

Supporting Our Struggling Students



Details of a Hybrid Mathematics Summer Bridge Program

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Outline

- Overview/Background
- First Summer
- Second Summer
- Future Plans
- Questions & Answers

Background

IMSA

- a public residential college preparatory institution for academically talented students (grades 10-12)
- a diverse student body of 650 from all areas of Illinois
- serves thousands of educators and students in Illinois and beyond through innovative instructional programs that foster imagination and inquiry
- enrichment programs for elementary, middle and high school students.



Student Population of IMSA

2020-2021

% of Students	Identifying As...
37.2	Asian
31.0	White
12.0	Hispanic or Latinx
10.3	Black or African American
8.1	Two or More Races, Non-Hispanic or Latinx

EXCEL Program

- A 3-week bridging program for incoming sophomores.
- Instruction in Math, Science and English
- Provides content and helps generate skills necessary for success at IMSA that some students have not been exposed to in under resourced schools.
- Residential Life Counselors provide programming to help students adjust to living at IMSA

By the Numbers...

Graduation Year	Number of EXCEL Students	Average SAT Math Score*	Average SAT RW Score**	Graduation Rate***
2015	47	559.8	537.9	77.8%
2016	43	544.7	546.7	75.6%
2017	41	573.2	562.4	90.0%
2018	41	542.2	527.8	75.0%
2019	40	531.0	537.8	69.2%
2020	45	563.8	571.1	88.6%

* Average IMSA applicant SAT math is 675.

** Average IMSA applicant SAT RW score is 608.

*** Average yearly graduation rate is 85%.

Mathematics Course Offerings at IMSA

Pre-Calculus Core Courses

- Geometry
- Mathematical Investigations I/II
- Mathematical Investigations II
- Mathematical Investigations III
- Mathematical Investigations IV

Calculus Core Courses

- AB Calculus I
- AB Calculus II
- BC Calculus I
- BC Calculus II
- BC Calculus III
- BC Calculus I/II
- BC Calculus II/III

Pre-Calculus Electives

- Discrete Mathematics
- Game Theory & Rationality
- Graph Theory with Applications
- Mathematical Modeling
- Modern Geometries
- Problem Solving
- Statistical Experimentation and Inference
- Statistical Exploration and Description

Post-Calculus Electives

- Advanced Problem Solving
- Advanced Topics in Mathematics
- Differential Equations
- Linear Algebra
- Abstract Algebra
- Multi-Variable Calculus
- Number Theory
- Theory of Analysis

Justification

As a STEM school for gifted students, no student should graduate from IMSA without having completed a semester or two of Calculus instruction or pre-calculus elective courses. If sophomore and junior (and in some cases, senior) years are required to complete or re-take core courses, little time remains for completion of this variety of electives that we offer.

EXCEL 2

Summer enrichment program for rising IMSA juniors and seniors

- 4-6 week courses
- Online and/or on campus
- Course(s) selected based on need

Summer 2019 – Mathematical Investigations III

Course & Student Selection

Course	Number of Students Failed in...				TOTAL
	2014-15	2015-16	2016-17	2017-18	
MI-1/2	0	1	3	2	6
MI-2	2	1	0	1	4
MI-3	9	4	4	6	23
MI-4	1	0	1	5	7

Organization

Online (4.5 weeks)

- Meeting times based on student survey
- 90 minutes Mon / Wed / Fri
- Careful to balance in-class and out-of-class work

In-Person (1 week)

- 3 hours Mon / Tues / Thurs / Fri (field trip on Wed)

“Going into the week I was really worried, but I felt like the schedule wasn’t too demanding and allowed for as much study time as needed.”

Content

Mathematical Investigations III

- Logarithms
- Polynomials
- Rational Functions
- Trigonometry

EXCEL2 Program

- Exponential and Logarithmic Functions
- Quadratic, Polynomial, and Rational Functions
- Trigonometric Functions and their Inverses

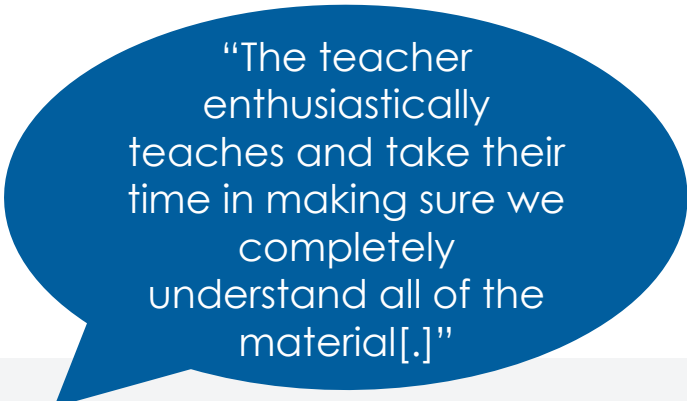
Pedagogical Approach

Mathematical Investigations III

- Inquiry-Based
- Highly Collaborative
- Problem-Centered

EXCEL2 Program

- “Conversational Lecture”



“The teacher enthusiastically teaches and take their time in making sure we completely understand all of the material[.]”

Assessment & Grading

Mathematical Investigations III

- Coursework (12% - notebook checks)
- Problem Sets (16% - review, current, stretch)
- Assessments (52% - written)
- Final Exam (20% - comprehensive)

EXCEL2 Program

- Homework (24% - written, “concept checks”)
- Assessments (56% - written)
- Final Exam (20% - comprehensive)

	MI-3	EXCEL2				
STUDENT	FINAL GRADE	CLASSWORK	ASSESSMENTS	PRE-FINAL EXAM OVERALL	FINAL EXAM	OVERALL
1	D	93.64%	90.22%	91.25% (A-)	86.50%	90.30% (A-)
2	C	80.00%	86.00%	84.20% (B)	73.00%	81.96% (B-)
3	C-	77.27%	94.89%	89.60% (B+)	96.00%	90.88% (A-)
4	D	91.82%	90.89%	91.17% (A-)	83.50%	89.63% (B+)

STUDENT	EXCEL2 OVERALL	FALL 2019	SPRING 2020	FALL 2020
1	A-	Left IMSA	–	–
2	B-	Mathematical Investigations IV (passed)	Discrete Mathematics (passed)	AB Calculus 1 (passing)
3	A-	Mathematical Investigations IV (passed)	BC Calculus 1 (passed)	BC Calculus 2 (not passing) Statistics (passing)
4	B+	Mathematical Investigations IV (failed)	Mathematical Investigations IV (passed)	AB Calculus 1 (passing) Statistics (passing)

Contributing Factors

- Second time through the content
- Less distracted over the summer
- Flexible assessment timing
- Low pressure course (a lot to gain, nothing to lose)
- Altered pedagogical style

Student Reaction

- Strongly Agree to...
 - “I enjoyed being a part of the EXCEL2 pilot program.”
 - “I would recommend EXCEL2 to a friend next summer.”
 - “I understand the material better than I did before EXCEL2.”
 - “I feel more confident moving into MI4 as a result of EXCEL2.”

“For me at first I was very unhappy with the idea of excel 2. But at the end of the program i was very happy I did it. I feel like this program really allowed for me to grasp the concepts within MI3 and has 100% made me feel a lot more confident with going into another year at IMSA. I think the programs setup wasn't too demanding and still allowed me to enjoy my summer.”

Recommendations Made...

Administrative

- Keep a low participant count
- Start selection process earlier
- Address tech needs earlier
- Provide formal academic support in the following semester

Curricular

- Rework content schedule
- Rework homework assignments
- Build additional concept checks
- Create additional reviews

Summer 2020 – Geometry

Historical Data

- Students who would need to take Geometry as a Junior based on initial placement at IMSA

Class of...	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL
Geometry	1	3	5	1	5	4 (1)	3	6	10	9	47

- Does not include students who needed to repeat the course or those who took a summer course outside of IMSA.

Course & Student Selection

- Students required to repeat Geometry (*Fall 2020*)
- Students (*Juniors*) required to enroll in Geometry (*Fall 2020*)

	Rising Junior	Rising Senior	TOTAL (9)
Repeat Course	1	1	2
Upward Mobility	7	--	7

Organization

“Start the course a little later...keep a break in between sessions, providing think time. I often came back with questions.”

Online (6 weeks)

- Meeting times based on student survey
- 1.5 hours in the morning
- 1 hour in the afternoon

Course Work

- Inquiry Approach with Collaboration (*AM Session*)
- Review & Direct Instruction (*PM Session*)
- Homework/Projects/Assessments

Content

Traditional Geometry

- Building Blocks of Geometry
- Congruence
- Similarity
- Right Triangle Trigonometry
- Coordinate Geometry
- Circles
- Solid Geometry
- Proofs (*2 column & Flow Proofs*)
- Constructions & Rigid Transformations

Summer Geometry

- Congruence
- Similarity
- Right Triangle Trigonometry
- Coordinate Geometry
- Circles

*Solid Geometry covered outside of class.

**Proofs incorporated in multiple units

Pedagogical Approach

Traditional Geometry

- Skill Based
- 2 – Column Proof (*formulaic*)

Breakout groups are really helpful as a way to get a break from lecturing and talk with other students about the work, almost like a normal class.

EXCEL2 Program

- Flipped Classroom
(reading & pre-requisite skill review)
- Inquiry-Based/Problem-Centered
- Highly Collaborative
- Mathematical Communication

Assessment & Grading

IMSA Geometry

- Coursework (12% - notebook checks)
- Problem Sets (20% - review, current, stretch)
- Assessments (48% - written)
- Final Exam (20% - comprehensive)

EXCEL2 Geometry

- Participation (8% - homework & in-class engagement)
- Modeling & Class Activities (16% - Problem Solving & Inquiry)
- Assessments (48% - written)
- Final Exam (20% - comprehensive)

Geometry: Take 2

EXCEL2: Geometry

STUDENT	PARTICIPATION	MODELING	ASSESSMENTS	PRE-FINAL EXAM OVERALL	FINAL EXAM	OVERALL
1	100%	78.37%	75.19%	78.76% (C+)	75%	77.9% (C+)
2	97.5%	80.23%	86.7%	85.84% (B)	95.5	87.77% (B+)

Geometry (Fall 2019)

STUDENT	NOTEBOOK	PROBLEM SETS	ASSESSMENTS	PRE-FINAL EXAM OVERALL	FINAL EXAM	OVERALL
1	99%	85.5%	55.1%	68.01% (D+)	29.6%	61.4% (D-)
2	88.7%	74.1%	60.3%	68.01% (D+)	74.4%	69.3% (D+)

Upward Mobility

EXCEL2: Geometry

STUDENT	PARTICIPATION	MODELING	ASSESSMENTS	PRE-FINAL EXAM OVERALL	FINAL EXAM	OVERALL
3	97.08%	88.59%	82.36%	85.7%	75%	83.6% (B)
4	99.54%	86.2%	91.77%	90.89%	92%	91.1% (A-)
5	99.79%	93.82%	86.94%	90.28%	89%	90% (A-)
6	98.96%	78.02%	77.35%	79.64%	81%	80% (B-)
7	100%	90.03%	85.15%	85.28%	77%	85.9% (B)
8	100%	79.88%	85.52%	85.28%	84%	85% (B)
9	99.58%	77.33%	78.53%	80.27%	90%	82.2% (B-)

STUDENT	EXCEL2	FALL 2020	SPRING 2021	FALL 2021
1	(C+)	Mathematical Investigations IV	Discrete Math	-
2	(B+)	Mathematical Investigations III	Mathematical Investigations IV	AB Calculus I
3	(B)	Mathematical Investigations III	Mathematical Investigations IV	AB Calculus I
4	(A-)	Mathematical Investigations III	Mathematical Investigations IV	BC Calculus I
5	(A-)	Mathematical Investigations III	Mathematical Investigations IV	BC Calculus I Problem Solving
6	(B-)	Mathematical Investigations III	Mathematical Investigations IV	BC Calculus I
7	(B)	Mathematical Investigations III	Mathematical Investigations IV	AB Calculus I
8	(B)	Mathematical Investigations III	Mathematical Investigations IV	AB Calculus I Problem Solving
9	(B-)	Mathematical Investigations III	Mathematical Investigations IV	BC Calculus I Machine Learning

Contributing Factors

- Eliminates the need to double up on math courses
- Ability to reach calculus
- Desire to enroll in higher level math courses
- IMSA math credit
- Second time through the content (*for 2 students*)
- Increased student confidence

Student Reaction

- Strongly Agree to...
 - 100% would recommend this as a summer class to another IMSA student
 - "...organized to allow all students to participate fully."
 - "...continue using Kami and breakout groups, they are very effective..."

"I appreciate the student slides with an outline of information for reviewing & staying engaged...continue having a positive attitude and trying to keep the class engaging by doing fun small activities such as the Near Pod game ... breakout groups are engaging as well if put with the right people."

Recommendations Made...

Administrative

- Keep a low participant count
- Explore asynchronous options

The small class size gave a lot of room for collaboration which was also a huge part that aided this class.

Curricular

- Integrate more algebra review
- Reorder curriculum to provide more opportunities to further develop understanding of trigonometry
- Identify areas to complete asynchronously

Future Plans

Future Plans the EXCEL Program

- Modular Algebra 1 (skills-focused, asynchronous)
- Maintain flexibility
 - Other core math classes
 - Core science classes
 - English and/or writing class

Thank you! Any Questions?