

Constructive Alignment in “Mathematics and Optimization” ?

This poster summarizes my final pedagogical project for the Higher Education Teaching Programme 2010/2011. The project was aimed at reporting on, analyzing, and developing my own teaching in Mathematics and Optimization, which is a small applied mathematics course for students at the Faculty of Life Sciences (LIFE).

Mathematics tends to be difficult for LIFE’s students.

“How does it happen that there are people who do not understand mathematics? If the science invokes only the rules of logic, those accepted by all well-formed minds, if its evidence is founded on principles that are common to all men, and that none but a madman would attempt to deny, how does it happen that there are so many people who are entirely impervious to it?”

Henri Poincaré, 1908



I strove to present the mathematical contents through examples of relevance for students at LIFE.

Example: The Farmer’s Problem

A farmer wants to grow potatoes (P) and tomatoes (T) in some combination on his field... Consequently,

$$\begin{cases} Q(P, T) = 3000P + 2500T = \text{Max!} \\ P + T \leq 10 \\ T \geq 2 \\ 2P + 0.5T \leq 12 \\ P, T \geq 0 \end{cases}$$



I aimed to write clear and useful ILOs.

Some Intended Learning Outcomes

- Select between optimization methods to find the one relevant for solving a given problem.
- Solve concrete optimization problems.
- Give mathematical descriptions of linguistically formulated real life optimization problems.

The Viewpoint of Anna Sfard

Notions in mathematics can be conceived in two fundamentally different ways: structurally—as objects, and operationally—as processes. The processes of learning and of problem-solving consist in an intricate interplay between operational and structural conceptions of the same notions.

I designed TLAs intended to reflect the ILOs and Sfard’s point of view.

Some Teaching and Learning Activities

- Lectures (abstract and concrete)
- Mini-exercises (short, operational)

Do the following pivot operation:

$$\begin{array}{cc|cc} & x_1 & x_2 & \\ y_1 & -1 & 0 & 3 \\ y_2 & 4 & 2 & 4 \\ & 1 & -3 & -4 \end{array} \rightsquigarrow ?$$

- Problem sessions (long, structural)

A farmer can buy three types of NPK fertilizer whose contents of nitrogen, phosphorus, and potassium per kg fertilizer is as follows.

	Nitrogen	Phosphorus	Potassium
Fertilizer type I	2	2	4
Fertilizer type II	2	4	2
Fertilizer type III	5	3	2
...			

- Projects (in groups)

Examination

A written exam. The students did well.

Student evaluations came in written and oral form.

Feedback from Students

- Through LIFE’s standard online questionnaire.
- Through an interview on 5 April 2011.

Conclusions, Compliments, and Complaints

- ✓ The course was well-structured.
- ✓ The course was constructively aligned to a high degree.
- ➡ Focus even more on real life examples.
- ➡ Find new and more contemporary textbook.
- ➡ Possibly change the examination form.