Education Challenges and Opportunities Amidst Disruptive E-Learning Technologies

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Contents

• The Disruptive Education Landscape
  - Innovation and Disruption
  - Disruptive ans Societal Forces

• Some Innovation Axes in E-Learning
  - Interactive E-Learning Activities
  - The Architecture of Collaboration
  - Toward Evolvable Modular Content

• Discussion and Conclusion

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THE DISRUPTIVE EDUCATION LANDSCAPE
DISRUPTION AND INNOVATION
On Economics and Innovation

**Creative destruction** is a theory, popularized by *Joseph Schumpeter*, of economic innovation and the business cycle. The *gale of creative destruction* describes the “process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one“.

**Disruptive innovation** is a term defined and analyzed by *Clayton Christensen* in 1995. It refers to an innovation that creates a new market and value network, and eventually disrupts an existing market and value network, displacing established market-leading firms, products, and alliances. It has been called the most influential business idea of the early 21st century.
On Economics and Innovation

The Innovators Dilemma

Key Message: There are two essential types of developments.

- Sustaining developments that maintain existing value chains and incumbents
- Disruptive developments that overturn existing value chains and incumbents

Struggling with this, that's what a disruptor is.
On Destruction, Innovation, and Disruption

- Creative destruction
  - Mainframes → PC’s with OS → Open Source Software
  - PSTN Long Distance Calls → Internet connectivity
- Inertia of value networks
  - Digital music → disc / box / rack / store
- Resistance of value networks
  - Digital music → record labels
  - Digital cinema → theatre owners
- Group dynamics in disruptive innovation
  - Open Source Software
  - Teslarati and volunteers
On Destruction, Innovation, and Disruption

Where does lasting prosperity come from? The answer: Market-Creating Innovations.
— Clayton Christensen

It takes 30 years for a new idea to seep into the culture. Technology does not drive change. It is our collective response to the options and opportunities presented by technology that drives change.
— Paul Saffo

Invention requires a long-term willingness to be misunderstood. You do something that you genuinely believe in, that you have conviction about, but for a long period of time, well-meaning people may criticize that effort ... if you really have conviction that they’re not right, you need to have that long-term willingness to be misunderstood. It’s a key part of invention.
— Jeff Bezos
Plenty of Disruptive Innovations
DISRUPTIVE AND SOCIETAL FORCES
Is E-Learning Potentially Disruptive?

For most complicated issues in statistics, I go on the Web to Khan Academy. There, it is explained much better and clearer.

— Belgian High School Student

Why can’t I just go on the Web and follow a MOOC on ‘Introduction to Economics’. I can’t get it any better than explained by a Noble Prize Winner, can I?

— Belgian College Student Economics

I prefer to work part time during my master studies. There are many things I only learn at the company, and it enables me to know what I’m looking for, and actively improve my learning at the university.

— Czech College Student Informatics

“Education Disruption On Its Way.”
Is There Inertia in Current E-Learning?

- LMS (Learning Management Systems) are still mainly used by lecturers to publish PDF’s ...
- Teaching classes are often recorded from beginning to the end, year after year ...
- In order to have computer examinations, lecturers resort to multiple choice questions ...
- And how are we going to overcome it ...

“Who is going to send our learning Tesla Roadster into orbit and create the imagery and the same sense of possibility that nothing will ever be the same again?”

Are we Really Ready for Disruption in Learning?, Peter Philips, Feb 2018
Disruptive Forces in Education

- Massive Open Online Courses
  - edX, Coursera, Udacity, ..
- Online tools to educate students
  - Khan Academy, PatrickJMT, EdTech Talks, ...
- Technology Certification Programs
  - Java, SAP, Scrum, ...
- Market pull on students
  - From big companies
  - To start their own company
- And, as always, a lot of hype ...
Societal Forces in Education

- Government allocation mechanisms
  - Competitive, market-driven
- Double degrees, university alliances
- Local and global accreditation bodies
SOME INNOVATION AXES IN E-LEARNING EDUCATION
INTERACTIVE E-LEARNING
Toward Interactive E-Learning Activities

- Several techniques exist:
  - Scenarios and simulations
  - Stories
  - Games
  - Quizzes and assessments
- Many more tools exist
  - With many templates, formats, scenarios, ...
- People are hailing *interactive instructional simulations* as the demand for e-learning content seems to start falling
Toward Interactive E-Learning Activities

- Engaging and effective interactive content is scarce
- Should be developed in a domain-specific way
  - Taking advantage of domain intricacies
    - E.g., interactive exercises in ‘accountancy’
      - Huge improvements in results in former threshold course
- Provides many opportunities
  - In domain-specific interactive e-learning content
  - In generalizing it through induction
ARCHITECTURE OF COLLABORATION
The Architecture of Collaboration

- Next to the many challenges due to globalization, there are equally collaboration opportunities
- Collaborate with university partner networks
  - Leverage incoming exchange students to create mixed student groups for assignments, e.g., UA-JMU
  - Leverage exchange of lecturers to establish mixed virtual groups for such assignments, e.g., UA-CTU
  - Develop and establish common courses with partner universities
The Architecture of Collaboration

- Collaborate with private industry partners
  - Internships, master theses
  - Summer schools, bootcamps
  - Usage of tools from spin-off companies
  - Run integration projects co-supervised by companies
    - Multinationals, SME’s, NPO’s

- Use and embed publicly available content
  - Embed external content in learning channel. E.g.,
    - Khan Academy
    - PatrickJMT
    - EdTech
Reach Out and Leverage Alumni
Reach Out and Leverage Alumni
EVOLVABLE MODULAR CONTENT
What About the Future of Documents?
What About Re-Use and Evolvability?

- Variations x Versions
- Variations
- Versions

* Security documents plants
* Technical manuals machines
* Accreditation body reports
What About Re-Use and Evolvability?

- Look at software...

“expect families of routines to be constructed on rational principles so that families fit together as building blocks”

What About Re-Use and Evolvability?

- Look at software ...

The Law of Increasing Complexity
Manny Lehman

“As an evolving program is continually changed, its complexity, reflecting deteriorating structure, increases unless work is done to maintain or reduce it.”

What About Re-Use and Evolvability?

- Look at rockets ...
What About Re-Use and Evolvability?

- Look at bikes ...
What About Re-Use and Evolvability?

- Look at cars...
What About Re-Use and Evolvability?

Variations x Versions

Step 1: Fine-grained Modules

Step 2: (Re)Generate
Toward Evolvable Modular Content

- accounting
- marketing
- business fundamentals
- sustainability
- engineering
Toward Evolvable Modular Content

Abstract

Contents

Teaching method

Assignments

Learning outcomes

Societal Impact

Internationalization

Engineering

Business

Sustainability

Ethical awareness

Contents

Abstract
Toward Evolvable Modular Content
Toward Evolvable Modular Content
Toward Evolving Modular Content

- Other types of variations exist as well
  - Layout styles
  - Verboseness
  - Languages

- Ordering should be configurable
  - Within an hierarchical level
  - Between hierarchical levels

- Multimedia adds some variations
  - Exchange video without sound
  - Exchange scenario’s without video/sound
CONCLUSION AND DISCUSSION
Conclusions

- E-learning technologies are in essence disruptive
- Learning disruption is still in a preliminary phase
- It poses or will pose many challenges for educators
  - Prestigious MOOC providers
  - Free content platforms
- Nevertheless, educators have ample opportunities
  - Creating specialized interactive content
  - Creating new collaborative architectures
- One should be well aware of modularity issues
  - Hampering future re-use and evolvability
Questions/Remarks

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