Synchronous Online Meetings + Asynchronous Independent Learning

= The Future of Math Instruction

NCTM Annual Conference April 27, 2018 Joshua Link

MARET

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MSON

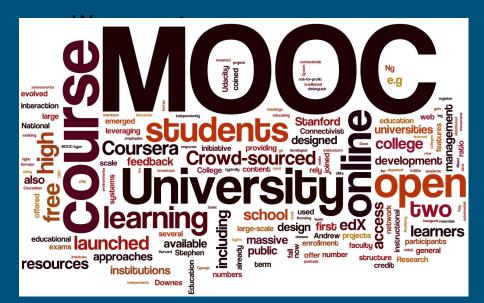
MALONE SCHOOLS ONLINE NETWORK

Julien H. Meyer III



Online learning--what comes to mind?

- Self paced?
- MOOCs?





Online learning--what should come to mind?

Real-time/interactive





Malone Schools Online Network

A 5-year old consortium with the technological platform at Stanford
 Online HS

• Endowed by the Malone Family Foundation--John Malone

• 22 member schools enroll 300-400 students in 29 courses from Organic Chemistry to Ancient Greek to Multivariable Calculus to Financial Algebra







Malone Schools Online Network

Two hours of synchronous instruction per week

"In the technologically-evolving world of today, it was a great experience to have a digital discussion-based class."--MSON student

6-8 hours of asynchronous work

"I was forced to take control of my own learning in the class, and I think that was good for me."--MSON student

Geographic diversity; avg of 11, max of 16 per class

"I learned important skills of how to communicate and work with people I cannot meet with personally." --MSON student

"When I taught an online college class, I never saw my students' faces and only interacted with them via email and a message board. When the MSON class convenes, we are able to forge wonderful relationships and make it feel like a brick-and-mortar classroom."--MSON teacher (Josh, in fact)



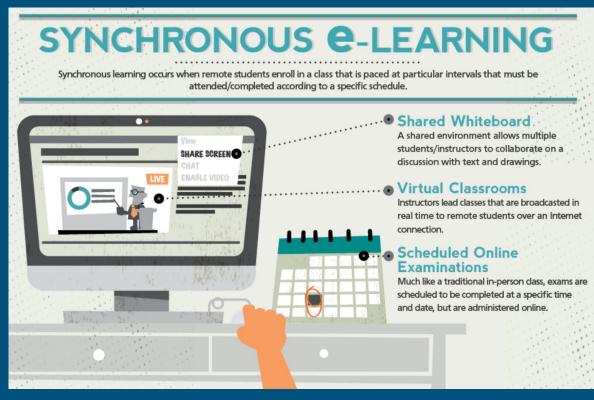
"In class, we have fun getting to know each other while also working on a shared whiteboard to solve complex problems."--MSON teacher

The MSON Difference

- Real-time interaction:
 - Student-teacher
 - student-student
- Advanced electives

Consortium model

Advanced students

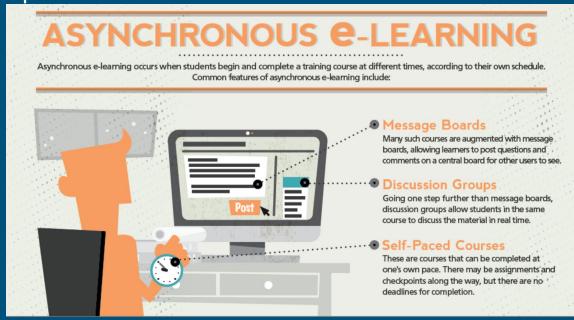


Differences from MOOCs

Greater retention and completion rate

Smaller class size

Credit



https://www.elearninglearning.com/asynchronous/synchronous/

Synchronous + Asynchronous--the best of both

Synchronous advantages:

- Immediate feedback
- Ability to gauge understanding

Asynchronous advantages:

- Review of the material when convenient
- Quieter learners can shine without interruptions

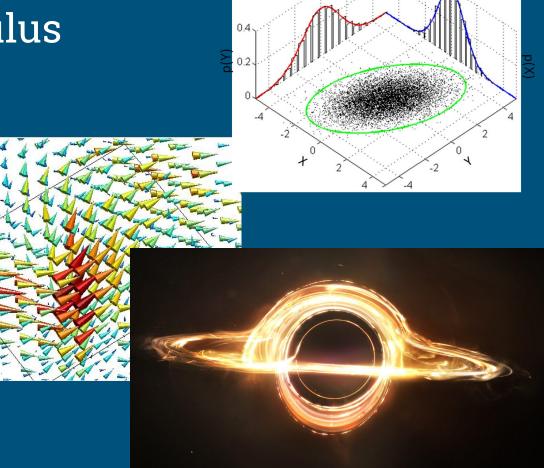


^{*}some material taken from xlprotraining.com

Multivariable Calculus

College level Calc III and IV

- Vectors
- Differentiation
- Integration
- Vector Calculus
- Additional Topics
 - Linear Algebra
 - Differential Equations
 - Probability
 - Physics
 - Finance/Economics



MVC feedback

Navier-Stokes equations (general)

$$\rho \left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v} \right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$$

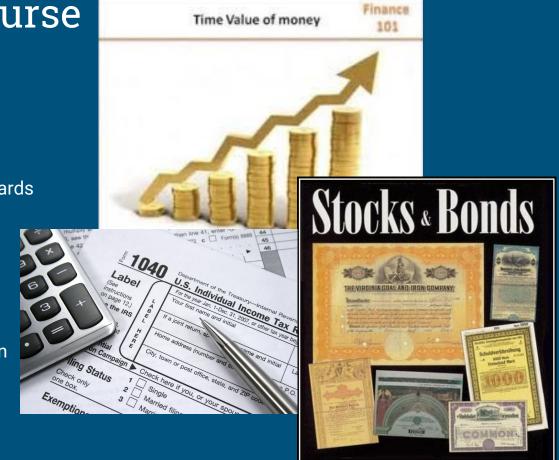
"I hope everything is going well with you, and just want to thank you again for the amazing education you gave me. Other than some more advanced Linear Algebra, I almost haven't learned anything new all year! I'd like to think that is a testament to your teaching rather than a failure of my school."--Email from former MSON MVC student

"That moment when you learn more physics in math class than in physics class."--Chat Message from current MSON MVC Student

"While I don't feel that LaTeX really adds to the utility of the course, I enjoy it because, first of all, it makes my math pretty. Second of all, I know that I will have to use it in college, so I'm really glad I'm getting a solid understanding of it now."--Survey from current MSON MVC Student

Financial Math Course

- Time Value of Money
 - Compound interest
 - Present and Future Value
 - Loans, mortgages and credit cards
 - o Bonds
 - Exponential functions
- Financial instruments
 - Equities and mutual funds
 - Risk vs reward
 - Stats: std. deviation, correlation
- Taxes



Financial Math feedback

BLACK-SCHOLES EQUATION

$$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$$

"I like the fact that this class allows me to explore a completely different topic that isn't really covered in general math classes and that will be beneficial to adult life. It's one of the few classes that I can guarantee will help me long-term."--Former MSON Finance student

"I really like how applicable the things we learn in this course are not only for business majors, accountants and financial planners, but for everyone in real life. It is a class everyone should take at some point."--Current MSON Finance student

Equity and inclusion

Regional differences are surprising



"It was an eye-opening experience to have the opportunity to work with other students across the country who were interested in the same things I was."--MSON student

- A look ahead to college
- Enabling students to take classes their school can't support or don't offer; they can't "max out"
- No extra cost to students, but scheduling challenges

Technology needs

- Video conferencing platform--Blue Jeans
- Large TVs and LifeSize
- LMS--Canvas
- Math Tools
 - LaTeX
 - TI SmartView
 - Desmos
 - PlayPosit
 - Wolfram|Alpha
- Digital whiteboard/computer
 - Surface Pro, iPad or Wacom tablet
 - OneNote or Smartboard Notebook







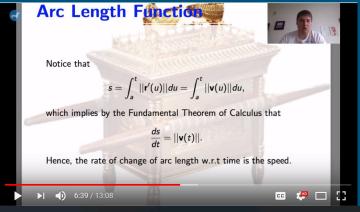
desmos



Screencasting/Digital Whiteboard

- Tips
 - Videos five minutes or less
 - Recording voice and picture/text separately
- Hardware
 - Stylus
 - Microphone
- Software
 - Doceri--iPad
 - Camtasia--laptop
 - Explain Everything
 - Scribblar







Preparing Main Window

Course design considerations*



- "...the mathematical content must provide the possibility of deep-discussion and cross-cutting themes."
- "...the instructor must engage in discourse and encourage cross-site conversation..."
- "Clear norms for participation are essential..."
- "A synchronous activity must be at the heart of the experience..."

^{*} All quotations from "Creating a Hybrid Immersive Math Experience" by Gates et al., *Mathematics Teacher*, November 2016

Cross-site conversation

- Introductory email to students with questionnaire
- First class: students introduce each other
- Assigning partners before class
- Forced group projects
- Anonymous survey in the first month
- Forced individual BlueJeans calls with each student
- To chat or not to chat?



Norms for participation

- "Face Time"
 - Tight focus on the face
 - Reduce distractions, but have something in the background
 - Home vs school vs airport login
 - Number of screen tiles
 - Proper attire
- Sound and ambient noise
 - o "Room in use" sign
 - Hall and bathroom noise
 - Mute button



Norms for participation

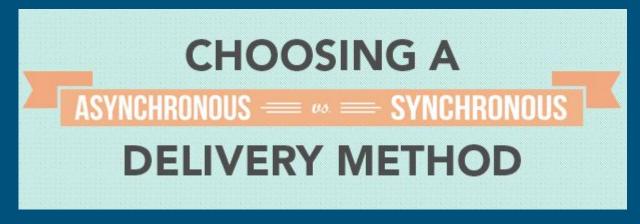
- Attendance
 - Minimum number of classes attended
 - No excused absences
- Extra help
 - o Email
 - Videoconferencing
 - No Skype or FaceTime (BlueJeans is preferred)
- Academic integrity
 - Proctored assignments
 - Honor code
 - Guidelines for collaboration



"I thought that the teacher would be harder to reach and less available to students"--Current MSON Finance student

What to teach synchronously?

- What is essential?
- What could be taught asynchronously? Surprising how much there is.
- Cut in half
- Plan every class for the semester and try to stay on schedule



What to teach synchronously?

- Discussion of big ideas
- Creating conversation to synthesize information
- Items that require empathy or instant responsiveness
- Checking in about how things are going
- Just...having fun and asking people about their lives



What to cover asynchronously

- The role of screencasts
- Practice problems
- In-depth problem sets
- Modeling activities
- Assessment



"I liked the MSON format, the level of engagement was super high and in some ways it was easier to contact the teacher than it is at BM school"--Former MSON Finance student

"I was worried that I would have a tough time learning the material without a teacher physically in the classroom to help me. Luckily, I have understood the material very well and found that asking questions is no problem."--MSON student

Texts and course materials

Helpful to have a common reference point, such as a text and a course

outline



- How to get physical materials, such as a lab kit, to the students
- Do your students have access to a laptop, TI calculator, scanner (Genius Scan), and smartphone/tablet?

Differences from brick and mortar

- Little background information on students
- Lack of communication with other teachers and parents
- Grading scales
- Checking homework
- Assessment
- Reporting to host school
 - Yearly conference to get to know other teachers

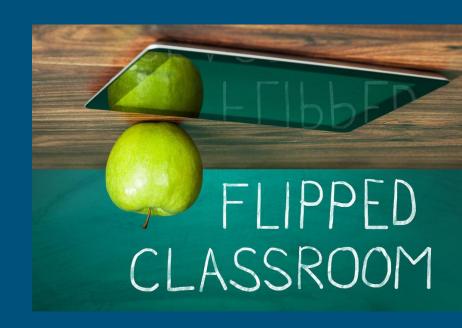


Synergies with brick and mortar

Not necessarily a totally new prep

Outside speakers

Using screencasts/flipped classroom



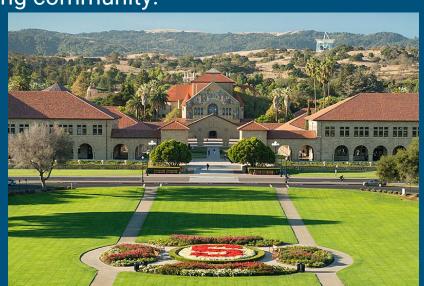
Sharing with colleagues at "home" school

Professional Development

 Yearly conference for the entire MSON community focused on training new teachers, reflecting on and improving our practices and policies, discussing our wider role and impact, and building community.

Sessions:

- •Be a Synchronous MSON Student
- •My First Day: Orienting Students to Your Class
- Internal Marketing of MSON
- •Engaging, Collaborative Student Work
- MSON From the Student Perspective
- Making Use of Students' Diversity



Funny stories



Feedback

"I would just like to add that I personally loved this course. I looked forward to it everyday I had it and will miss having the class. I have learned more than I could have imagined before coming in, and I would recommend this course to anyone who wants to pursue Finance or business in college. I am very appreciative of this course and look forward to using what I've learned from this class in college and in life."--Former MSON Finance student

"I think it is amazing that I can learn and be a part of the class, whether I am at school or home. Being able to work from home gives me a sense of relief because I know that even if I am not feeling well, that there is still a way for me to be "in" class and take part in discussions. I have also enjoyed this course because it has allowed me to meet new people and be a part of a whole new style of learning."--Former MSON Finance student

Feedback

"Thank you for showing me cool stuff about gravity and speed and particles and quantum mechanics, but most of all, thank you for keeping the nerd dream alive."--Former MSON student

"Aside from the knowledge of the class that I learned, it was an eye-opening experience to have the opportunity to work with other students across the country who were interested in the same things I was."--Former MSON student

Feedback

"I'm not a huge fan of the whole electronic classroom. I prefer regular classes."--Former MSON Finance student

"One of the things about this class that I am missing is the social aspect of it. After a few weeks of taking this course, I honestly don't know many of the other student's names"--Former MSON Finance student

"I'll admit that at the outset I was somewhat skeptical of the distance learning concept, but your tremendous engagement in teaching the course seems to have overcome the risks inherent in that approach...it was evident to me that you managed to forge a sense of real connection with students."--MSON parent

More information

MSON

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maloneschoolsonline.org