EPFL MOOCs

Lessons learned

Prof. Pierre Dillenbourg

Data from F. Pinto and P. Jermann
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Authors</th>
<th>Language</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Programming Principles in Scala</td>
<td>M. Odersky</td>
<td>EN</td>
<td>Bs</td>
</tr>
<tr>
<td>Digital Signal Processing</td>
<td>P. Prandoni, M. Vetterli</td>
<td>EN</td>
<td>Ms</td>
</tr>
<tr>
<td>Linear and Discrete Optimization</td>
<td>F. Eisenbrand</td>
<td>EN</td>
<td>Bs</td>
</tr>
<tr>
<td>Analyse numérique pour ingénieurs</td>
<td>M. Picasso</td>
<td>FR</td>
<td>Bs</td>
</tr>
<tr>
<td>Mécanique I</td>
<td>J.-P. Ansermet</td>
<td>FR</td>
<td>P</td>
</tr>
<tr>
<td>L'Art des Structures I: Câbles et arcs</td>
<td>A. Muttoni, O. Burdet</td>
<td>FR</td>
<td>Bs</td>
</tr>
<tr>
<td>Initiation à la programmation en C++</td>
<td>V. Lepeit, J. Chappelier</td>
<td>FR</td>
<td>Bs</td>
</tr>
<tr>
<td>Initiation à la programmation en Java</td>
<td>J. Sam, V. Lepeit</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Neuronal Dynamics: Computational Neuroscience of Single Neurons</td>
<td>W. Gertsner</td>
<td>EN</td>
<td>Ms</td>
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<tr>
<td>Comprendre les Microcontrôleurs</td>
<td>J.-D. Nicoud, P. Rochat</td>
<td>FR</td>
<td>HP</td>
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<tr>
<td>Principles of Reactive Programming</td>
<td>M. Odersky</td>
<td>EN</td>
<td>Bs</td>
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<tr>
<td>Electrotechnique II</td>
<td>Y. Perriard, P. Germano</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Éléments de Géomatique</td>
<td>P. Gilliéron, B. Merminod</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Villes Africaines - Introduction à la planification urbaine</td>
<td>J. Chenal</td>
<td>FR</td>
<td>Ms</td>
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<tr>
<td>Introduction à la programmation orientée objet (en C++)</td>
<td>J. Chappelier, J. Sam</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Introduction à la programmation orientée objet (en Java)</td>
<td>J. Sam, J. Chappelier</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Mecanique des Fluides</td>
<td>C. Ancy, F. Gallaire</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Introduction to Household Water Treatment and Safe Storage</td>
<td>R. Johnston</td>
<td>EN</td>
<td>HP</td>
</tr>
<tr>
<td>Electrotechnique I</td>
<td>Y. Perriard, P. Germano</td>
<td>FR</td>
<td>Bs</td>
</tr>
<tr>
<td>Introduction à l'Astrophysique</td>
<td>F. Courbin</td>
<td>FR</td>
<td>Bs</td>
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<tr>
<td>Planning and Design of Sanitation Systems and Technologies</td>
<td>C. Lüthi</td>
<td>EN</td>
<td>HP</td>
</tr>
<tr>
<td>L'Art des Structures II - Structures en treillis, poutres et cadres</td>
<td>A. Muttoni, O. Burdet</td>
<td>FR</td>
<td>Bs</td>
</tr>
<tr>
<td>Mécanique II</td>
<td>J.-P. Ansermet</td>
<td>FR</td>
<td>P</td>
</tr>
<tr>
<td>Cellular mechanisms of brain function</td>
<td>C. Petersen</td>
<td>EN</td>
<td>Ms</td>
</tr>
</tbody>
</table>

- Functional programming; object-oriented programming; Scala programming language.
- Digital signal processing theory, algorithms, and applications.
- Linear and discrete optimization in the context of computational mathematics.
- Basic numeric analysis tools; solving numerical differential equations.
- Mathematical description of physical phenomena; Newtonian mechanics.
- Supporting structures of buildings, roofs and bridges; Design of cables and arches.
- Basics of C++ programming language.
- Basics of Java programming language.
- Theoretical and computational neuroscience; single neuron models.
- Theory and practice of microcontrollers; practical examples of their usage.
- Composable event-driven software; scalability, resiliency, and responsiveness.
- Three-phase AC systems; loads and transients; power supplies.
- Procurement methods; modeling and representation of spatial data.
- Basics of urban planning; technical, environmental, socio-economic factors.
- Basics of object-oriented C++.
- Basics of object-oriented Java.
- Physical properties of fluids; surface tension; capillary action; hydrostatics.
- Water treatment methods; successful implementation strategies.
- Linear electric circuits; continuous and alternating currents.
- Physical principles of astrophysics.
- Urban sanitation planning; sanitation systems and technology.
- Operation principles of lattice structures, beams, slabs and frames.
- Rigid body dynamics; basic principles of relativity and the Lagrangian formalism.
- Mammalian brain function; nerve cells and synaptic interactions.
Why does EPFL produce MOOCs?

1. Share knowledge outside campus
2. Increase EPFL visibility
3. Better pedagogy on campus
4. Support French speaking Africa
5. Boost Continuous training
6. Generate revenues
WHY?

1. Knowledge outside campus
2. EPFL visibility
3. Better pedagogy on campus
4. French speaking Africa
5. Continuous training
6. Generating revenues
Why does EPFL do MOOCs?

1. Knowledge outside campus
2. EPFL visibility
3. Better pedagogy on campus
4. French speaking Africa
5. Continuous training
6. Generating revenues
MOOCs are not the « McDonaldisation » of European universities
Figure 17. Users’ level of engagement for each MOOC. The users are classified as *actives* (solved at least one exercise), *viewers* (watched a video, but didn’t solve any exercise), and *inactives* (never watched a video nor solved an exercise). The 21 bars on the left represent all registered users for which the data is available [$N = 645,455$]; the 2 bars on the right represent only those users who’ve paid $50 for a verified Coursera certificate [$N = 2,847$].
Figure 19. Users’ level of achievement for each MOOC. The users are classified as having passed (obtained the minimum grade specified by the teacher) or failed (didn’t obtain the minimum grade). The top 21 bars represent all registered users for which the data is available [N = 655,453]; the middle 21 bars represent only those users who were classified as active [N = 120,985]; the bottom 2 bars represent only those users who’ve paid $50 for a verified Coursera certificate [N = 2,847].
<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th># Participants</th>
<th>% Explored</th>
<th>% Certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher (is or has been)</td>
<td>39%</td>
<td>33,228</td>
<td>42%</td>
<td>20%</td>
</tr>
<tr>
<td>Not a teacher (has never been)</td>
<td>61%</td>
<td>51,127</td>
<td>34%</td>
<td>15%</td>
</tr>
<tr>
<td>Teaches this topic</td>
<td>21%</td>
<td>6,122</td>
<td>46%</td>
<td>21%</td>
</tr>
<tr>
<td>Teaches another topic</td>
<td>79%</td>
<td>22,915</td>
<td>43%</td>
<td>20%</td>
</tr>
<tr>
<td>Responded</td>
<td>21%</td>
<td>84,355</td>
<td>38%</td>
<td>17%</td>
</tr>
<tr>
<td>Did not respond or unsure</td>
<td>79%</td>
<td>310,485</td>
<td>13%</td>
<td>4%</td>
</tr>
<tr>
<td>Surveyed</td>
<td>27%</td>
<td>394,840</td>
<td>19%</td>
<td>7%</td>
</tr>
<tr>
<td>Not surveyed</td>
<td>73%</td>
<td>1,077,305</td>
<td>16%</td>
<td>8%</td>
</tr>
</tbody>
</table>
If our MOOCs are continuing education
And if we are lazy on continuing education
Then MOOCs solve a problem
Why does EPFL do MOOCs?

- Knoweldge outside campus
- EPFL visibility
- Better pedagogy on campus
- French speaking Africa
- Continuous training
- Generating revenues
Why does EPFL do MOOCs?

- Knowledge outside campus
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- Generating revenues
« Flipped Class »

Introduction à la programmation, J.-C. Chappelier

MOOC Physique Générale EPFL, J.-Ph. Ansermet

Dans l'ensemble, j'estime que cet enseignement est:

<table>
<thead>
<tr>
<th>Réponse</th>
<th>Nbr répondants</th>
<th>En %</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 excellent</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>5 bon</td>
<td>47</td>
<td>42</td>
</tr>
<tr>
<td>4 suffisant</td>
<td>47</td>
<td>42</td>
</tr>
<tr>
<td>3 insuffisant</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>2 très insuffisant</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1 mauvais</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>pas concerné</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Moyenne : 5.2  
Médiane : 5.0  
Ecart-type : 0.9

Le MOOC vous aide-t-il pour la physique ?

<table>
<thead>
<tr>
<th>Réponse</th>
<th>Nbr</th>
<th>Pourcentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oui</td>
<td>84</td>
<td>92%</td>
</tr>
<tr>
<td>Non</td>
<td>7</td>
<td>8%</td>
</tr>
</tbody>
</table>

En physique, le MOOC serait-il suffisant ?

<table>
<thead>
<tr>
<th>Réponse</th>
<th>Nbr</th>
<th>Pourcentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oui</td>
<td>8</td>
<td>9%</td>
</tr>
<tr>
<td>Non</td>
<td>83</td>
<td>91%</td>
</tr>
</tbody>
</table>
Pierre

can you prove that MOOCs
are courses in lectures
rooms?
Good MOOCs are (in general) better than bad MOOCs
What is a « Good MOOC » ?
A MOOC with rich activities
Fluid Dynamics (Gallaire & Anciay)

http://128.178.27.98:8082/LHE1.html

Statics (Muttoni & Burdet)
Watching MOOCs together
MOOCs are very social
Why does EPFL do MOOCs?

- Knowledge outside campus
- EPFL visibility

Better pedagogy on campus

French-speaking Africa

Continuous training

Generating revenues
Teachers spend more time preparing their course
Is it better to have a paper in nature or a MOOC with 50’000 participants?
Why does EPFL do MOOCs?

- Knowledge outside campus
- EPFL visibility
- Better pedagogy on campus
- French speaking Africa
- Continuous training

Generating revenues
MOOCs in Africa?
Language Matters
!!! Raw numbers are low
Research
An increase of 0.25 video speed results in an average decrease of perceived difficulty by 16% 

(p < .0001)
SYSTÈMES TRIphasés SYMétrIQUES

Tension Simple: $U_{RN}$, $U_{SN}$, $U_{TN}$

Tension Composée: $U_{RS}$, $U_{ST}$, $U_{TR}$

$U_{RS} = U_{RN} - U_{SN}$

$U_{ST} = U_{SN} - U_{TN}$

$U_{TR} = U_{TN} - U_{RN}$

$U_{RN} = Me^{j\alpha}$

$U_{SN} = Me$

$U_{RS} = Me^{j(\alpha - \frac{2\pi}{3})}$

$U_{TR} = Me^{j(\alpha - \frac{2\pi}{3})}$

$U_{ST} = Me^{j(\alpha - \frac{2\pi}{3})}$

Kshitij Sharma, Patrick Jermann, Pierre Dillenbourg
EPFL Center for Digital Education
« withmeness »

Kshitij Sharma, Patrick Jermann, Pierre Dillenbourg
EPFL Center for Digital Education
Please upload 3 pictures of soil erosion
20’000 X 3 / 0.5 = 30’000 pictures
30'000 pictures

Is it geological erosion or accelerated erosion?

Which one illustrates the best erosion?
Geological erosion

Accelerated erosion
Select top 5% pictures

500
Geological erosion

600
Accelerated erosion
Orchestration Graphs
erre Dillenbourg
And....

- Students spent 4-5 h/week
- No ECTS credits so far
- Series 3 MOOCS + capstone
- Interest for corporate training
- Interest from vocational education
Why is instructional psychology absent?

« MOOCs are lower quality than standards in instructional design, hence learning scientists should not work on MOOCs »
Better be an actor than a spectator

Beware of the Kodak syndrome

Pierre Dillenbourg, Center for Digital Education, EPFL
Will small universities disappear?