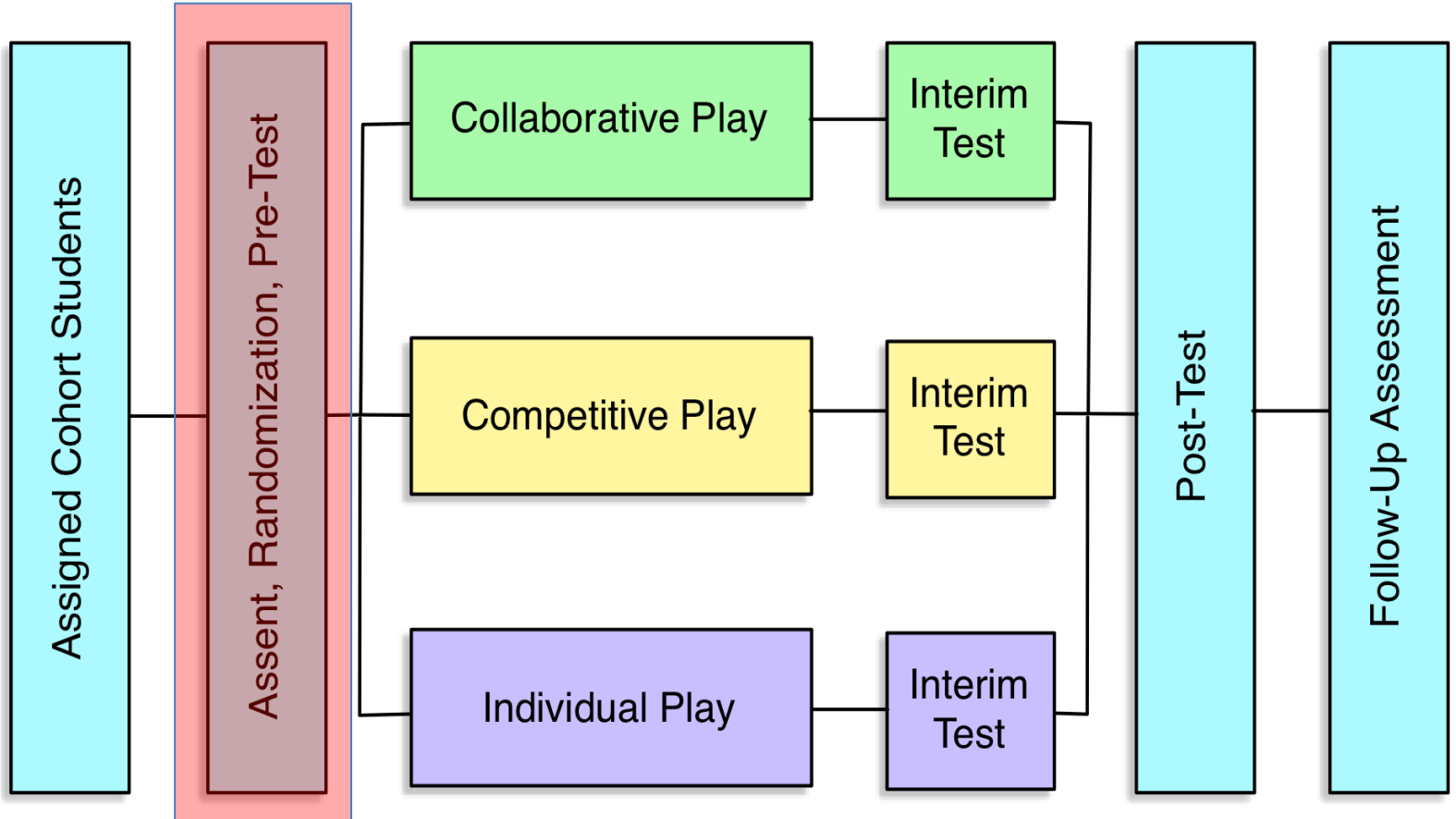
# Intervention Time-line



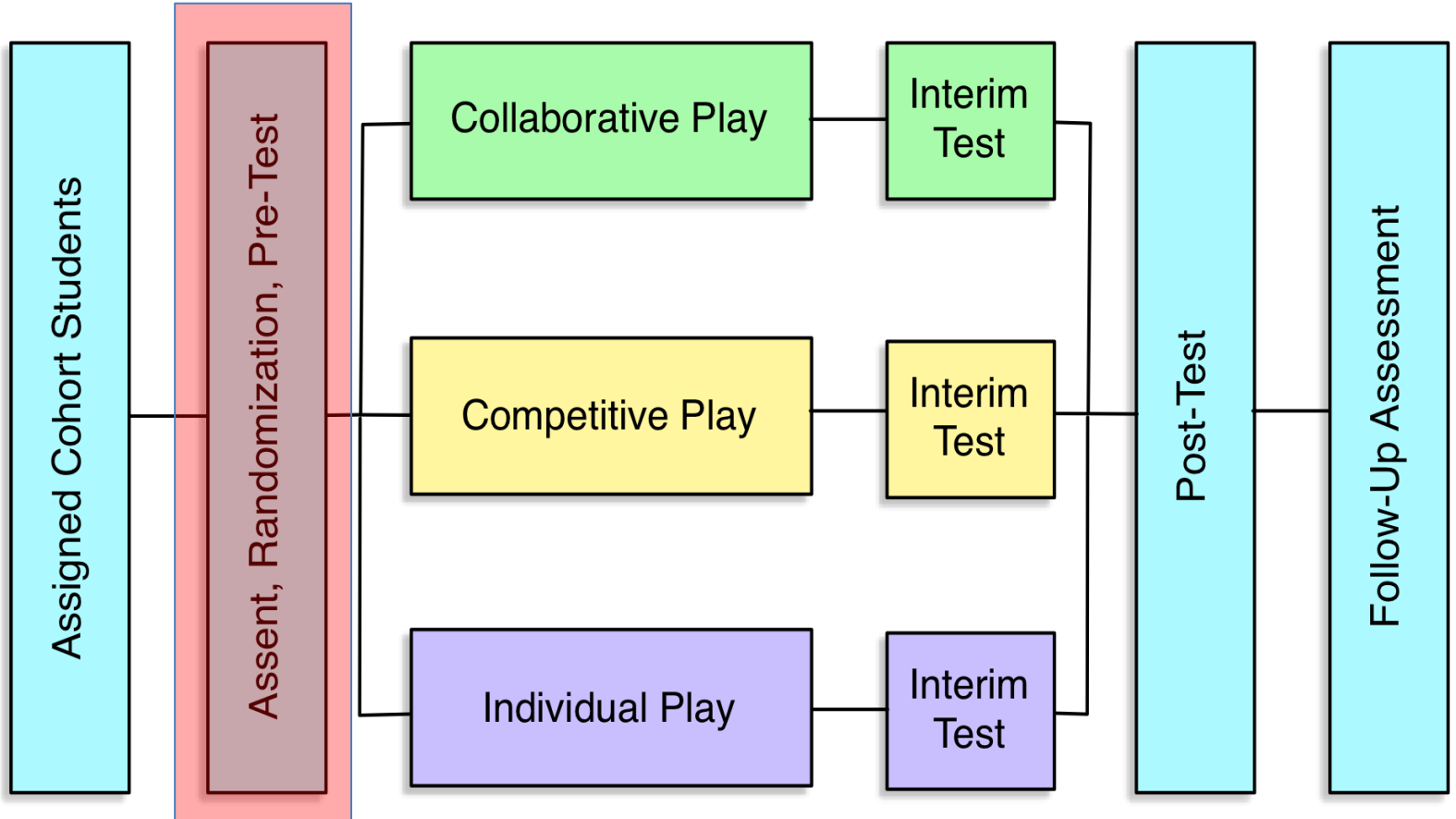
# Procedures

- Conducted in a dedicated classroom
- School provided laptops for each student

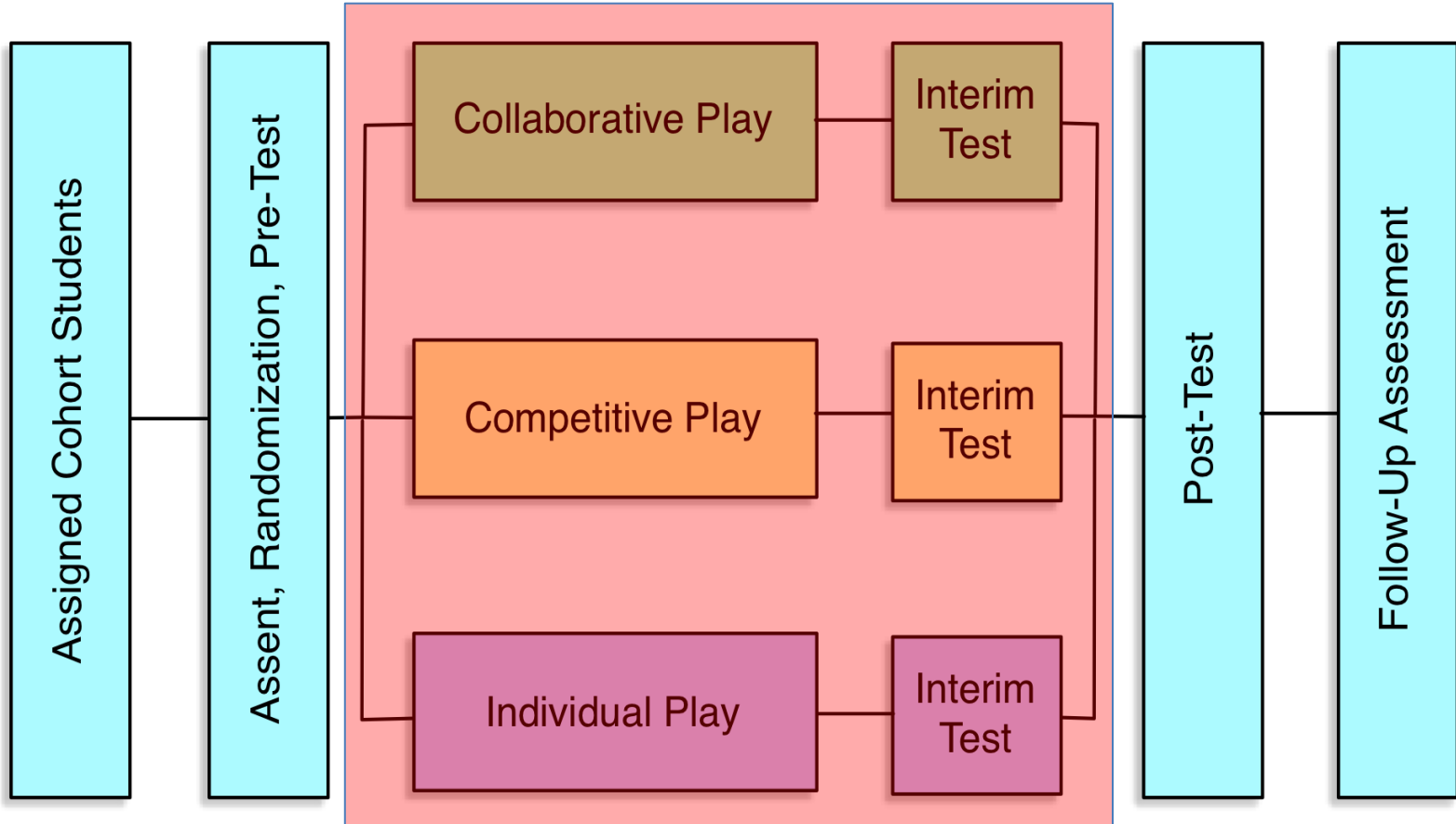
## Assent & Randomization



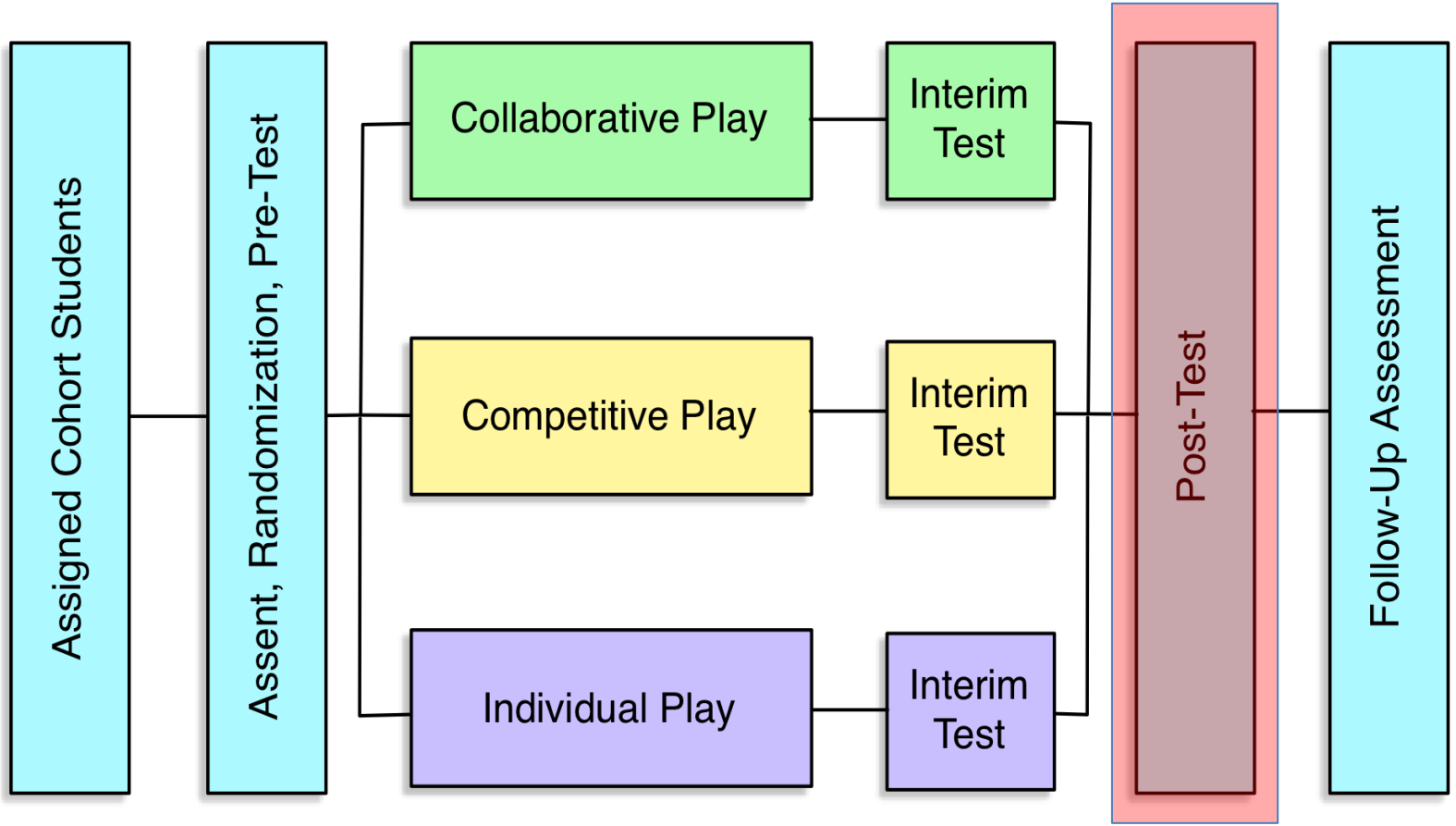
## Pre-Test



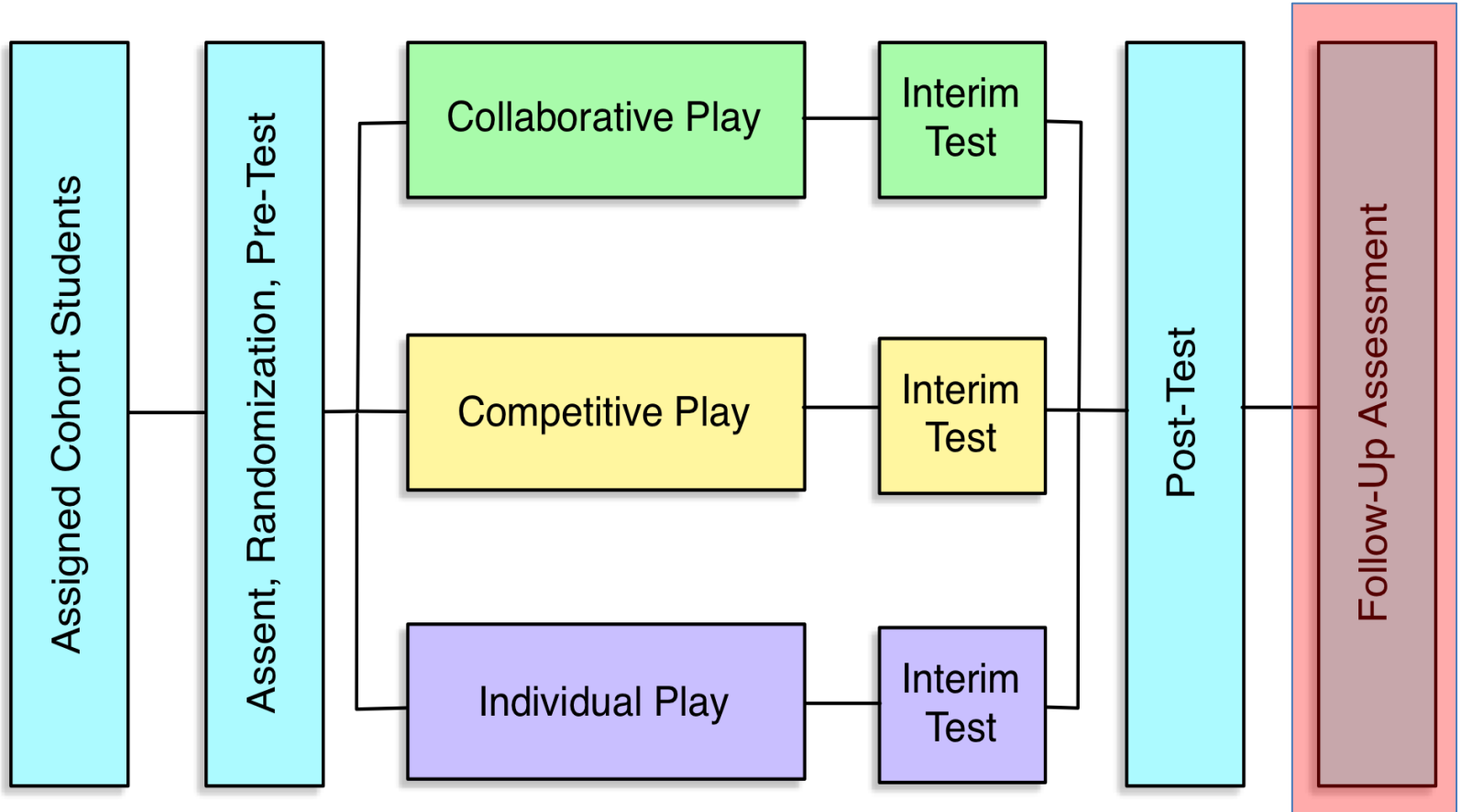
# Intervention & Interim Assessments



## Post-Test



## Follow-up





## Measures

- All data collected online via Qualtrics
  - secure
  - easily exportable
  - reduces data entry errors
- Played audio recordings of each question

# Knowledge Measures

- Set of 10 multiple-choice questions for each six modules
- Aligned directly to our curriculum content outlines
- Reviewed by educators and substance abuse researchers
- Pre, Interim, Post, Follow-up summations

# Gender Measures

- Children's Personal Attributes Questionnaire
- 21 five-point Likert items
  - e.g. “I almost always stand up for what I believe in” and “I am a gentle person”
- Three factor-derived sub-scales
  - masculinity, femininity, androgyny

# Science Attitudes

- Project specifically geared towards science education
- Used measure from previous projects
- Nine five-point Likert items
  - e.g. “I enjoy my science course” and “Doing science often makes me feel nervous.”

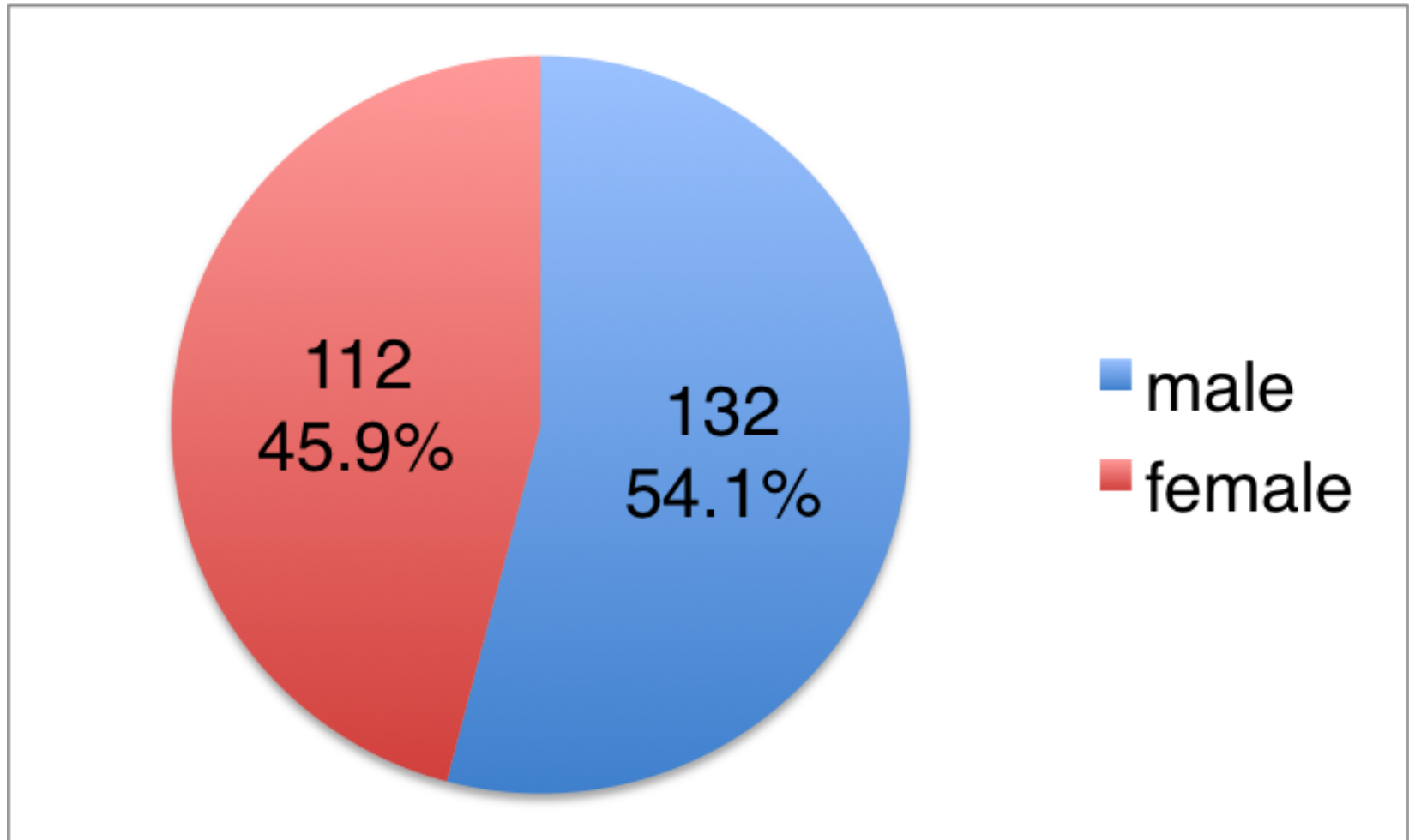
# Computer Experience

- Assessment of students' experiences using computers and video games
  - Ten five-point Likert items
  - e.g. “I like playing computer or video games,” and “I would describe myself as a gamer.”

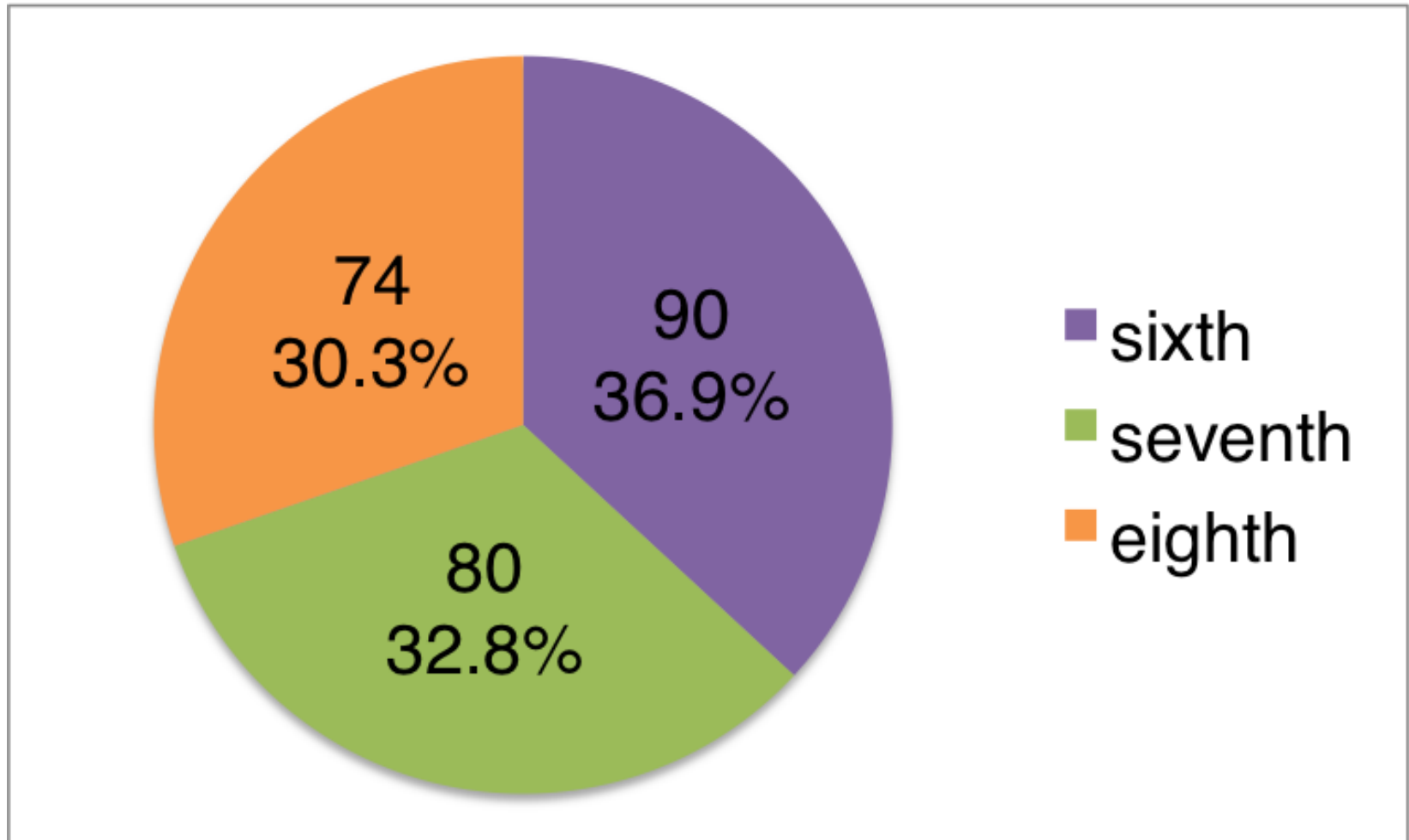
# Evaluation Results

- Twelve ten-day cohorts
- First two trimesters
- All students at school eligible

## Description of Participants

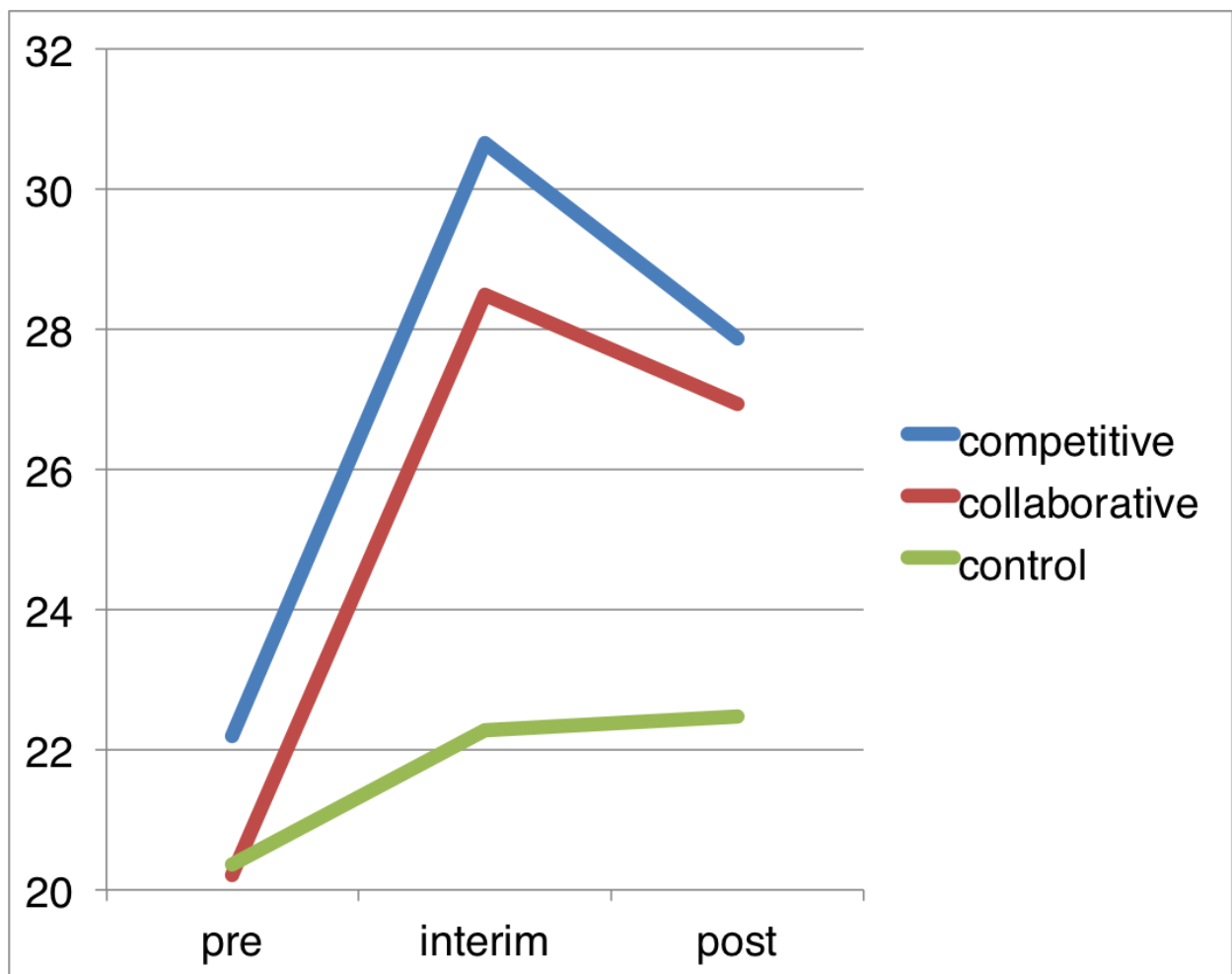


## Description of Participants

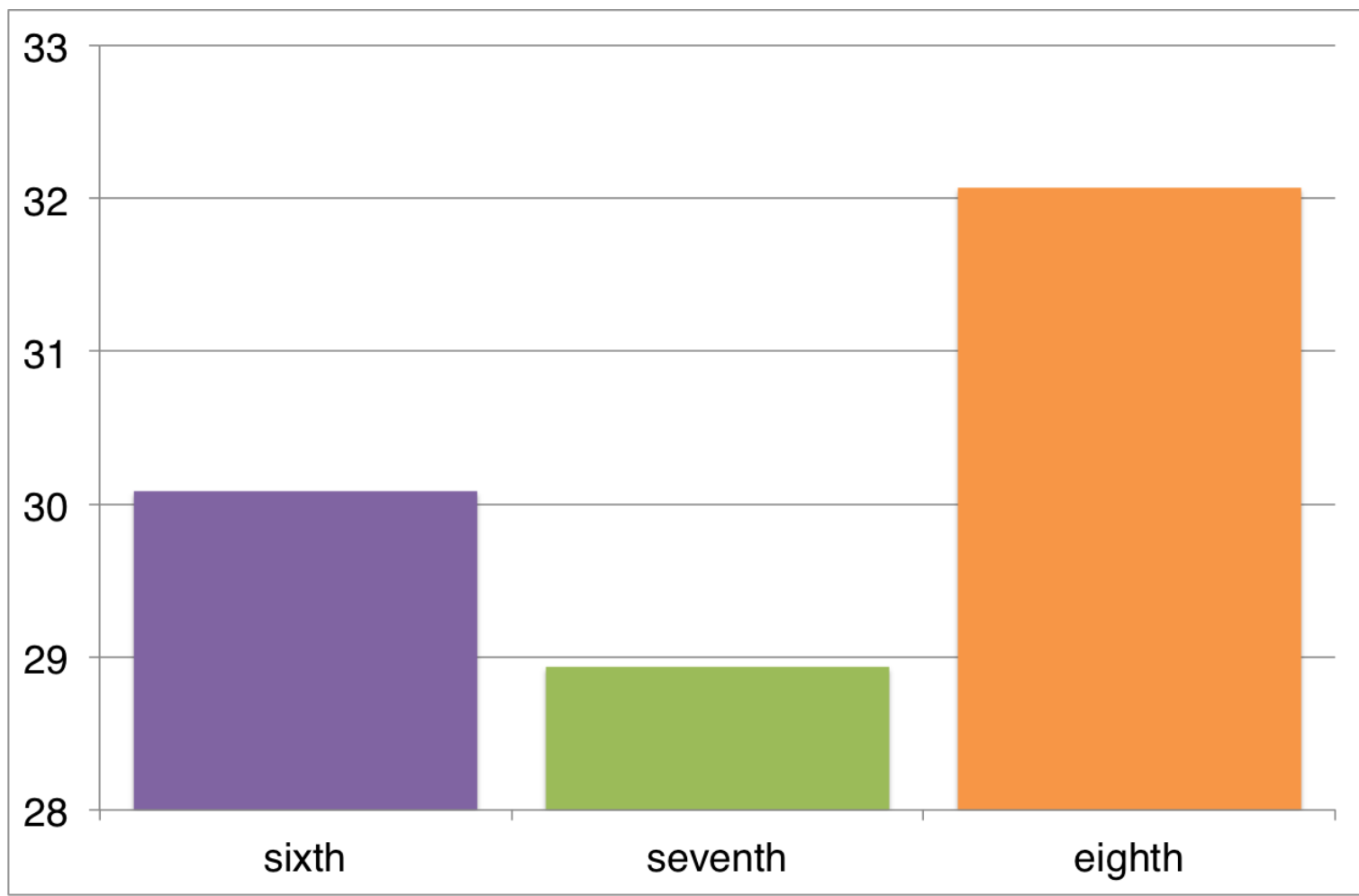




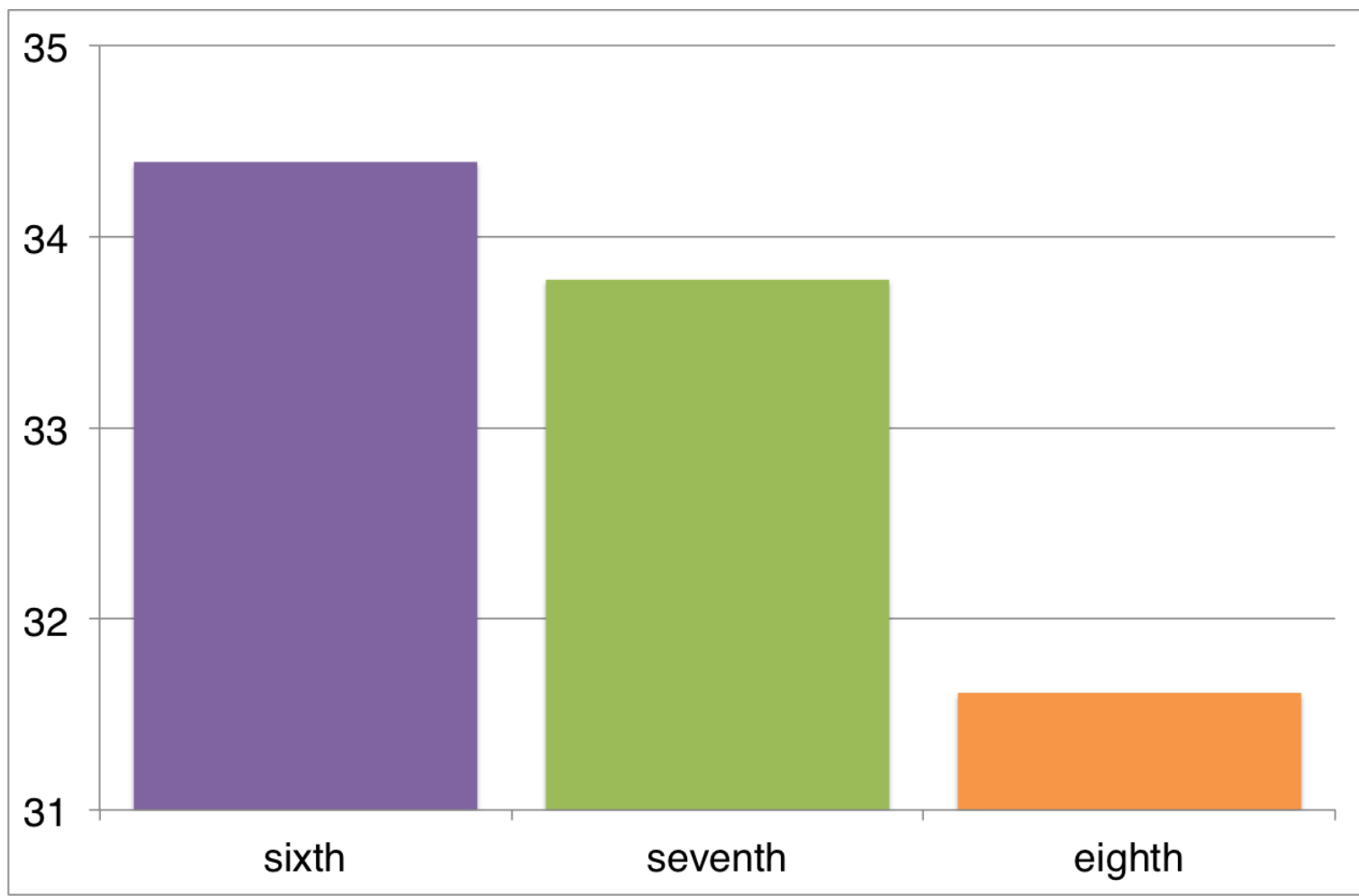
## Preliminary Analyses - Overall



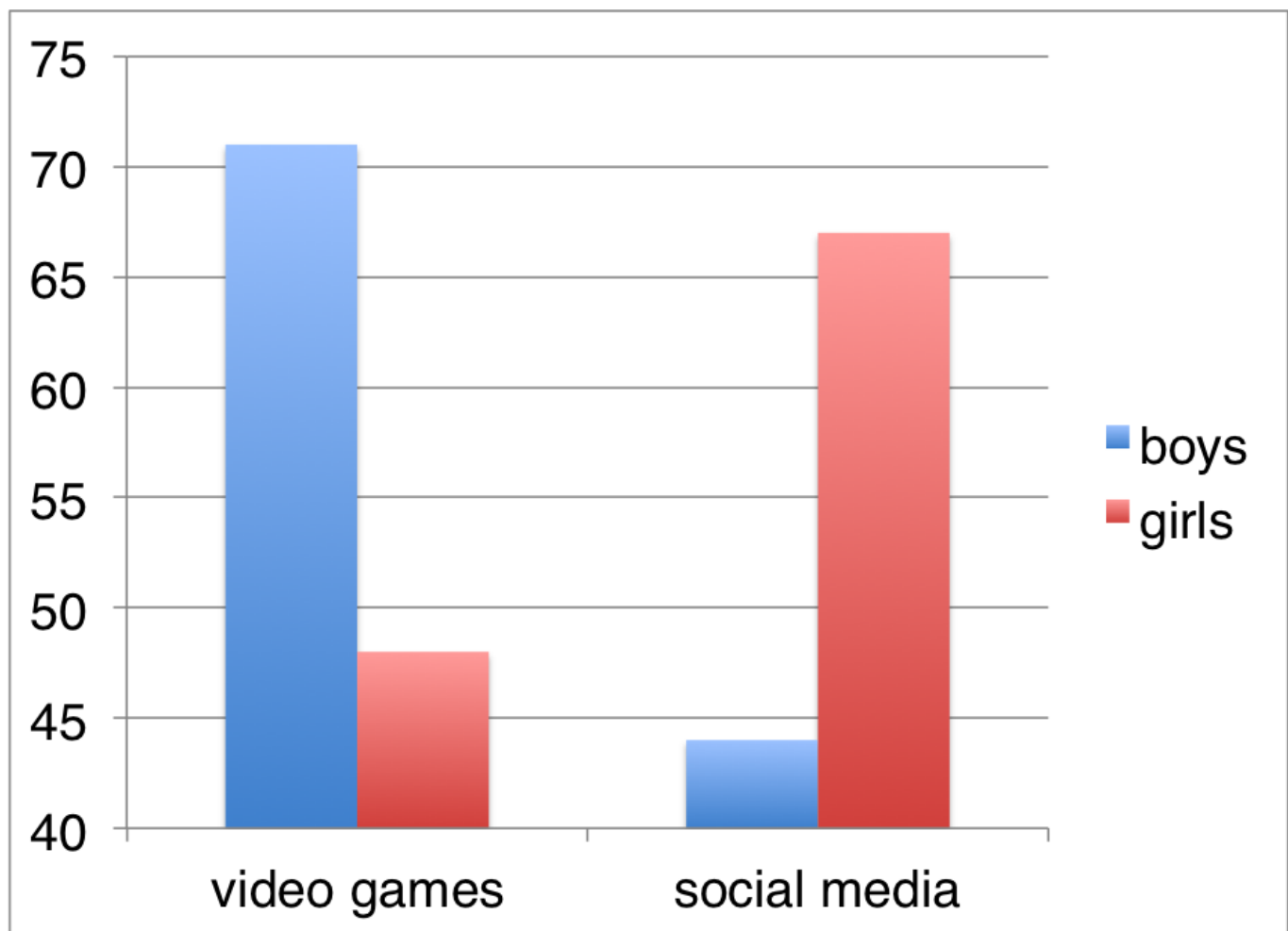
## Science Attitudes



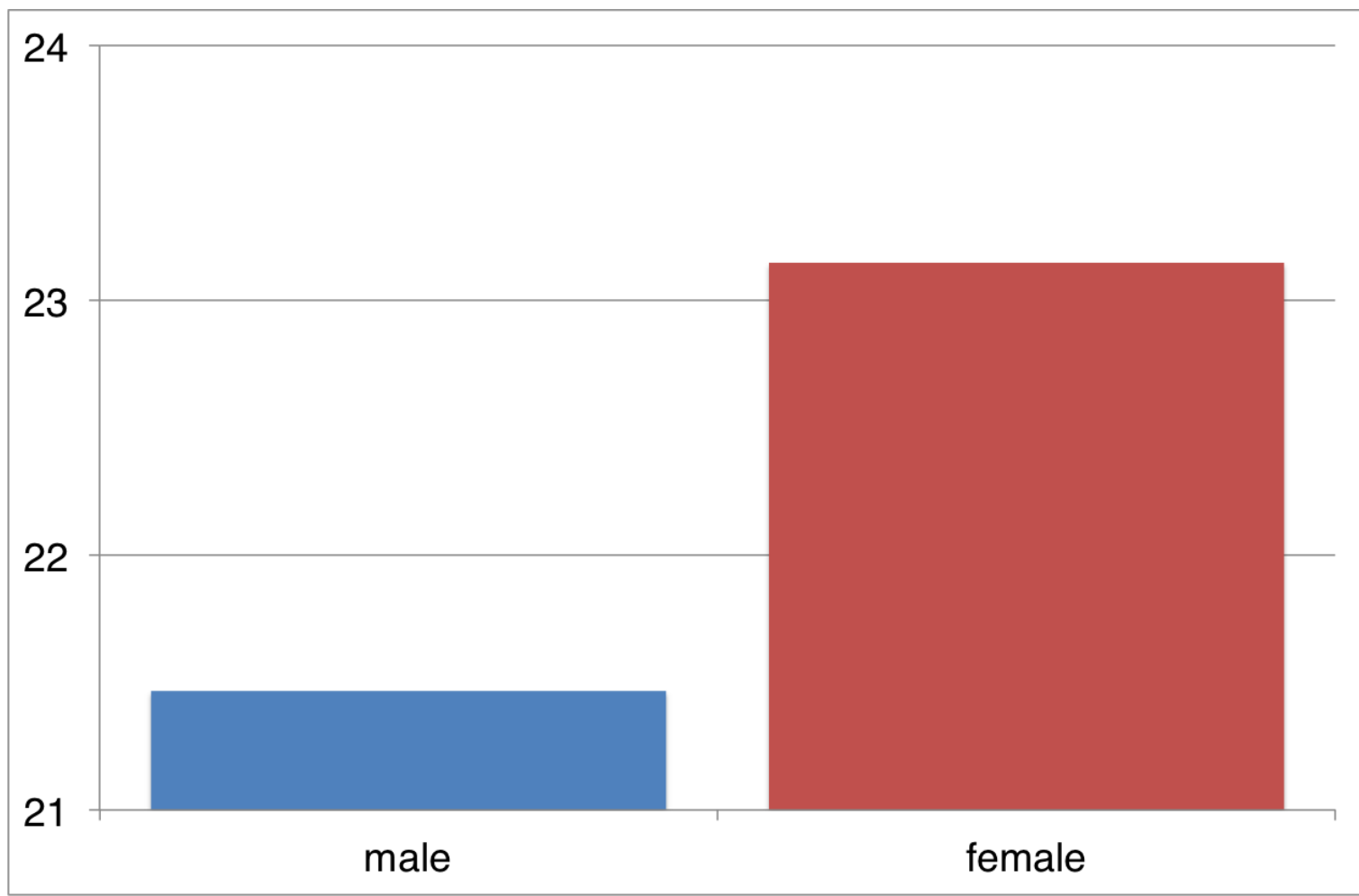
## Computer Gaming Experience



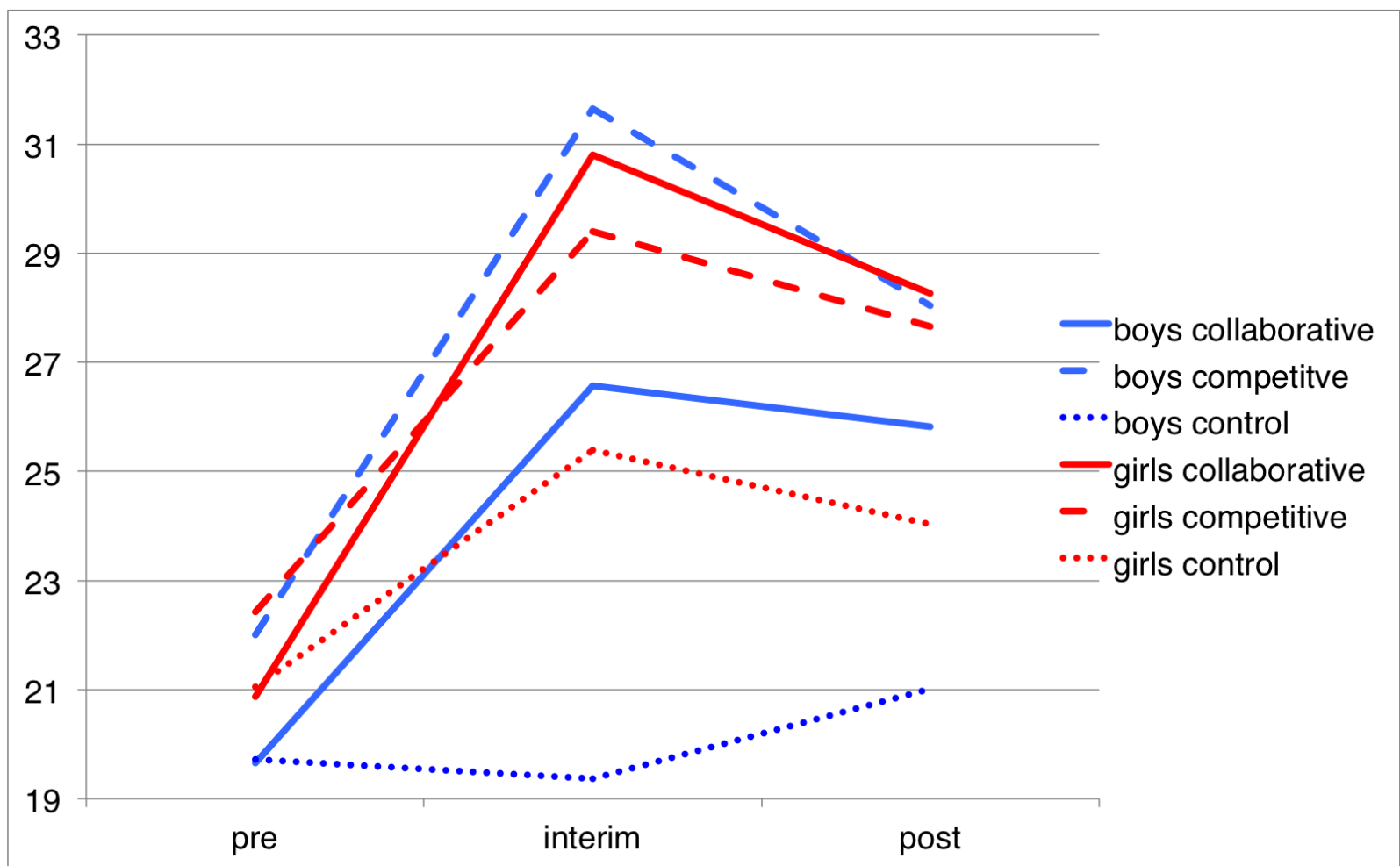
## Computer Use (3 or more hours/day)



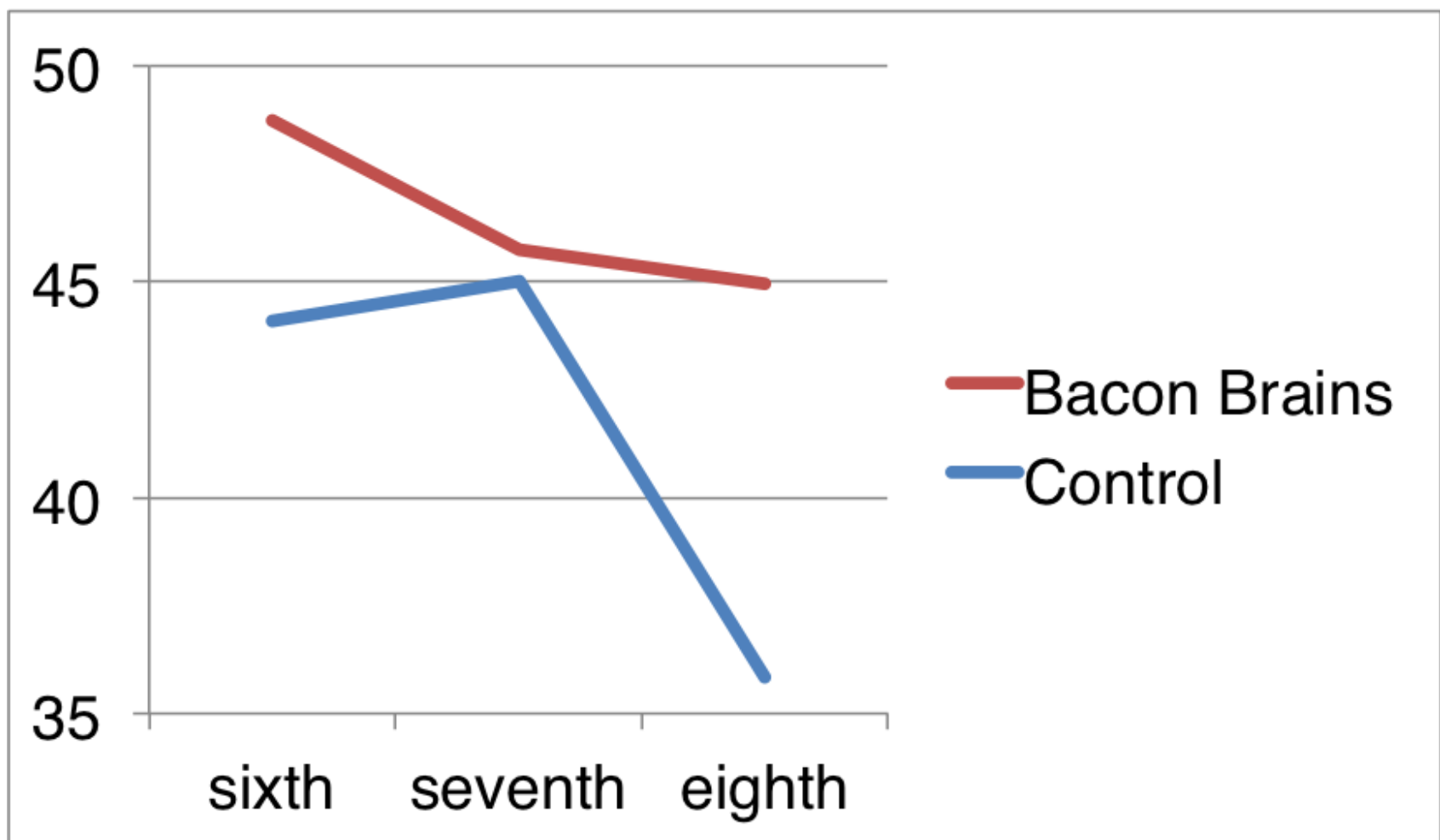
## Femininity Scale



## Primary Outcomes



## Satisfaction with Intervention



## Discussion

- Students enjoyed Bacon Brains
- Intervention effective in teaching our curriculum
- Significant gender effects
  - Boys learn best when competing
  - Girls learn regardless of condition



# Limitations

- Full-scale evaluation at school is difficult
  - Did not complete 8-week follow-up
  - Programs treated as a stand-alone activity
    - Ideally, integrate games into science classroom
    - Games used to reinforce complex topics

## Future Directions

# BACON BRAINS



TEACHER'S MANUAL



# Thanks

- NIDA & project officer Cathrine Sasek
- MIMH and my team
- Family for putting up with my obsession with bacon for six years

## References

- See notes section for complete list of references