Design-Based Research (DBR) on MOOCs and Open Education

Wow. This could blow our minds.
Or open them!

Agenda
- MOOCs and Open Educational Resources
- Rationale for Design Based Research (DBR)
- DBR Case Studies
- DBR Planning Exercise and Review
- Discussion and Questions

IRRODL THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTRIBUTED LEARNING

Where is Research on Massive Open Online Courses Headed? A Data Analysis of the MOOC Research Initiative

Dejan Golović1, Vlado Kovanović1, Srečko Joksimović1, and George Siemens3
1Athabasca University, Canada, 2Simon Fraser University, Canada, 3University of Texas at Arlington, USA

Major MOOC Research Themes
1. student engagement and learning success,
2. MOOC design and curriculum,
3. self-regulated and social learning,
4. social network analysis and networked learning,
5. motivation, attitude and success criteria

Generate a research question related to student engagement and learning success

Design-based research is driven by a desire for IMPACT
Too Much Research on Things

• MOOCs and OERs
• Mobile Learning
• Online Learning
• 3D Printing
• Games and Gamification
• Wearable Technology
• The Internet of Things
• Machine Learning
• Virtual Assistants
• Immersive Learning

Too Little Research on Problems

• Ineffective education
• Increasing poverty
• Child abuse
• Crime
• Lack of literacy
• Poor motivation
• Hopelessness
• Lack of engagement
• Racism, Sexism

<table>
<thead>
<tr>
<th>Title</th>
<th>Treatment</th>
<th>Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning to take the tablet: How pre-service teachers use iPads to facilitate their learning</td>
<td>Apple iPad</td>
<td>Case Study of 8 pre-service teachers</td>
<td>Helped teachers: - develop understanding of content and pedagogy - stay connected and get more organized</td>
</tr>
<tr>
<td>Interactivity with the interactive whiteboard in traditional and innovative primary schools: An exploratory study</td>
<td>Interactive whiteboard</td>
<td>Qualitative analysis of 6 video recorded lessons (3 each from traditional and innovative schools)</td>
<td>Expected innovative schools to have more student or shared use of interactive whiteboard, but this was not found</td>
</tr>
<tr>
<td>Evaluating types of students’ interactions in a wiki-based collaborative learning project</td>
<td>Wiki</td>
<td>Content analysis of wiki pages and qualitative analysis of 10 interviews</td>
<td>No strong evidence of learning; more cooperation than collaboration; instructor role is critical</td>
</tr>
<tr>
<td>Collaboration and competition on a wiki: The praxis of online social learning to improve academic writing and research in undergraduate students</td>
<td>Wiki</td>
<td>Content analysis of wiki screen captures and analysis of 22 surveys</td>
<td>Some evidence of student learning from the task, i.e., analysis of a cultural artifact related to public health</td>
</tr>
<tr>
<td>Effects of experiential-based videos in multi-disciplinary learning</td>
<td>Digital videos</td>
<td>Mixed method quasi-experimental design with quantitative and qualitative analysis</td>
<td>No significant differences</td>
</tr>
</tbody>
</table>

UN Millennium Development Goals

Goal 1: Eradicate extreme poverty and hunger
Goal 2: Achieve universal primary education
Goal 3: Promote gender equality & empower women
Goal 4: Reduce child mortality
Goal 5: Improve maternal health
Goal 6: Combat HIV/AIDS, malaria and other diseases
Goal 7: Ensure environmental sustainability
Goal 8: Develop a Global Partnership for Development
Most educational research in the USA is conducted by faculty and students in schools and colleges of education.

Where is the impact of our research on problems that really matter?

Research Paradigm Arguments Persist

Paradigm
The assumptions underlying any approach to research.

Positivist Paradigm
- There are facts with an objective reality that exist regardless of our beliefs.
- The goal of research is to detect the causes of changes in phenomena through measurement and quantitative analysis.
- Experimental designs are best because they reduce “error” hiding “the truth.”
- Detachment is the ideal state.

Interpretivist Paradigm
- Reality is socially constructed through collective definitions of phenomena.
- The goal of research is to interpret phenomena from multiple perspectives.
- Ethnographic methods such as observation and interviews are best because they provide the basis for shared interpretations.
- Immersion is the ideal state.
### Critical Paradigm
- Reality is individually constructed based upon experience, gender, culture, etc.
- The goal of research is to improve the status of the under-privileged.
- Critical theory deconstructing phenomena is best when it reveals the hidden power agendas in many educational technology interventions.
- Political engagement is the ideal state.

### Heuristic Paradigm
- Reality is complex and social phenomena are unpredictable.
- The goal of research is to provide education practitioners with the information they need to make better decisions.
- Methods and tools should be selected on the basis of their potential for enhancing the quality of decision-making.
- Skepticism is the ideal state.

### Design Paradigm
- Educational phenomena are exceedingly complex.
- The goal of research is to have a positive impact on teaching and learning practice and to contribute to theory.
- Creative design efforts combined with rigorous evaluation using multiple methods are recommended.
- Commitment is the ideal state.

### Where would you invest 100 million in educational research?
Using Post-It Notes, invest 100 million dollars in grant funds in one or more of the paradigms.
“Pasteur’s Quadrant” (Stokes, 1997).

<table>
<thead>
<tr>
<th>Research is inspired by:</th>
<th>Considerations of use?</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Quest for fundamental understanding?</td>
<td>Bohr</td>
<td>Pasteur</td>
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<tr>
<td></td>
<td>No</td>
<td>Edison</td>
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Educational Technology Research

Technology Lies
- Technology lets you replace the teacher with the machine.
- Technology makes learning easy and automatic.
- Changing the medium alone enhances learning.

Educational Technology Research

Level of Involvement
- Passive
  - Reading Words
  - Hearing Words
  - Looking at Pictures
  - Watching a Movie
  - Watching at an Exhibit
  - Seeing it done on Location
- Active
  - Participating in a Discussion
  - Giving a Talk
  - Doing a Dramatic Presentation
  - Simulating the Real Experience
  - Doing the Real Thing

We Tend to Remember
- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we see & hear
- 70% of what we say
- 90% of what we say & do

Oversold & Underused

Abundant technology has not led to extensive use of computers for “tradition-altering classroom instruction.”
- The small percentage of computer-using instructors only use it to maintain existing classroom practices.
**Educational Research Reality**

- Isolated researchers conduct individual studies rarely linked to a research agenda or concerned with any relationship to practice.
- Studies are presented at conferences attended by other researchers and published in journals few people read.
- Occasional literature reviews and meta-analyses are published.

**Bernard et al. 2004 - “How Does Distance Education Compare to Classroom Instruction?”**

- very small mean effect size for interactive distance education over traditional classroom instruction on achievement
- small negative effect for retention

**Tallent-Runnels et al. 2006 - “Teaching Courses Online: A Review of the Research**

Major conclusion: “…overwhelming evidence has shown that learning in an online environment can be as effective as that in traditional classrooms.”

**Internet-Based Learning in the Health Professions: A Meta-Analysis**

Cook et al. (2008)

Internet-based learning compared with non-Internet instructional methods show effectiveness similar to traditional methods.
Is “just as good” good enough?

Educational researchers often fail to distinguish between research goals and methods.

Six research goals:

- Theoretical
- Predictive
- Interpretivist
- Postmodern
- Design/Development
- Action/Evaluation

Theoretical Goals

- Focus on explaining phenomena through logical analysis and synthesis of principles and results from other studies
- EXAMPLE: Gagne’s theory of the conditions of learning

Predictive Goals

- Focus on determining how education works by testing hypotheses related to theories of learning, teaching, performance, etc.
- EXAMPLE: cooperative learning and control studies by Hooper, Temiyakarn, and Williams

Interpretivist Goals

Focus on determining how education works by describing and interpreting phenomena related to learning, teaching, performance, etc.

EXAMPLE: Delia Neuman’s observations of disabled children using commercial software

Simon Hooper

Delia Neuman
Postmodern Goals
- Focus on examining the assumptions underlying educational programs with the goal of revealing hidden agendas and empowering disenfranchised minorities
- EXAMPLE: Ann DeVaney’s analysis of IT in relation to race, gender, and power

Design/Development Goals
- Focus on dual objectives of developing creative approaches to solving problems and constructing reusable design principles
- EXAMPLE: Sasha Barab’s “Quest Atlantis” project and “Learning Engagement Theory”

Action/Evaluation Goals
- Focus on describing, improving, or estimating the effectiveness and worth of a particular program
- EXAMPLE: Hill and Reeves four-year evaluation of ubiquitous computing initiative.

Methods should not be selected until goals & research questions are clear:
- Quantitative experiment
- Qualitative observation
- Critical deconstruction
- Historical analysis
- Literature Review
- Mixed-methods

- Is there a control group?
- Are the control and experimental groups assigned randomly?
- If a matched study, are the groups extremely similar?
- Is the sample size large enough?
- Are the results statistically significant?
Problems with Medical Research Model
• Double blind experiments impossible in education.
• Implementation variance reduces treatment differences.
• Causal agents are under-specified in education.
• Goals, beliefs, and intentions of students and teachers affect implementation of treatments.


The only defensible rationale for Educational Research is IMPACT on real world problems!

Key Criteria for Educational Design Research
• Collaborative
• Utility-oriented
• Theory-informed
• Interventionist
• Iterative
• Rigorous
• Relevant
Case Study 1
Susan McKenney & Harini Raval
University of Twente, The Netherlands


- **Type of Study**: Educational design research study led by doctoral student and her supervisor.

- **Main Research Question**: What kind of professional support can help para-teachers adopt teaching strategies with a learner-centered orientation?

- **Dual Outcomes**:
  - Robust para-teacher professional development program
  - Design heuristics for creating similar programs in other contexts

- **Analysis**
  - Literature review
  - Field portrait
  - Classroom observations
  - Teacher interviews
  - Management interviews

- **Exploration**
  - Program inspiration
  - India education weak
  - Long term interest in developing countries
  - SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to establish options and boundaries for a sustainable professional development program
Para-teacher learning in an Indian NGO

- **Design**
  - Four major factors
    1. the para-teacher
    2. the instructional setting
    3. the organizational setting
    4. policy
  - Conceptual model
    - lesson planning
    - lesson enactment
    - reflection on the lessons

- **Construction**
  - Workshop components
    - tailor-made templates for lesson planning and reflection
  - Opportunities to increase content knowledge
  - Pedagogical guidelines

- **Evaluation**
  - Three rounds of testing of professional development workshop
    1. Researcher alone
    2. Local managers with researcher present
    3. Local managers alone

- **Reflection**
  - Enhance PD program
  - Identify reusable design heuristics

Para-teacher learning in an Indian NGO

Implementation

- First: Organizational conditions
- Second: Basic teaching and classroom management skills
- Third: Learner-centeredness

- **Diffusion**
  - From start: Eye toward scale and sustainability
  - Program institutionalized (endures and grows without researchers)
  - Multiple publications

Para-teacher learning in an Indian NGO

- **Evaluation**
  - Three rounds of testing of professional development workshop
    1. Researcher alone
    2. Local managers with researcher present
    3. Local managers alone

Article-Based Dissertation


Case Study 2
Enhancing Group Work in an E-learning Evaluation Course

Eunjung Oh, Ph.D.
**Research Goals**

- To optimize collaborative group work (and ultimately learning) in an online learning environment
- To present both a refined model and design principles for online collaborative group work among adult learners in higher education

**EDR Process**

<table>
<thead>
<tr>
<th>2007 Summer</th>
<th>2007 Fall</th>
<th>2008 Spring</th>
<th>2009 Spring</th>
<th>2009 Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration</td>
<td>Enactment</td>
<td>Implementation</td>
<td>Dissemination</td>
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</table>

- Needs analyses
- Literature review (rationales, research problems, initial theoretical framework)
- Context exploration
- Preliminary study
- Design specification
- Develop prototype
- Research design
- Refine design & prototype
- Course implementation
- Data collection
- Refine design & theory
- Overall outcome evaluation
- Publish results
- Diffusion/Adoption/Adaptation
- Dissemination
- Course implementation
- Data collection
- Refine design & prototype

**Design-Based Research**

- Analysis of Practical Problems by Researchers and Practitioners in Collaboration
- Development of Solutions Informed by Existing Design Principles and Technological Innovations
- Iterative Cycle of Testing and Refinement of Solutions in Practice
- Reflection to Produce “Design Principles” and Enhance Solution Implementation

- Refinement of Problems, Solutions, Methods, and Design Principles


**Phase 1:**

- Identification of problem
- Practitioner Interest

  Professor desired to move evaluation course online and open it to the world.

  Few online courses optimized for learning. Group work and self-regulation are challenges.
Phase 3: Iteration 1

- Implemented online course for three semesters
- Intensive observations
- Surveys
- Interviews
- Document analysis
- Redesign iterations

Phase 4:

- Design principles and models related to:
  - Supporting collaborative group work in online learning environments
  - Supporting self-regulated learning in online learning environments

Optimizing Group Work in Online Courses

- Two-year EDR project to design and develop a graduate-level online “E-Learning Evaluation” course to best support adult learners’ group work experience
- Evaluation course delivered face-to-face for 20 years.
- Numerous requests to have the course converted to an online version

Research Questions

- What challenges do learners encounter when they work in groups in online learning environments?
- What are the attributes of groups working well together and what are the attributes of groups not working well together? What makes them different from each other?
- What supports or scaffolding do learners need during the group work process?

Conceptual Framework
Findings 1: challenges encountered

<table>
<thead>
<tr>
<th>First Iteration</th>
<th>Second Iteration</th>
<th>Third Iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication related issues</td>
<td>Communication</td>
<td>Delay in project process</td>
</tr>
<tr>
<td>• Working in different time zones</td>
<td>• Differences in expectations</td>
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<tr>
<td>• Tool affordance and choices</td>
<td>• Regarding commitment and product quality</td>
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<tr>
<td>• Major events in personal lives</td>
<td>• Insufficient knowledge or opportunity to learn about each other and build relationships as team members</td>
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<tr>
<td>• Culture and language</td>
<td>• Uncontrollable challenges that retarded the work process</td>
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<tr>
<td>Technology related factors</td>
<td>• Ineffective leadership</td>
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<tr>
<td>Lack of sense of community and belongingness</td>
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<tr>
<td>Differences in motivation, expectations and accountability</td>
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<td>Overly optimistic expectations regarding student self-direction and autonomy</td>
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<tr>
<td>Lack of leadership or ineffective leadership within groups</td>
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</table>

Findings 2: attributes of groups

<table>
<thead>
<tr>
<th>Positive Indicators</th>
<th>Negative Indicators</th>
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<tbody>
<tr>
<td>• High quality deliverables</td>
<td>• Low quality deliverables</td>
</tr>
<tr>
<td>• Clear communication and active interaction</td>
<td>• Lack of communication and interaction</td>
</tr>
<tr>
<td>• Clear documentation</td>
<td>• Unclear documentation</td>
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<tr>
<td>• Appropriate use of tools</td>
<td>• Inappropriate use of tools</td>
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<tr>
<td>• Fair and balanced workload</td>
<td>• Free riders/social loafing</td>
</tr>
<tr>
<td>• Shared sense of mutual contributions</td>
<td>• Lack of understanding of contribution of others</td>
</tr>
<tr>
<td>• Substantive discussion of task/content</td>
<td>• Superficial division of tasks</td>
</tr>
<tr>
<td>• Effective leadership/management (person, time, and deliverables)</td>
<td>• Ineffective leadership/management (person, time, and deliverables)</td>
</tr>
<tr>
<td>• Successful negotiation/conflict resolution</td>
<td>• Unsuccessful negotiation/conflict resolution</td>
</tr>
</tbody>
</table>

Findings 3: identified scaffoldings & support

<table>
<thead>
<tr>
<th>First Iteration</th>
<th>Second Iteration</th>
<th>Third Iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model appropriate communication styles and methods</td>
<td>Guide communication and organization/management strategies directly</td>
<td>Provide more task-centered scaffolding to improve time management</td>
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<tr>
<td>Encourage students autonomy, yet provide sufficient course structure and specific guidelines</td>
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<tr>
<td>Enhance the sense of community and belongingness</td>
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<tr>
<td>Provide new, enhanced tools and guidelines for technology use for group work</td>
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<tr>
<td>Facilitate students’ learning about evaluation</td>
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<tr>
<td>Assign groups with careful consideration of particular students’ heterogeneous characteristics</td>
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<td>Share instructor’s expectations for performance</td>
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<td>Provide opportunities for discussion of their expectations</td>
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<td></td>
<td>Guide communication and organization/management strategies directly</td>
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<td></td>
<td>Provide guidance on effective leadership</td>
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<tr>
<td></td>
<td>Assign groups with careful consideration</td>
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<td></td>
<td>Reach out to students</td>
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<td></td>
<td>Establish an atmosphere for more social/personal interaction</td>
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</tr>
<tr>
<td></td>
<td>Provide task-centered scaffolding</td>
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Outcomes

- 7 design principles & 30 associated strategies
- Research: explore the sustainability, transferability and generalizability of the outcomes
  - Application without the presence of design researchers
  - Application beyond the local setting
- Practice: Application in broader settings
  - Design principles/strategies need adjustment depending on the context
  - High transferability because of familiar/free technology use
  - Online evaluation courses, courses using a semester-long authentic project

7 Design Principles

- Facilitate communication
- Establish a strong sense of community and a sense of belongingness to their own groups and the class
- Provide a variety of technology everyone can use
- Maximize the opportunities of collaboration and scaffold the group work process
- Provide opportunities for establishing positive interdependence
- Enhance individual accountability, motivation, and engagement for active participation in group work
- Facilitate individual student learning about evaluation
All my EDR students used research articles format for dissertations.

Publishing Educational Design Research

Rationales for MOOCs

• Increase access to educational opportunities for those who would otherwise not have them
• Increase the quality and effectiveness of teaching and learning

You have 15 minutes to work with another participant to outline a design-based research plan focused on improving the educational quality of MOOCs. Please describe in brief:
- problem
- collaborators
- initial design principles
- research questions
- data collection methods
Should I engage in design-based research?

Education is a design profession like architecture and engineering, and thus educational researchers should pursue design research that integrates the desire to solve problems with the search for knowledge.

EDR Resources

http://dbrxroads.coe.uga.edu/
http://www.international.slo.nl/edr
http://authenticlearning.info/DesignBasedResearch/Design_based_research.html

“The status of research deemed educational would have to be judged, first in terms of its disciplined quality and secondly in terms of its impact. Poor discipline is no discipline. And excellent research without impact is not educational.”
Charles Desforges (2000)

Thank You!
Professor Emeritus Thomas C. Reeves
The University of Georgia
treeves@uga.edu
http://www.evaluateitnow.com