“Mathematical Education” in Belgium.

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2010
Storrs, UConn (Connecticut (USA))
1. Belgium in general
2. Education in Belgium
3. “Mathematical Education”
Belgium in general

1. Where is it?
2. What do you need to know about Belgium?

Education in Belgium

“Mathematical Education”
Belgium in Europe

- Member of EU.
- Time zone: UTC + 2 (in Summer)
Belgium

- Capital: Brussels (Capital of EU)
- Languages: French, Dutch, German
- Motto: “Strength through Unity”
- Anthem: The “Brabançonne”
- Area: 30,528 km²
- Population: 11,000,000 (great density)
- Currency: Euro
History

- Independence from Netherlands: 1830
- Monarchy (but no power):
  - First King: Leopold 1st
  - Now: Albert 2nd (he is the 6th king)
- 2 hard periods: first world war ('14–'18) and second ('40–'45)
- → thanks to Americans who helped us
What to visit and taste?

- Some cities: Brussels, Bruge, Namur, Antwerpen
- Sea (check up forecast beforehand!) and lots of forested zone
- Of course: chips, chocolate and beers
Some Belgian known?

**Movies:** Jean-Claude Van Damme ('60)
- Double impact, full contact, JCVD,...
Some Belgian known?

Comics:
- Hergé (Tintin)
- Peyo (The “Schtroumpfs”)
- Morris (Lucky Luke)
Some Belgian known?

Scientists:
- Georges Lemaitre (1894 → 1966, Big Bang theory)
- Ilya Prigogine (1917 → 2003, Nobel Prize in chemistry)
Some Belgian known?

Mathematicians:
- Pierre Deligne (’44, Fields Medal in ’78)
- Jean Bourgain (’54, Fields Medal in ’94)
Some Belgian known in sport?

**Cycling:** Eddy Merckx (’45)
- 5 “Tour de france” (’69− ’74),
- 5 “giro” and 2 “vuelta”,
- **One day race:** 7 “Milan-San Remo”, 3 “Tour des flandres”, 5 “Liege-Bastogne-Liege”, 3 “Paris-roubaix”
- 2 world championships
Some Belgian known in sport?

**Tennis:** Kim Clijsters ('83)
- 2 US Open, 2 Masters, 1 Fed Cup, Number one...and a girl of 2!!!

and Justine Hénin ('82)
- 2 US Open, 1 Australian Open, 4 French Open, 2 Masters, Olympic champion, 1 Fed cup, number one.
Some Belgian known in sport?

**Soccer: team sport number one (’45)**

- Olympic champion in 1920
- Second place at European championship in 1980
- Fourth place at *World Cup* in 1986
- Fourth place at Olympic Games in 2008
Some Belgian known in sport?

**Basketball (man):** Didier Mbenga (’80 in Congo)
- First Belgian in NBA
- He’s playing for Lakers
- Champion in ’09
Schedule

1 Belgium in general

2 Education in Belgium
   1 What about politics?
   2 Elementary School
   3 Secondary School
   4 High School and Universities

3 “Mathematical Education”
Politics: very complicated (related to 3 languages)!!!

Different levels of power

- **Federal** one
  1. **Government** (head: Prime Minister (Yves Leterme)): “build” laws
  2. Bicameral **Parliament** (Senate and Chamber of Representatives elected by Belgian people): **vote** laws

- **Community** one: Community and Region Governments (and Parliaments) for each language

  → Many ministers in each topics
  → slow system to solve problems!!!

Remarks: compulsory voting system and only one round.
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Most of decisions taken by Community Government:

1. Pre-School (3 years, 2.5 → 6): NOT an obligation
2. Elementary School (6 years, 6 → 12, free): obligation
3. Secondary School (6 years, 12 → 18, free): you must go to school until 18.
4. Superior School: High School or University.

Remark: Minister for point 4 is different as for the three others points.
Education in the **french** Community

Most of decisions taken by **Community** Government:

1. Pre-School (3 years, 2.5 → 6): **NOT** an obligation
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Education in the **French** Community

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Most of decisions taken by **Community** Government:

1. Pre-School (3 years, 2.5 → 6): *NOT* an obligation
2. Elementary School (6 years, 6 → 12, **free**): obligation
3. Secundary School (6 years, 12 → 18, **free**): you must go to school until 18.
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Types of school

- **Public** school: controlled by communities or municipalities
- “Catholical” school: controlled by a private person but supervised by municipalities.
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- “**Catholical**” school: controlled by a private person but supervised by municipalities.
**Elementary School**

- Learn Basis: reading, writing in French, counting,…
- Only one person to teach all the topics (18–22 by class)
- Tests all the time and final exam every year
- Commun final exam in 6th year
- The level gets down slowly year after year (social reasons)
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Secundary School

- One teacher by topic
- Tests all the time and final exam in each topics every year
- NO commun final exam in last year...maybe in the future
- The level gets down fastly (political and social reasons)
- Three “levels”: Profesional, Technical and General
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**Aim**: To work directly at 18.

- **Manual jobs**: bricklayer, finish carpenter,...
- midwife, nursing auxiliary, help-family,...
Aim:

- **Mix** up between theoretical and “manual” courses.
- You work at 19 (with one more year) or go to high school.
- You can switch to Professional level at every moment but not to general one.

Possibilities:

- accountant, “social teacher”, secretary,...
General “level”

**Aim:**
- Only theoretical courses
- You can switch to technical or professional level at every moment.
- After, you **must** go to high school or University.

**Problem** if you fail.

The **three first years** are common at everyone in this “level”.
- **Languages**: french (5h/w), dutch or english (4h/w), (Latin or greek (4h/w))
- **“Sciences”**: math (4h/w), sciences (3h/w)
- **Miscellaneous**: geography (2h/w), history (2h/w), gym (3h/w)

Then, you choose **options** (Math-Sciences, (Math-Latin), Sciences-Languages,...)

- **Commun part**: geography (2h/w), history (2h/w), french (4h/w ), gym (3h/w),...
- **Option**: Math (4h/w → 6 or 8h/w), Sciences (2h/w → 5h/w), languages (6h/w → 8h/w)
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Ch. Grumiau (UMons)
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- **Commun part**: geography ($2h/w$), history ($2h/w$), french ($4h/w$ ), gym ($3h/w$),...
- **Option**: Math ($4h/w \rightarrow 6$ or $8h/w$), Sciences ($2h/w \rightarrow 5h/w$), languages ($6h/w \rightarrow 8h/w$)
High School (3 years)
- Teacher in pre-school or elementary schools
- Math, french, english,... teacher in secondary schools (3 first years)
- Technician (in computer, electricity,...), nurse,...

University (at least 5 years (3 + 2)), you can study
- Math, french, latin, languages, physics,...
- Political sciences
- Study to become a lawyer
- Business sciences
- Medical sciences (doctor(7y), dentist(5y), pharmacist(5y),...)
- Engineering

Universitary diploma → research, teaching in secondary school, working in private,...
“Mathematical Education”
1. Math Program at the secondary school
2. What to do to be a Teacher at the secondary school?
3. What about research in mathematics?
Maths in secondary school...general level

- **Three first years:**
  - Calculus (fractions, \((a + b)(c + d) = \ldots, (a \pm b)^2 = a^2 \pm 2ab + b^2\),
    powers, square root,\ldots)
  - Geometry (compute area and volumes, Pythagore, Thales, notion of isometry,\ldots)

- **Year 4:**
  - Functions (notion of domain, application, image, study of classical functions, dilatation of functions,\ldots),
  - Equations

- **Year 5 (if 6h/w):**
  - Analysis (sequence, limit, derivative)
  - Inequalities
  - Analytical geometry (notion of plane, hyperplane,\ldots)

- **Year 6 (if 6h/w):**
  - Analysis (integrals, arcsin and arccos functions)
  - Complex space \(\mathbb{C}\)
  - Matrices, Determinant
Teacher can not ask during homeworks, tests or exams something not done in classroom.
→ Students never think by themselves...big trouble in maths!!!

Exercises must be given in a “live” context or “games”
→ Technics and “boring” calculus are avoided
→ Students do not control basis calculus as well as before.
Maths in High school

**Aim:** to be teacher in secondary school (3 *first year*)
- you *just* learn again the program of secondary school (*no more*)
- lots of *pedagogy* lessons and *practice* in schools
Maths at the University: Masters in math

**Aim**: to do research, to be a teacher in secondary school or work in private (banks,...)

**How is it working?**
- Bologna Process defined some rules (signed up in ’98, started in ’04)
  - 5 years: 3 general (called bac) and 2 specialized (called master)
  - Exams for each courses must be organized twice a year (end of the semester + September)
  - Only the final exam decide if you fail a course...so, no tests during the semester
- Each year, you must obtain 60% in average and 50% in each course
- Professors organize oral exam or written exam

**Remark**: Level gets down, students does not control enough courses and forget very fastly.
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First year:

- Elementary Mathematics (60h): recall of the secondary program
- Analysis (180h): limit in $\mathbb{R}^N$, continuity, derivative, Taylor development, differential equation (easy)
- Linear algebra (90h)
- Algebra (90h): notions of group, annulus, permutations,...
- You **choose** between computer science and physics lessons
Second year:
- Analysis (140h): Frechet derivative, Hilbert space, topology
- Algebra (60h): the goal is the Sylow theorems
- Probabilities (60h): introduction
- Logic (60h): introduction
- Differential manifold and complex analysis (60h): introduction
- You again choose between computer science and physics lessons
Third year:

- Analysis (110h): Lebesgue’s integration, functional analysis, Banach spaces ($L^p, l^p, ...$),
- Algebra (45h): the goal is the Galois classification
- Probabilities and statistics (45h)
- Logic (45h)
- Numerical analysis: rootfinding methods, interpolation, Runge-Kutta,
- You again **choose** between computer science and physics lessons
At this moment, you need to choose between

- To be a **teacher** in secondary school: pedagogy lessons and practice in schools
- To make a **PhD**: followed by a Professor, theoretical courses, go to seminars,...
- To work in **private**: business lessons, probabilities and practice in some companies

**Remark**: There is a Master-thesis to make in final year.
What about a PhD-thesis?

Two possibilities

- Grant from FNRS (like NRC): 4 years, related to an adviser
- Assistant (payed by the University): 6 years because you **must** give some lessons related to courses of your adviser

Thanks for your attention

Contact: christopher.grumiau@umons.ac.be
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