



# Student Engagement, Science, Society, and Community at IMSA

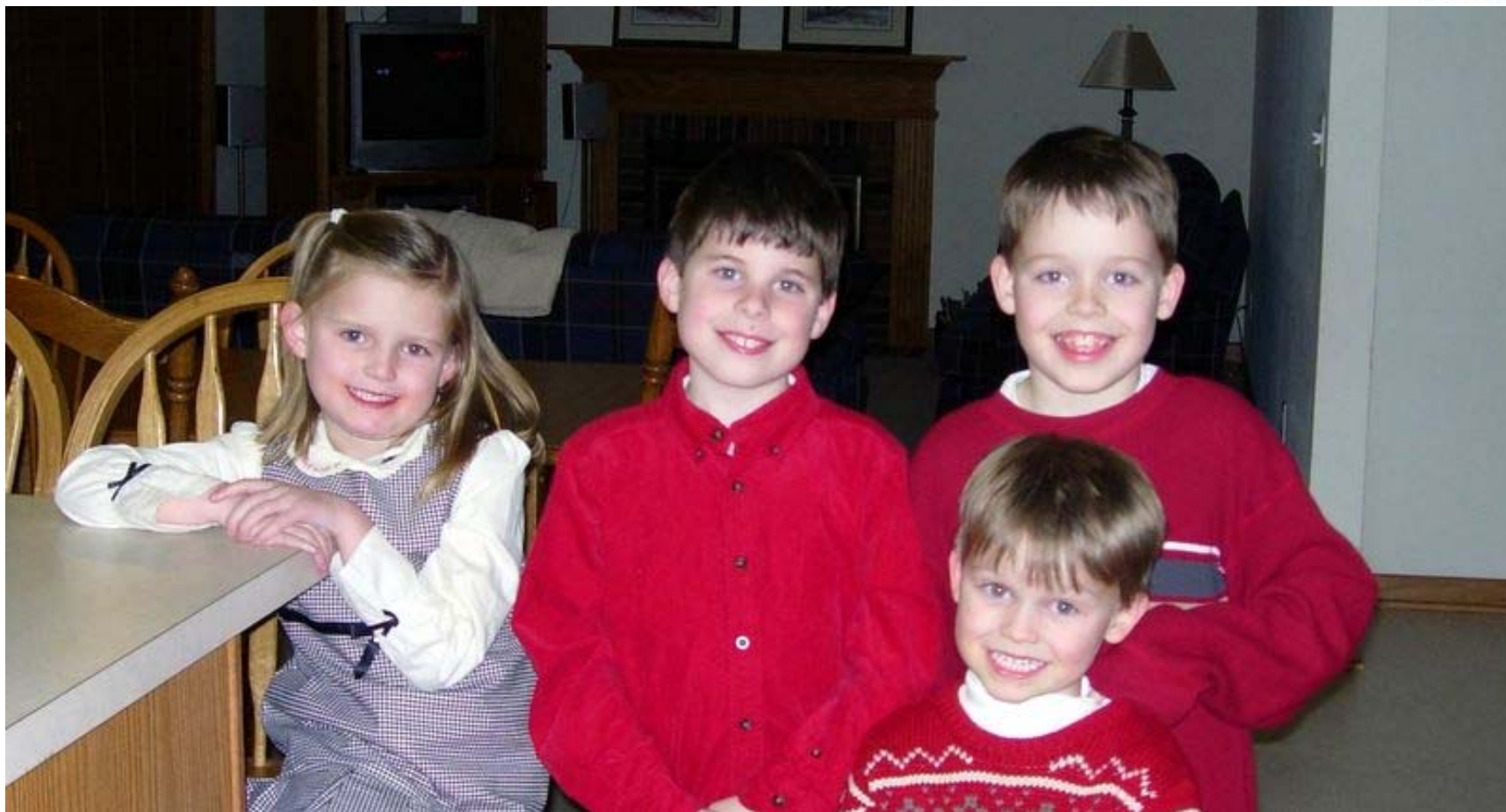
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*Coordinator of Research and Evaluation  
Illinois Mathematics and Science Academy*

*Advanced International Colloquium on Building the Scientific  
Mind, The Hague, Netherlands, May 19, 2005*



# The Smallest School



Illinois Mathematics and Science Academy<sup>®</sup>





# Inquiry and Mentorship

## Inquiry

- In-depth and actively pursued study of topics reflecting student interests.
  - Planning
  - Investigation
  - Analysis
  - Communication

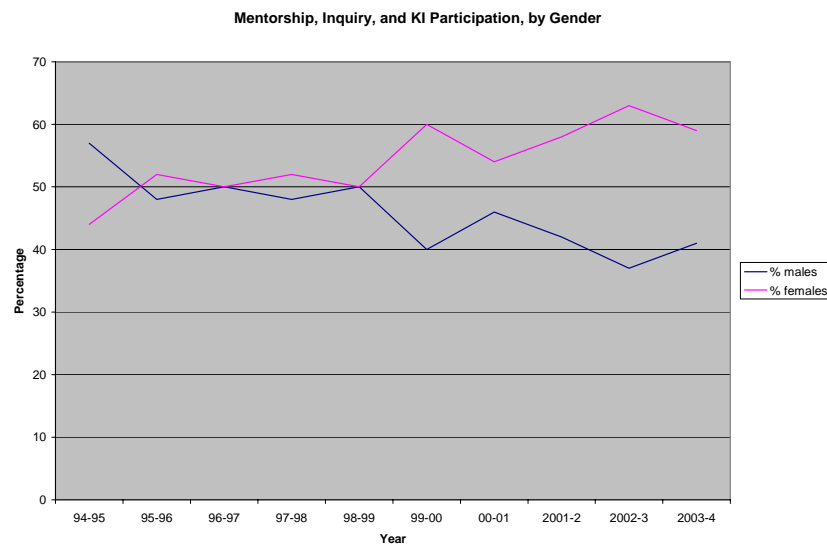
## Mentorship

- Actively pursued research under the direction of mentor working in industry or academic laboratory.



# Mentorship and Inquiry

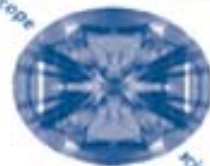
99-00	00-01	01-02	02-03	03-04
238	251	276	304	302





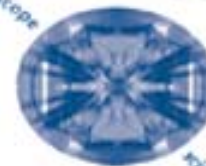
# Core Competency

- Competency-Driven
- Inquiry-Based
- Problem-Centered
- Integrative



## The Class of 2006

- The Class of 2006
  - 210 students active in spring of 2005
  - 5.7% African-American, 5.7% Latino, 35.7% Asian, 52.9% White/Mixed
  - 51% Female, 49% Male
  - 17.6% 8<sup>th</sup> graders, 82.4% 9<sup>th</sup> graders
  - 22.4% admitted through EXCEL for academic reasons



## Problem

- Needed to look for way of evaluating EXCEL program for students admitted with academic or transitional needs.
- Indicators included:
  - Academic performance
  - Social networking and engagement
  - Enrollment in upper-level elective courses





# Measuring Engagement

- We adopted the Motivated Strategies for Learning Questionnaire (Pintrich 1991) and modified it to reflect student engagement in mathematics
- The MSLQ is a self-administered instrument of 88 questions that measures 15 subscales related to student motivation and learning strategies



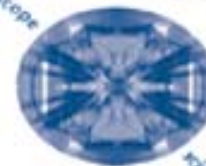
# MSLQ Subscales

- Motivation Subscales
  - Intrinsic goal orientation
  - Extrinsic goal orientation
  - Task value
  - Control beliefs
  - Self-efficacy for learning and performance
  - Test anxiety
- Strategy Subscales
  - Rehearsal
  - Elaboration
  - Organization
  - Critical thinking
  - Metacognitive self-regulation
  - Time and study environment
  - Effort regulation
  - Peer learning
  - Help seeking



# Data collection and subjects

- Data Collection
  - MSLQ administered 5 times
  - Current data range covers first 14 months at the academy and a summer administration before they arrived on campus



## Method: HLM

- Hierarchical linear modeling is a form of multiple regression that decomposes variance and allows for complex, nested models. (multiple measurements nested within students)
- Directly estimates individual “growth curves”

# The Statistics Page

**LEVEL 1 MODEL** (bold: group-mean centering; bold italic: grand-mean centering)

$$\text{MRHSEEK} = \pi_0 + \pi_1(\text{TIME}) + \pi_2(\text{TIME2}) + \pi_3(\text{TIME3}) + e$$

**LEVEL 2 MODEL** (bold italic: grand-mean centering)

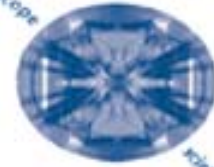
$$\pi_0 = \beta_{00} + \beta_{01}(\text{EXACAD}) + \beta_{02}(\text{BLACK}) + \beta_{03}(\text{LATINO}) + \beta_{04}(\text{ASIAN}) + \beta_{05}(\text{FEMALE}) + \beta_{06}(\text{GRADECO}) + r_0$$

$$\pi_1 = \beta_{10} + \beta_{11}(\text{EXACAD}) + \beta_{12}(\text{BLACK}) + \beta_{13}(\text{LATINO}) + \beta_{14}(\text{ASIAN}) + \beta_{15}(\text{FEMALE}) + \beta_{16}(\text{GRADECO}) + r_1$$

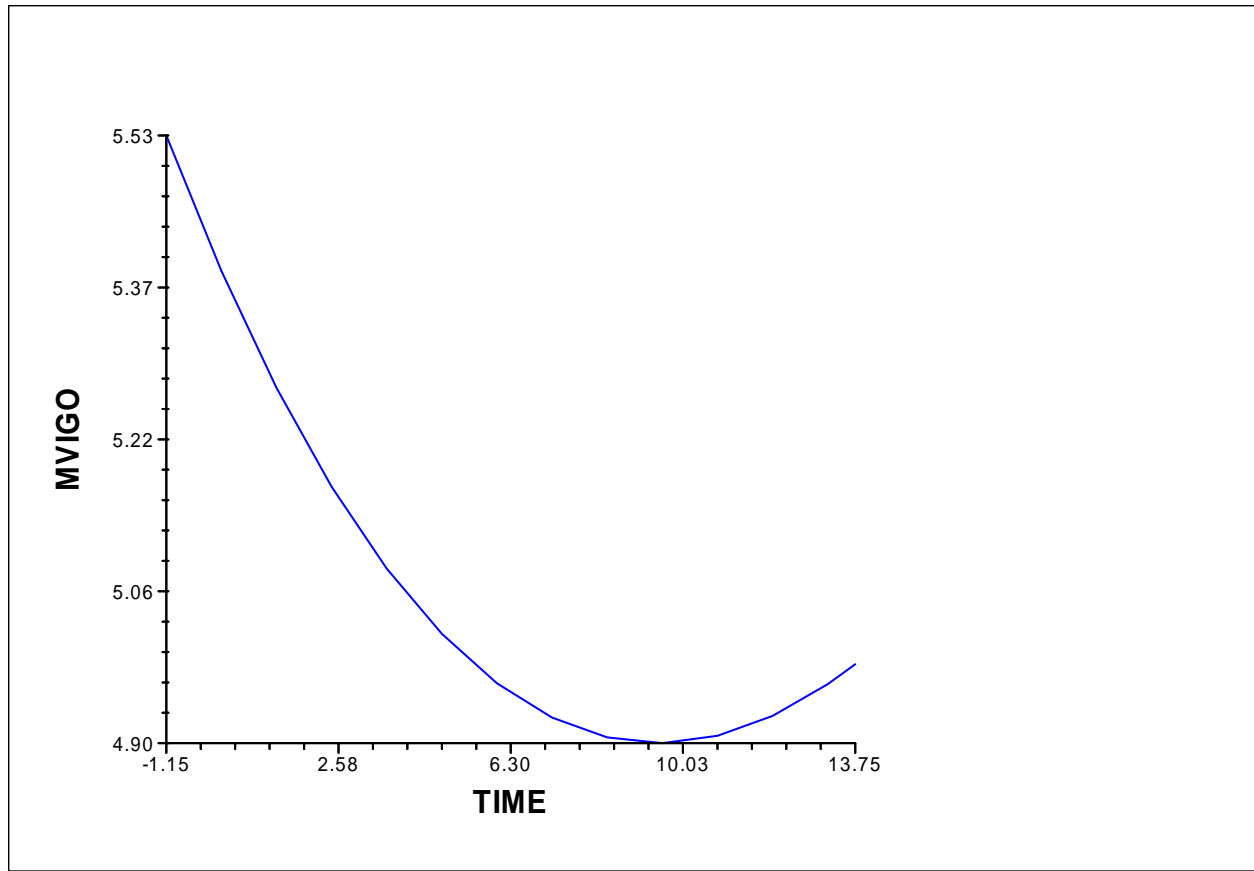
$$\pi_2 = \beta_{20} + \beta_{21}(\text{EXACAD}) + \beta_{22}(\text{BLACK}) + \beta_{23}(\text{LATINO}) + \beta_{24}(\text{ASIAN}) + \beta_{25}(\text{FEMALE}) + \beta_{26}(\text{GRADECO}) + r_2$$

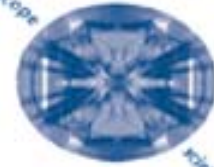
$$\pi_3 = \beta_{30}$$

Cubic growth model investigating student-level variables (EXCEL status, racioethnicity, gender, and age) and their potential effects on intercept, slope, and acceleration of help seeking behavior.

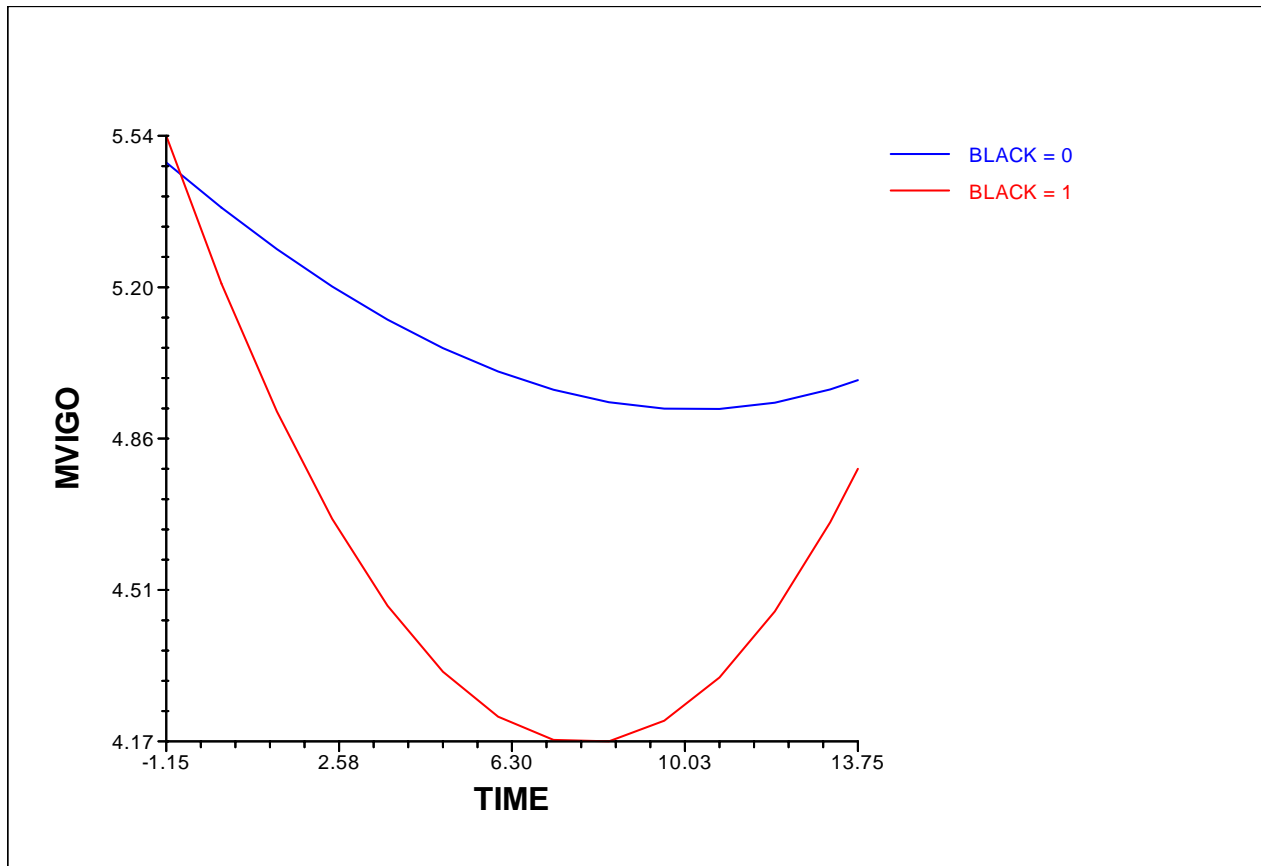


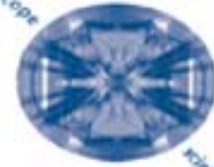
# Intrinsic Goal Orientation



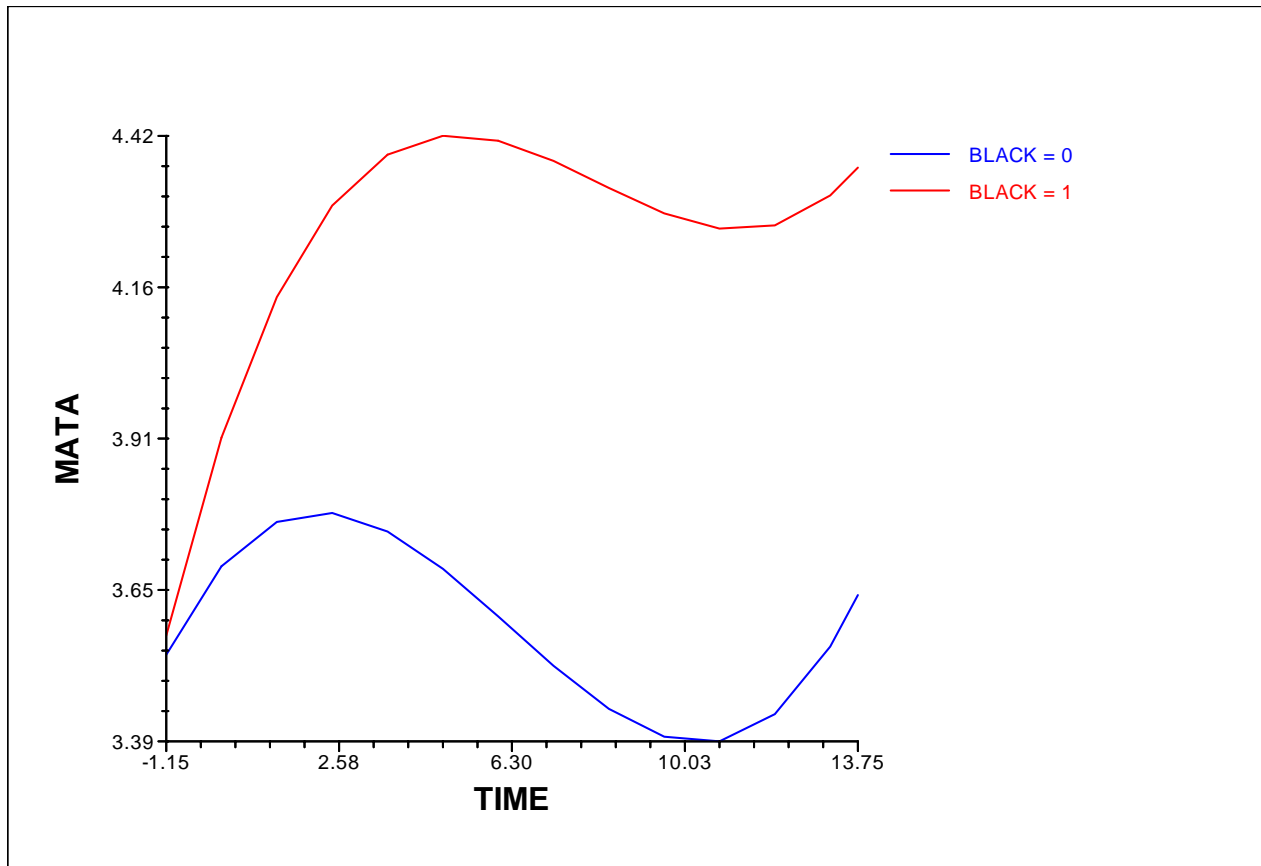


# Intrinsic Goal Orientation: African-American Students

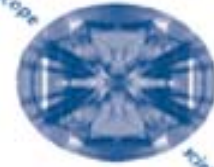




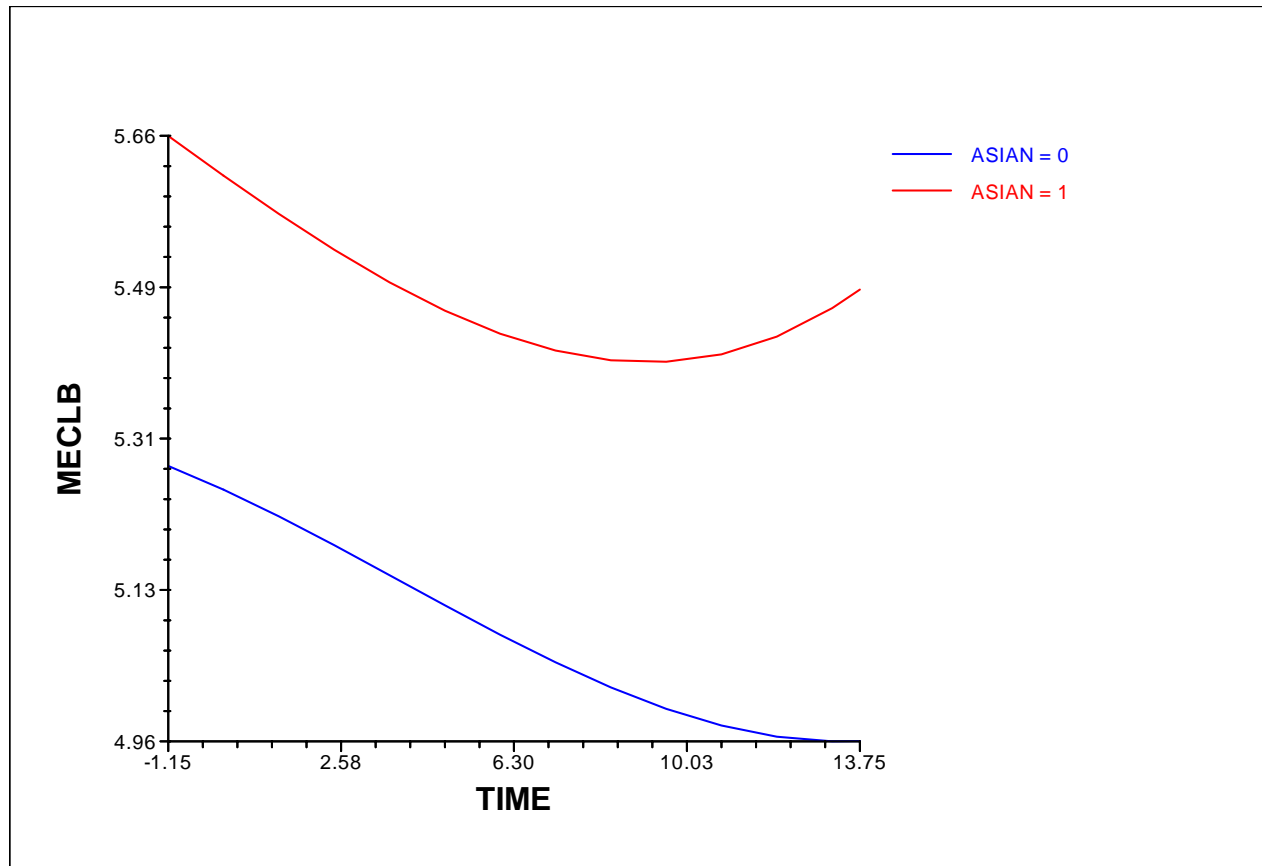
# Test Anxiety: African-American Students

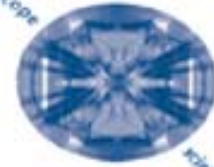




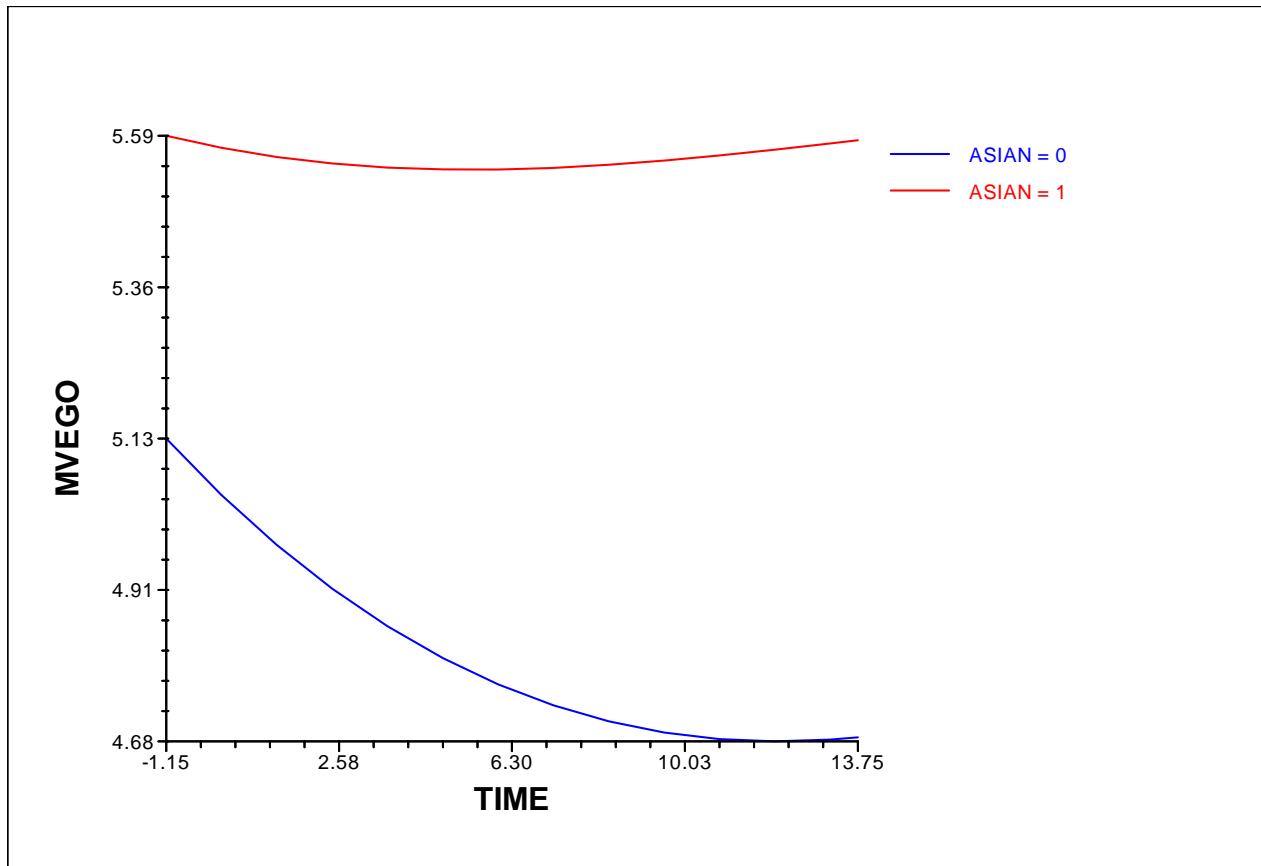


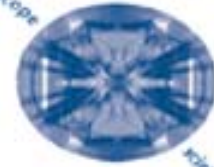
# Control Beliefs: Asian Students



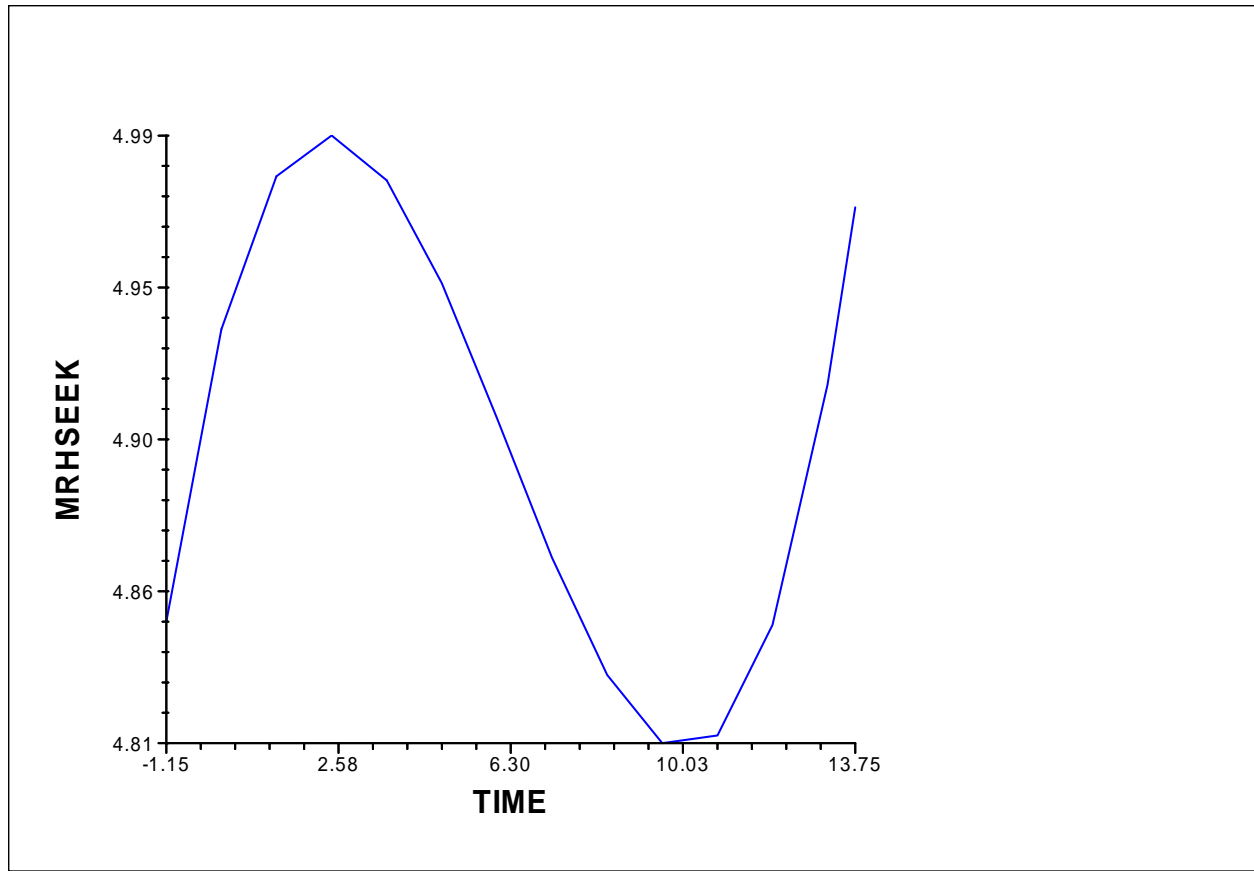


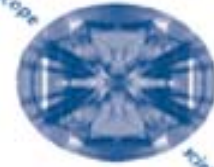
# Extrinsic Goal Orientation: Asian Students



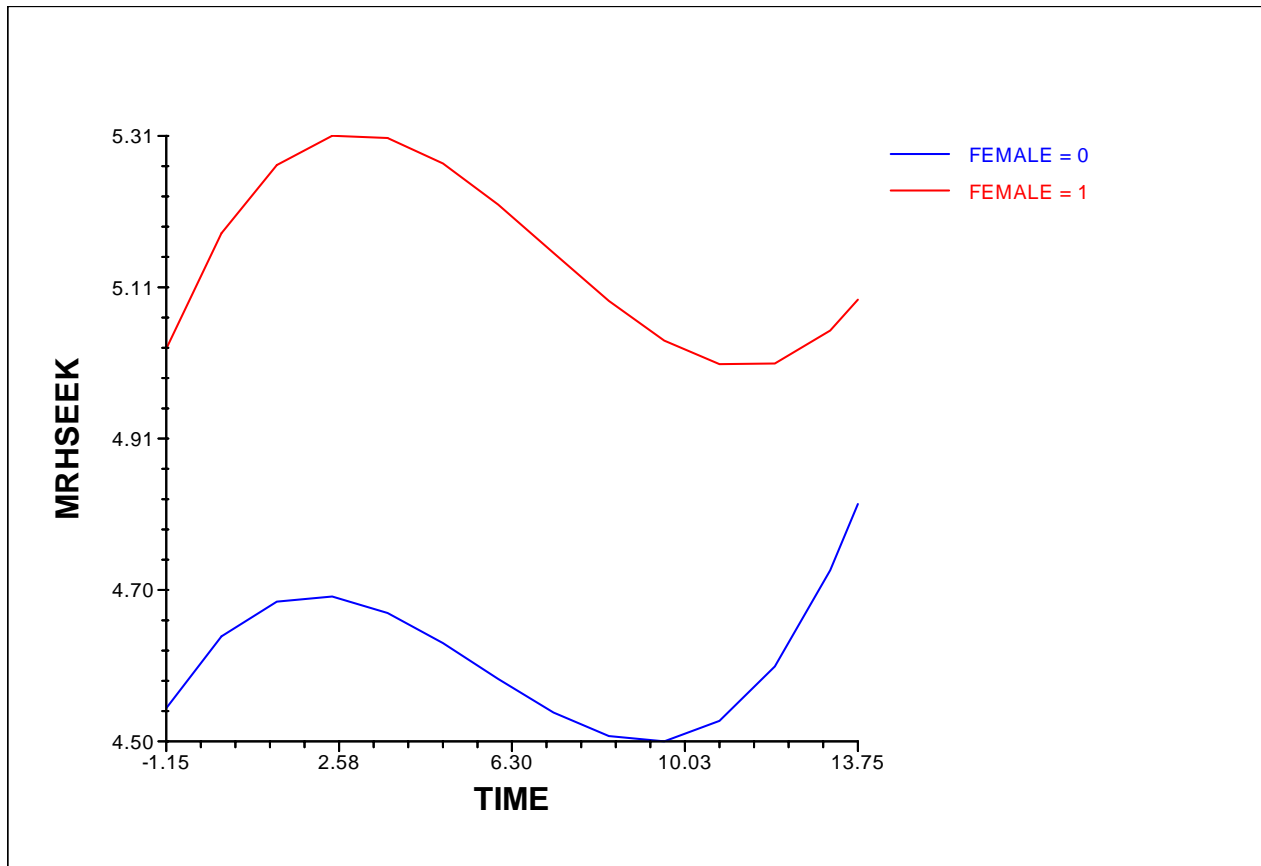


# Help Seeking Behavior: Unconditional



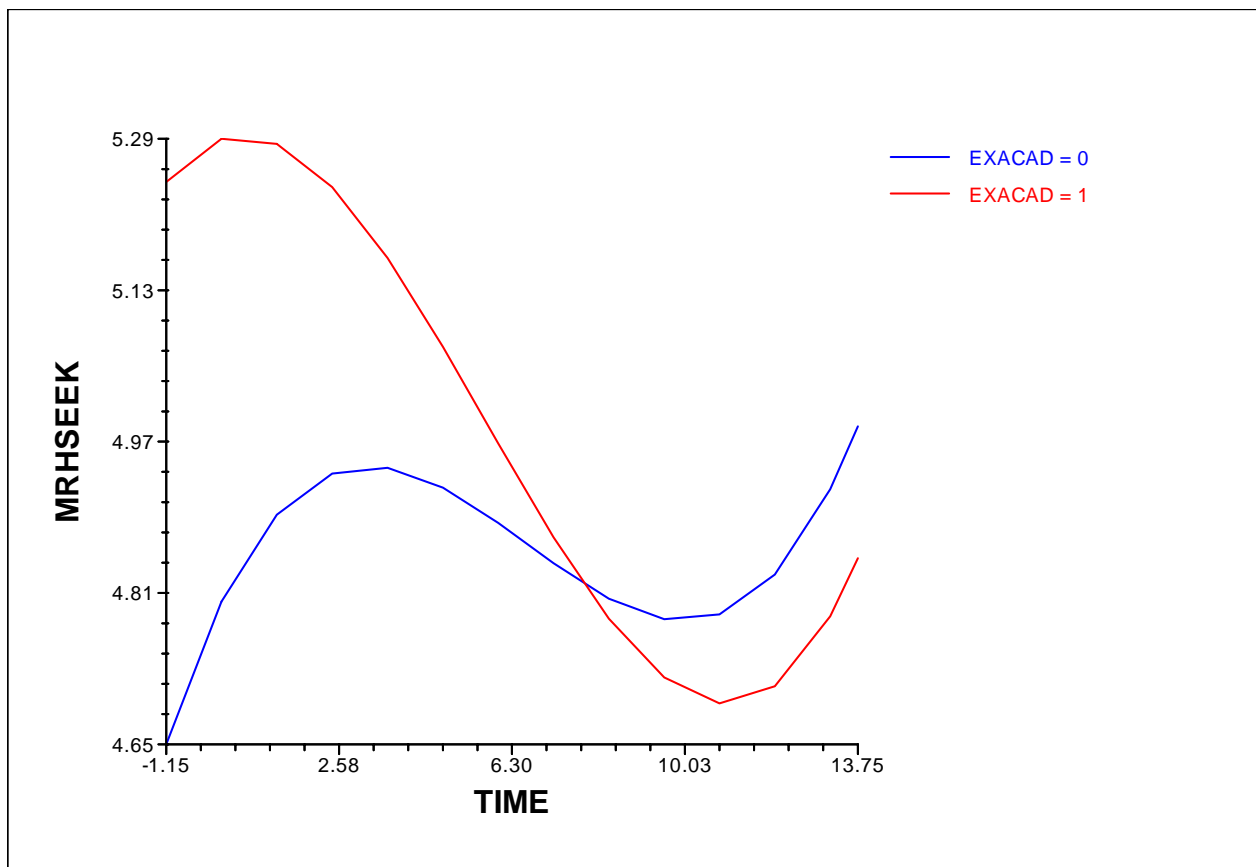


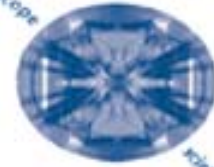
# Help Seeking: Male/Female Differences



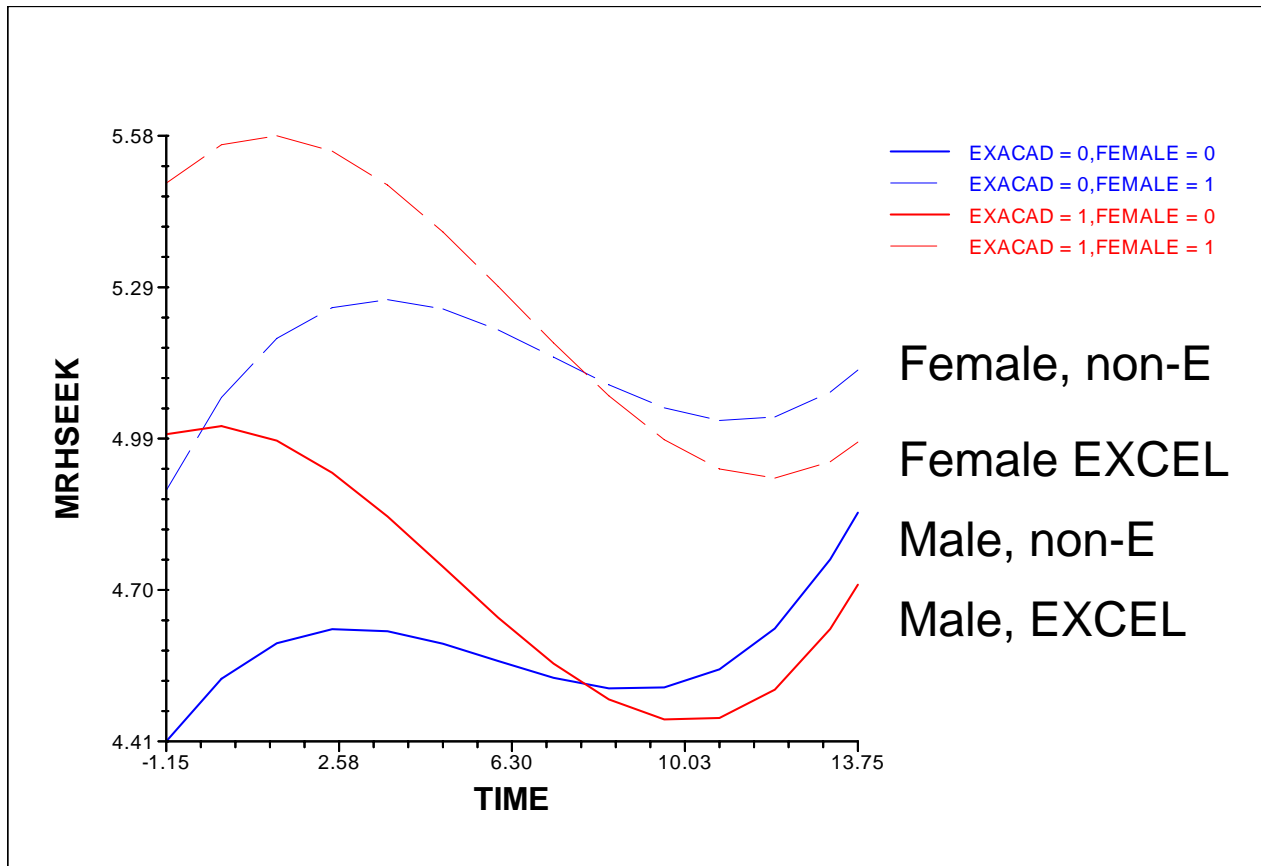


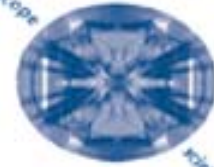
# Help Seeking: EXCEL Students



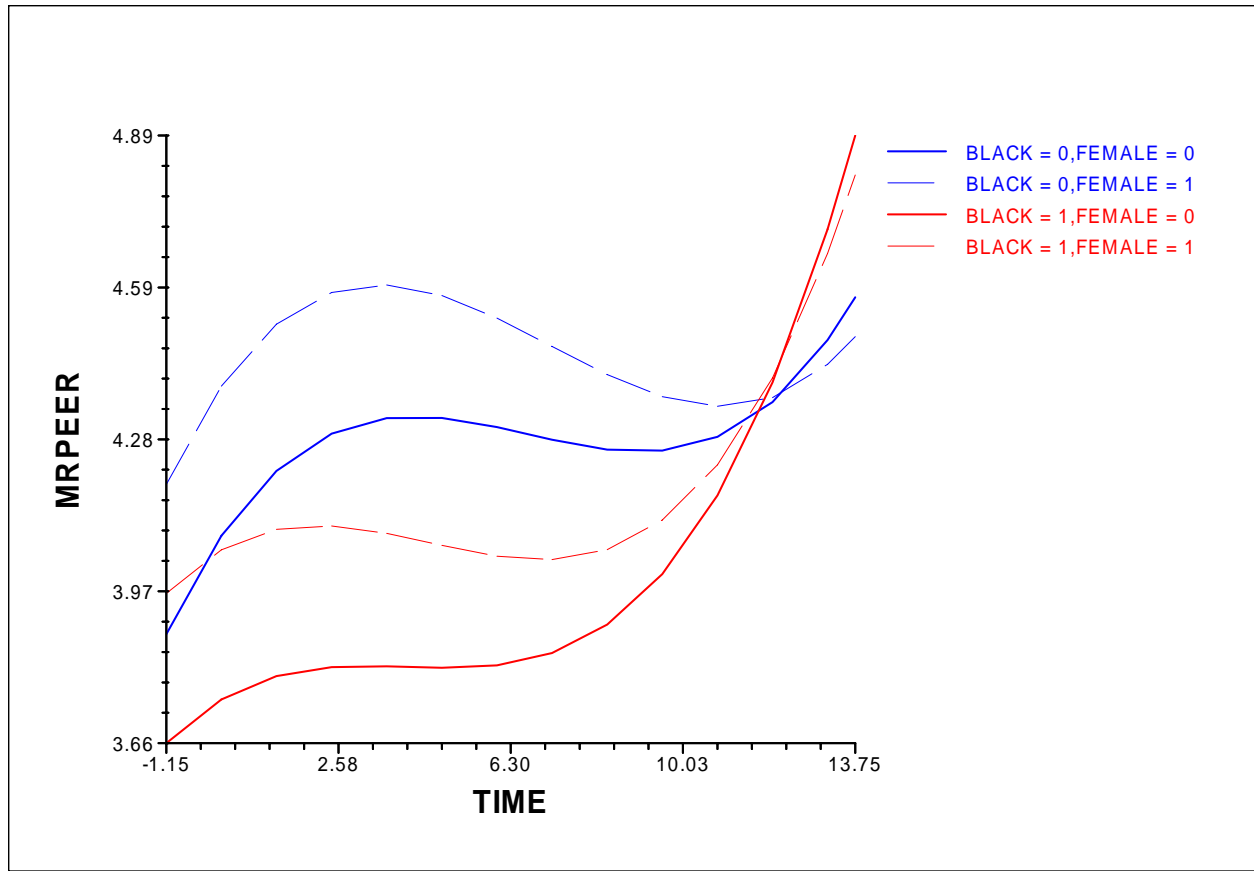


# Help Seeking: EXCEL/Female Interaction



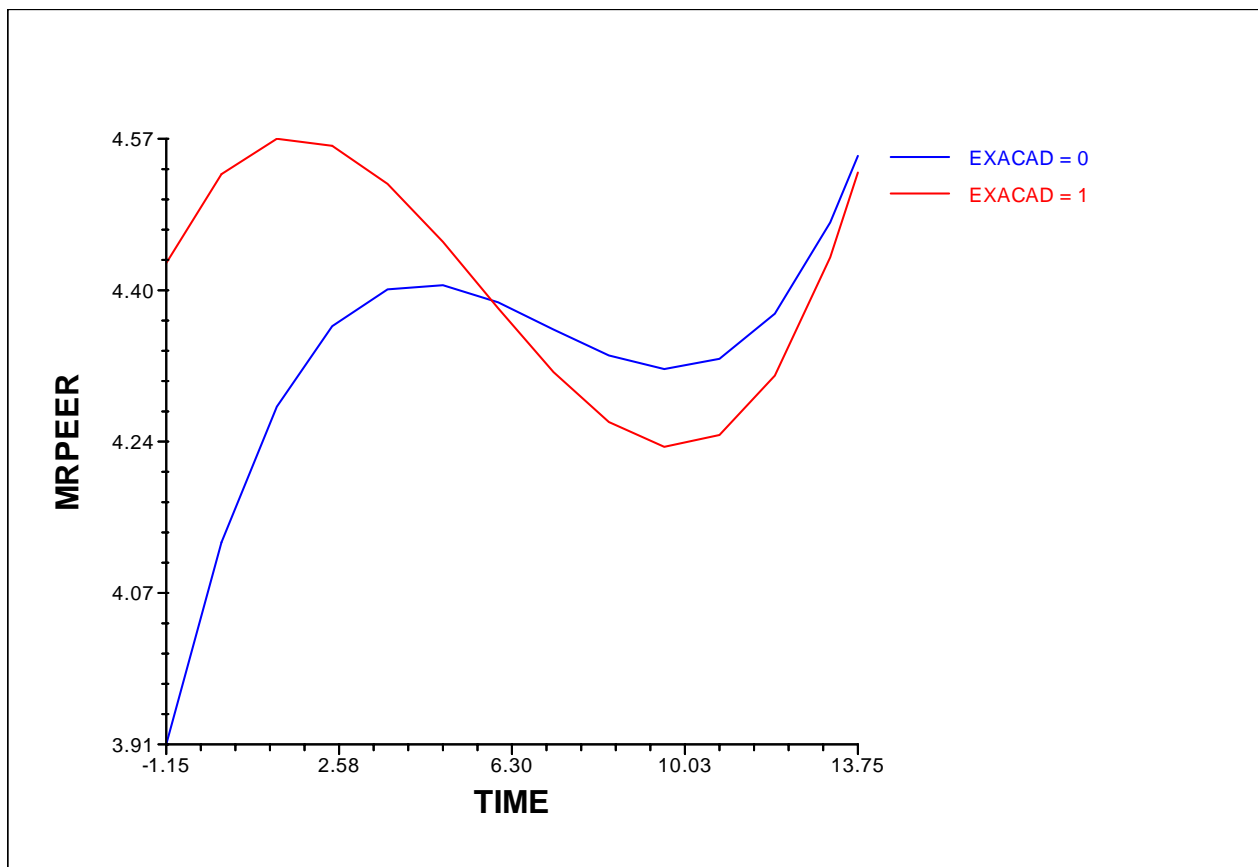


# Peer Learning: African-American and Gender Interaction

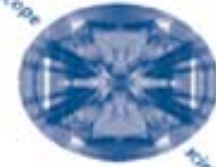




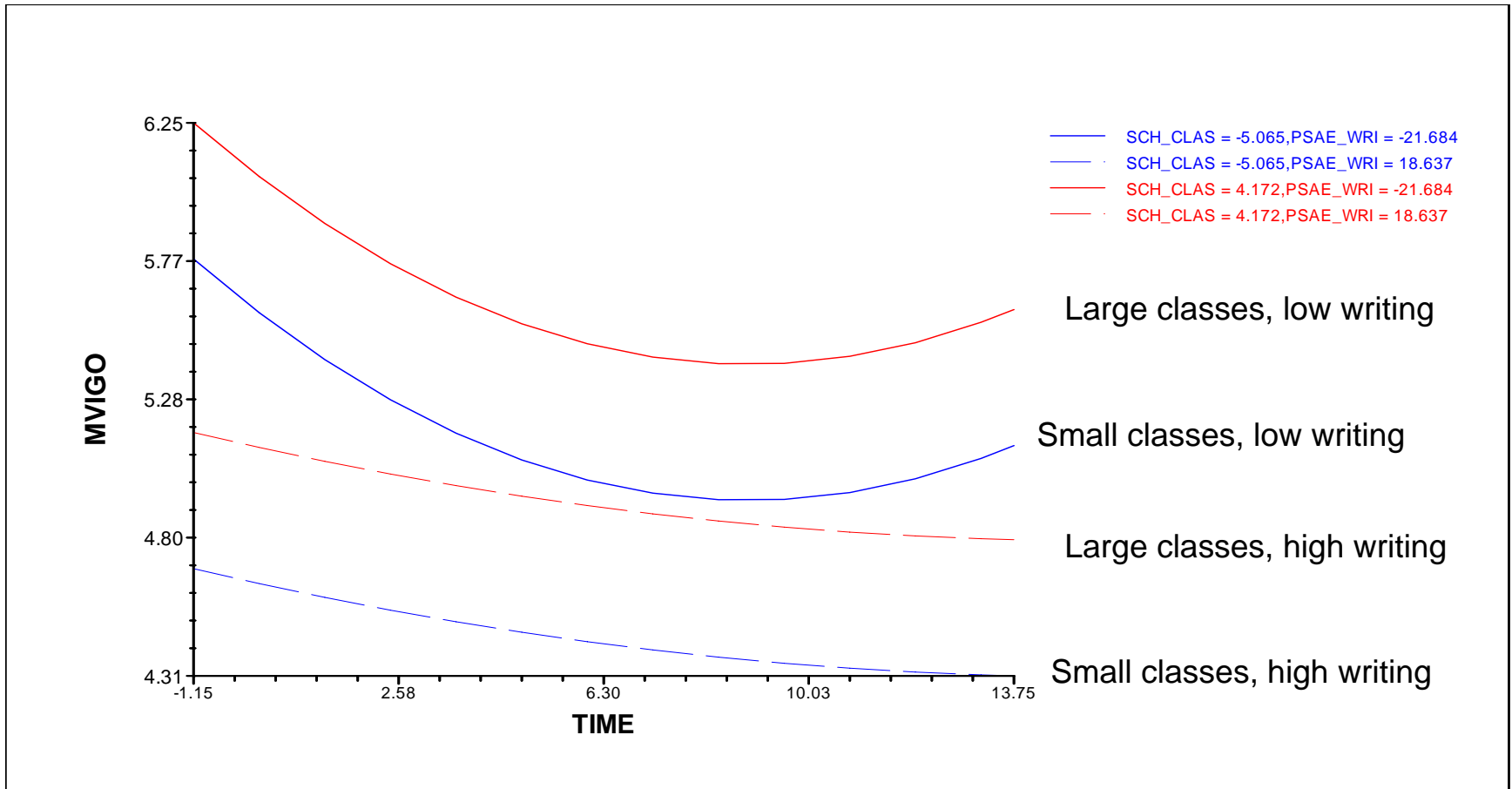
# Peer Learning: EXCEL







# Other Models: School Background Data





## Conclusions

- Highly talented students at IMSA develop behaviors relating to the community that assist in their performance.
- Even in an optimized environment, group differences express themselves and have policy implications.
- Minds create and are created by their environment. Even an environment designed to be friendly to tSM needs be adaptive while being adapted to.



## Conclusions

- Motivation and learning strategies can be collected and modeled over time
- Modeling can yield information that helps us better understand the student experience at IMSA and can inform programming
- **To Do: Collect sixth round of student responses, introduce student performance data (course information, grades), validation with second wave**