



## **Does Course Delivery Format Matter?**

**Examining Online Learning in a State Community College System  
Using an Instrumental Variable Approach**

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# The Rapid Growth of Online Enrollment in Higher Education

- Over 29% students in online courses in 2009
- Around 19% annual growth rate
- Over 97% of 2-year colleges by 2007

# Potential Benefit of Online Course Format

- Flexibility
- Computer-mediated interaction
- Immediate feedback
- Help with funding insufficiencies
- Expand learning opportunities

# Questions on the Effectiveness of Online Course Format in CC Setting

- Limited research carried out in CC setting
- Under-prepared students may struggle with online coursework
  - Experimental studies (e.g. Figlio, Rush, & Yin, 2010)
  - Observational studies (e.g. Bendickson, 2004; Chamber, 2002; Vargo, 2002)
- Little rigorous research on the impacts of online learning on course withdrawal

# A Call for New Studies...

- Studies carried out at CC setting
- Studies identifying potential online takers
- Studies that effectively address selection bias
- Studies examining potential heterogeneity across key demographic groups

# Research Questions

1. Are online courses more popular among certain demographic and academic groups?
2. How do online course outcomes differ from face-to-face outcomes?
  - Withdrawal
  - Final grade
3. How do online performance vary by types of students (i.e. gender, age, race, academic preparation)?

# Sample & Raw Outcomes

- ❑ Sample Restrictions
  - Transfer students
  - Offering both sections
  - College-level courses
- ❑ **represent an urban and white student population**
- ❑ 124,371 courses by 18,569 students in 34 colleges
- ❑ 22% taken online

	Attrition	Grade
F2F	6%	2.68
Online	9%	2.54
N	124,371	116,050

# Empirical Framework

## □ Basic Model

$$Y_{itkj} = \alpha + \beta \text{online}_{itkj} + \gamma X_i + \pi_t + \rho_k + \sigma_j + \mu_{itkj}$$

## □ Between-course Selection ---- Course Fixed Effects

$$Y_{itc} = \alpha + \beta \text{online}_{itc} + \gamma X_i + \pi_t + S_c + \mu_{itc}$$

## □ Within-course Selection ---- Instrumental Variable

$$Y_{itc} = \alpha + \beta \text{online}_{itc} + \gamma X_i + \pi_t + S_c + \mu_{itc}$$

where:  $\text{Online}_{itc} = \alpha + \delta \text{distance}_i + \gamma X_i + \pi_t + S_c + \mu_{itc}$



# Who Takes Online Courses?

	Full Course Sample		
	Baseline (1)	Adding Time, College & Subject FE (2)	Adding Course FE (3)
<b><i>Demographic Characteristics</i></b>			
Age	0.0065**(0.0005)	0.0067**(0.0005)	<u>0.0058**(0.0004)</u>
Female	0.0576**(0.0048)	0.0598**(0.0043)	<u>0.0508**(0.0037)</u>
Black Students (Base group: White)	-0.0432**(0.0118)	-0.0382**(0.0102)	<u>-0.0329**(0.0089)</u>
American Indians	0.0129(0.0218)	0.0149(0.0195)	0.0216(0.0182)
Asian	-0.0362**(0.0087)	-0.0495**(0.0076)	-0.0122(0.0086)
Hispanic	-0.0641**(0.0136)	-0.0595**(0.0119)	<u>-0.0492**(0.0108)</u>
Hawaiian	-0.0315(0.0353)	-0.0297(0.0311)	-0.0152(0.0270)
Pacific	-0.1151**(0.0342)	-0.0709**(0.0260)	-0.0497(0.0372)
Alaska	-0.0589(0.0470)	-0.0582(0.0501)	-0.0334(0.0456)
Multiracial	0.0099(0.0113)	-0.0008(0.0102)	-0.0014(0.0089)
Higher SES (Base group: Highest)	-0.0068(0.0077)	-0.0010(0.0064)	0.00006(0.0057)
Middle SES	-0.0138(0.0086)	-0.0057(0.0070)	-0.0043(0.0059)
Lower SES	-0.0255**(0.0091)	-0.0166*(0.0089)	-0.0103*(0.0061)
Lowest SES	-0.0188*(0.0101)	-0.0110(0.0078)	-0.0083(0.0068)
<b><i>Academic Characteristics</i></b>			
Working Hours	0.0002**(0.00001)	0.0001**(0.00001)	<u>0.0001**(0.00001)</u>
Dual Enrolled Prior to College	0.0154*(0.0082)	0.0173**(0.0071)	<u>0.0112*(0.0062)</u>
Received Federal Financial Aid	0.0195**(0.0050)	0.0178**(0.0043)	<u>0.0166**(0.0038)</u>
Limited English Proficiency	-0.0139(0.0396)	-0.0647(0.0407)	-0.0530(0.0384)
Num. of Credits Taken That Term	-0.0015*(0.0009)	-0.0009(0.0007)	-0.0008(0.0007)
Full Time Enrollment That Term	-0.0891**(0.0073)	-0.0442**(0.0064)	<u>-0.0410**(0.0056)</u>
Remedial Students	-0.0412**(0.0054)	-0.0677**(0.0047)	<u>-0.0599**(0.0041)</u>

# Relative Impacts of Online Format

	OLS Estimates			IV Estimates		
	Baseline	Adding Time, College & Subject FE	Adding Course FE	Baseline	Adding time, College & Subject FE	Adding Course FE
	(1)	(2)	(3)	(4)	(5)	(6)
<b><i>Dependent Variable: Course Withdrawal</i></b>						
Online Format	0.036** (0.003)	0.041** (0.003)	0.044** (0.003)	0.053** (0.023)	0.052** (0.024)	0.060** (0.028)
Observations	124,371	124,371	124,371	124,371	124,371	124,371
<b><i>Dependent Variable: Course Grade</i></b>						
Online Format	-0.190** (0.018)	-0.228** (0.017)	-0.261** (0.016)	-0.280** (0.135)	-0.303** (0.140)	-0.337** (0.160)
Observations	116,050	116,050	116,050	116,050	116,050	116,050
College & Subject FE	No	Yes	Yes	No	Yes	Yes
Year-Term FE	No	Yes	Yes	No	Yes	Yes
Course FE	No	No	Yes	No	No	Yes

# Validity of IV

- Correlation between IV and Treatment  
First Stage IV
- Correlation between IV and error term  
Falsification Test

# Effects of the Online Format by Student Characteristics

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	Course Withdrawal	Course Grade
By Gender	Male > Female***	Non-significant
By Age	Younger > Older***	Younger > Older***
By Academic Capacity	Weaker > Stronger***	Weaker > Stronger***
By Race	Non-significant	Black > White***

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# Summary of Findings

- ❑ Substantial difference between online takers and f2f takers
- ❑ Robust negative estimates for online learning for both course retention and course grade
- ❑ IV estimates consistently stronger than the OLS estimates
- ❑ Heterogeneous effects among students

*Thank You!*

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# First Stage IV b

	Baseline (1)	Adding time, College & Subject FE (2)	Adding Course FE (3)
Distance to College	0.003** (0.0002)	0.003** (0.0002)	0.003** (0.0001)
College & Subject FE	No	Yes	Yes
Year-Term FE	No	Yes	Yes
Course FE	No	No	No
Observations	124,371	124,371	124,371
F-test on Excluded Instruments (Prob > F)	268.22 <0.001	317.43 <0.001	280.74 <0.001

# Falsification Test b

	Baseline	Adding Time, College & Subject FE	Adding Course FE
	(1)	(2)	(3)
<b><i>Dependent Variable: Course Withdrawal</i></b>			
Distance	-0.00007 (0.00008)	-0.00008 (0.00008)	-0.00006 (0.00008)
Observations	97,276	97,276	97,276
<b><i>Dependent Variable: Course Grade</i></b>			
Distance	-0.0002 (0.0004)	-0.0003 (0.0004)	-0.0002 (0.0004)
College & Subject FE	No	Yes	Yes
Year-Term FE	No	Yes	Yes
Course FE	No	No	Yes