Round Table model

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Education philosophy

Learning facts - Training the mind to think

Empowering students

Ideas do not fall from helicopters

"Mathematics is not a spectator sport"
George Polya

Tomorrow's jobs have not been invented yet
Challenges

- Perceptions about mathematical ability
- Perceptions about learning
- Student motivation / engagement
- Knowledge gap / diverse backgrounds
- Too much information
- Find the right answers -> Ask the right questions
<table>
<thead>
<tr>
<th>Teaching and learning innovation</th>
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<td>Embedded into institutional and departmental constraints</td>
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<td>Teacher centered -&gt; balanced approach</td>
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<td>Lectures + active learning + peer-instruction workshops + technology</td>
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<td>Challenged student and teacher perceptions about learning mathematics</td>
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Model description and implementation
The shift

Established model

1. Lecture
2. Formative assignment submission
3. Class: assignment discussion

Round Table model

1. Prepare for lecture
2. Lecture
3. Prepare for class
4. Round Table class
5. Formative assignment submission

18/04/2018
Teaching and learning process with 5 milestones:

- Before the lecture (learning by preparing)
- During the lecture (teaching and learning by participating)
- Between the lecture and the class (learning by reading and systemizing)
- During the class (teaching, learning by doing and peer instruction)
- After the class (learning by doing)
Model application

- Implemented since 2014 on three mathematics courses:
  - Second year UG core course (proof based)
  - Second year UG optional course
  - Intensive summer course (abstract mathematics for economists)

- Varied between the modules: strategic development of skills

- Combined with curriculum enhancement
Milestone 1: Before the lecture

- Learning objectives
- Revise known key terms and results
- Read lecture notes
- Read lecture slides (hand written and full of graphical illustrations)
- Watch lecture videos
Milestone 2: During the lecture

- The lecture is the lecturer's show
- Student participation
- Community building

- Pay attention on what is said
- Annotate lecture slides
- Ask / answer questions

18/04/2018
Convergent sequences
Cauchy sequences

Question 3

If \((x_n)\) is convergent can we say something about the distance between any two terms of \((x_n)\)?

\[ x_n \to x, \quad \text{take } \varepsilon > 0 \text{ and consider } \frac{\varepsilon}{2} \]

there is \( N = N(\varepsilon) \) s.t.

\[ x_n \in V_{\frac{\varepsilon}{2}}(x), \quad \forall n > N \]

what is this distance?

\[ |x_n - x_m| < ? \]
Cauchy sequences

\[ \epsilon > 0 \text{ given}, \quad \exists N = N(\epsilon) \text{ s.t. if } n, m > N \text{ then} \]
\[ |x_n - x_m| \leq |x_n - x| + |x - x_m| < \frac{\epsilon}{2} + \frac{\epsilon}{2} < \epsilon \]

Definition 4 \((x_n)\) is Cauchy

Eventually all the terms are arbitrarily close to each other.
Milestone 3: Before the class

- **Prepare**
  - Class Preparation Guide (with learning objectives)

- **Study**
  - Study the material covered in the lecture

- **Reflect on**
  - Reflect on concepts, proofs and results

- **Connect**
  - Connect concepts: construct a K-map

- **Turn to**
  - Use office hours to ask questions

18/04/2018
K-map on sequences of real numbers
Milestone 4: During the class

The class is a student party:
- work in groups on a question set
- exchange ideas, compare answers
- explore
- ask questions

The class teacher is the DJ:
- guides students through the process
- answers questions

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Milestone 4: Skills/Roles

Students
- listening each other
- negotiating
- collaborating
- producers and consumers

Teachers
- share power
- trust students
### Milestone 5:
**After the class**

- **Use office hours** (turn to for advise)
- **Work on weekly assignment** (solitary work)
- **Submit assignment**
- **The next teaching-learning loop starts...**

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Assessment
Learning Objectives

- Gain a thorough understanding of the five C’s in mathematics: convergence, completeness, compactness, continuity and convexity.
- Be able to comprehend and critically reflect on results and proofs.
- Be able to write rigorously a mathematical proof.
- Develop a higher level of mathematical maturity combined with the ability to think analytically.
- Be able to follow more advanced treatments of Real Analysis and study its applications in disciplines such as economics.
Learning activities

Aligned to both course objectives and lecture objectives.

• Identify the modules of a proof.
• Apply a known technique in an unknown context.
• Use known results to develop a method.
• Produce a K-map.
• Give a presentation.

Vary in form and difficulty.
Assessment

**Formative assessment**
- Weekly assignments and group project/presentation.
- Communicate clear criteria, such as:
  - Ability to use mathematical notation.
  - Ability to give graphical illustrations.
  - Ability to perform a three step thought process.
  - Elegant, well organized and clear presentation.

**Summative assessment**
- The final exam will assess the degree to which the learning objectives were achieved:
  - Knowledge and comprehension of concepts and results.
  - Comprehension of proofs.
  - Ability to write a rigorous mathematical proof.
- Questions in the final exam will be of similar type as the exercises and questions in the weekly assignments, lecture notes and class quizzes.

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Feedback

Strategic approach to feedback
Feedback: to the students

- Individual feedback on weekly assignments (reassurance)
- Group feedback (social conversation)
- Hall of Fame: Share student solutions (comparative)
- Model answers
- How to prove it / how to study a proof: videos
- Real time feedback during class workshops

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Feedback: from the students

Mid term informal student surveys are conducted in the classes in week 5 or 6.

Course evaluation questionnaire after the exam.
Feedback from the students

The roundtable method is essential since it allows you to **experiment** with the course material whilst simultaneously having your **queries answered**. The scenario to **attempt**, **make mistakes** and have these mistakes **corrected** is an **exceptional method of learning**. This is **only ever the case when the round table method is implemented**. It also allows you to **learn from your peers**, seeing how they approach problems can allow you observe, adjust and **improve your own problem solving approach**.
Engage / motivate / lead
Student participation and engagement

- Lead by example / share enthusiasm and vision
- Frequent milestones / guidance
- Diverse forms of teaching material
- Plenty opportunities for teacher-student interaction
- Learning community
- Remove intimidation / change mindsets
Build a teaching team

- Introduce teaching assistants to students
- Weekly guidelines
- Open channel of communication
- Encourage contributions, solicit feedback, act on it
- Team peer observations and feedback

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Manage student expectations

Vision
- Share your goals and education philosophy.

Contract
- Make a contract with the students.
  - Learning objectives.
  - Course structure / teaching methods.
  - House rules.

Discussion
- Discuss student course evaluations.

Errors
- Creatively embrace errors / disruptions.

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