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# MOOCs, the Method of RCT, and More A Literature Review

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# Why MOOCs

- “massive” and “open” (Perna et al., 2014)
- the enrolling students of a typical MOOC is approximately estimated as 20,000 (Jordan, 2014)
- without demanding minimal registration requirements
- the *New York Times* declared 2013 “the Year of the MOOC.”

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# Downsides

“less uniform, regulated, and centralized” (Perna et al., 2014)

- low student retention rate,
- disappointing competition rate, **5~12 percent** (Koller et al., 2013)
- less learner interactions online,

retention and completion matter !!

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# Educational Research

*Coursera, Udacity and edX* have generated tremendous attention (Pappano, 2012)

- pedagogical methods and student incentives (Diver & Martinez, 201)
- student attrition (Khalil & Ebner, 2014; Rosé et al., 2014; Yang & Rosé, 2013)
- dropout rate (Khalil & Ebner, 2014; Yuan & Powell, 2013)
- conduct causal research in online MOOC spaces
- the quality of the courses (Morris, 2013)

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# Research Challenge

Lack of an operational definition to the learners' outcome in a MOOC setting (Perna et al., 2014 )

- variables such as completing the final assessment, passing the course (Ashby, 2004 )
- knowledge, perceived confidence and satisfaction (Hossain, et al., 2015 )

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# Research Gap

As of May 2014, only 2 out of the 60 studies on MOOCs analyzed implemented RCTs (Raffaghelli, Cucchiara, & Persico, 2015)

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# Why RCT

- the most desirable and reliable means of program evaluation (Rossi, Freeman, & Lipsey, 2004)

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# Eligibility Criteria

- (1) impacts studies on MOOC and MOOC engagement;
- (2) employed randomized controlled trials;
- (3) included at least one quantifiable measure of engagement or achievement, and
- (4) were available between 2015 to 2016.

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# Search Strategy

- Franklin database with the key words “MOOCs”, “RCT”, “randomiz(s)ed controlled trial”, and “randomize(s)ed experiment”
  - 60, Hossain, et al. (2015) and Cassidy, et al. (2014)
- Citation chasing and Internet searches
  - Martinez (2013), Lamb et al. (2015), Anderson et al. (2014)

RCT is still gaining ground...

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# Extracting Information

- Structured abstracts
- Intervention types and program theory
  - advocated by a group of Dutch researchers (van der Knaap, Leeuw, Bogaerts, & Nijssen, 2008), and was recently utilized by Petrosino et al. (2014)

# Structured abstracts

	Anderson, et al., 2014	Cassidy, et al., 2014	Lamb, et al., 2016	Hossain, et al., 2015	Martinez, 2014
Back-ground	MOOCs provide a record of learner activity of unprecedented scale and resolution.	MOOCs are falling short for a radical shift in education	Analytic challenges to RCTs: attrition and zero-inflation	Seeking efficient ways of providing consistent high-quality education	MOOCs have the potential to facilitate low-cost implementation of randomized control trials
Purpose	Proposing a framework for understanding how students engage with massive online courses	Student engagement 1) Workload 2) Task design 3) Facilitation	Improving forum participation	Knowledge /confidence improvement: spinal cord injuries	Understanding of the incentives and informational environment and how they affect learning
Setting	Several large Stanford University courses offered on Coursera	Both xMOOCs and cMOOCs	edX MOOC platform	Bangladesh	Coursera
Partici-pants	ML3 112,897	Group 1 (n=487) Group 2 (n=489) Group 3 (n=491) Group 4 (n=554) Group 5 (n=1,279)	Control (n= 2399) Treatment (n=2378)	Control (n= 24) Treatment (n=24)	Control (n= 2773.4) Treatment (n=5150.6)

## Structured abstracts - continued

Design	RCT	RCT	RCT	RCT	RCT
Intervention	Three different treatment conditions: top byline, thread byline, badge ladder	An eight-week MOOC, with different alterations to elements of the course design in terms of workload, task design, level of and nature of facilitation	Self-test participation check that reminds students and sets norms for desired levels of participation	The MOOC that involved completing the same online learning module but experimental participants' progress through the module was guided each week	Informational nudges on students' effort and performance
Data collection and analysis	Badge-ladder clearly had the most significant effect.	Engagement was measured by tracking user activity and the collection of student feedback	(TOT) Treatment group had a 20 percentage-point higher probability of having a forum action than the control group.	ITT analysis <ul style="list-style-type: none"> <li>• Knowledge: 0.7 points (95% CI – 1.3 to 2.6)</li> <li>• Confidence: 0.4 points (95% CI – 1.0 to 1.8)</li> <li>• Satisfaction: 0.0 points (95% CI – 1.1 to 1.2),</li> </ul>	Students assigned to the negatively framed treatment attempt a quiz in the week of the intervention more times and are ranked, on average, 8.43 percentage points better than students in the control group
Findings	Making badges more salient produced increases in forum engagement	The lightest workload and a subject expert had positive effect on participation	Self-assessment questions about forum participation encourage more students to engage	MOOC was no better for students than working at their own pace through an online learning module	<ul style="list-style-type: none"> <li>• Exerting more effort;</li> <li>• Higher achievement;</li> <li>• Framing plays an important role.</li> </ul>

# Theory of Change for Interventions

Intervention type	Studies	Underlying issues with MOOC education	Types of interventions	Key mechanism	Primary outcomes
<b>Promoting student engagement with MOOCs</b>	Anderson, et al., 2014	Further disentangling what make badges successful in MOOCs	A large-scale deployment of badges in the discussion forum of one of the largest MOOCs	Making the next badge milestone clear was important in keeping users engaged on the forums	Increases in forum participation by small variations in badge presentation had an effect on
	Lamb, et al., 2016	High attrition leads to methodological obstacles in analyzing interventions	Self-test participation check	Reminding students and set norms for desired levels of participation.	Treatment group had a 20 percentage-point higher probability of having a forum action than the control group
	Martinez, 2014	Little is known about whether providing information has any effect on student effort	Informational nudges on students' effort and performance	Students reacted differently to positive and negative framing in the nudges	Exerting more effort; framing plays an important role.
<b>Improving MOOCs learner outcome</b>	Hossain, et al., 2015	Inefficient ways of providing consistent high-quality education	The MOOC that aims at knowledge /confidence improvement in spinal cord injuries	Completing the same online learning module but experimental participants' progress through the module was guided each week	MOOC was no better for students than working at their own pace through an online learning module
<b>Correlational research - Course design and engagement</b>	Cassidy, et al., 2014	Whether specific elements of the course design could help boost the completion rate	Alterations to elements of the course design in terms of workload, task design, level of and nature of facilitation		The lightest workload and a subject expert had positive effect on participation

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# Wait...

- Cassidy, et al. (2014) is a correlational research as opposed to an experimental one.
- Small sample sizes in 3 studies ...
- Insufficient descriptions of some significant information

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# Descriptive Statistics

- Location
  - All ( $N=5$ , 100%) in English speaking countries
- Goal
  - Most ( $N=4$ , 80%) promoting students' engagement with MOOCs,  $N=1$  learners' outcome.
- Subjects
  - 4 ( $N=4$ , 80%) had over 2,000 participants in both treatment and control groups
- Impact
  - Most interventions ( $N=3$ , 80%) had a positive impact

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# Theme 1. information nudges

The “openness” characteristic of MOOCs makes these techniques even more nature and convenient to implement

- Self-test participation check, Lamb, et al. (2016)
- Emails that contained the relative performance on the previous quiz, Martinez (2014)

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## Theme 2. Learning order

- We know that most MOOC learners were found to access “course content in the sequential order identified by the instructor.” (Perna et al., 2014)

Designed learning order vs. “User-driven” progress pattern

- MOOC was **no better** for students than working at their own pace through an online learning module.
  - (Hossain, et al., 2015)
- MOOC format may be best suited to those “self-directed learners.”
  - Cassidy, et al. (2014)

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## Theme 3. Instructional design

- lighter workload
  - a subject expert
- Cassidy, et al. (2014)

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## Theme 4. Data analysis

- Just because it's easy to implement RCTs at MOOC platforms doesn't mean it's equally easy to analyze the data.

Zero-inflated and skewed outcomes, high attrition after assignment to treatment groups, difficulty in defining and measuring exposure to treatment, difficulty in defining dosage of treatment, unclear timing between outcome and treatment, and factorial experimental designs all conspire to make the analysis of MOOC experiments more complicated—in most circumstances—than running a simple t-test. (p. 30)

Lamb, et al. (2016)

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# Conclusions and Implications

- A promising sphere where big data are continuously generated and blooming
- The subject matters MOOCs are offering, since it somewhat relates to the workload
  - Cassidy, et al. (2014)
- RCT designs should be tempered by qualitative approach
- Increasing engagement with MOOCs doesn't guarantee productive learning outcomes
  - (Hossain, et al., 2015)