Introduction

No problem can withstand the assault of sustained thinking.

Voltaire

Any fool can know. The point is to understand.

Albert Einstein

A problem is a chance for you to do your best.

Duke Ellington

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Goals of this Course

To make you a better problem solver in general, by:

Understanding how you operate

Recognizing limitations and pitfalls in the approaches you use

Learning techniques that you can apply to solve problems

To improve your ability to successfully complete the CS degree

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Descriptive vs Prescriptive

Descriptive: discuss how other people do it

Prescriptive: teach you how you should do it

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What Motivated this Course?

We designed this course in hopes of:

Improving students' ability to design
Improving students' ability to develop algorithms
Improving students' ability to plan (projects)
Improving students' ability to test and debug
Improving students' performance on tests
Improving students' analytical abilities
Improving students' ability to "argue" (proving)
Improving students' ability with personal interactions

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Guiding Philosophy

1. Problem solving is a skill (it can be learned). It is not an innate ability.

2. Problem solving is fundamentally about attitude and effort (the "problem-solving stance").

3. The problem-solving stance isn't something that you can just "turn on" when you need it for a test, etc. You have to live it – and successful people do just that.

Course Organization/Process

Learn about yourself

Learn problem-solving techniques

Solve a wide variety of problems, so as to learn how to apply the techniques

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Problems "in the large": Engineering tasks

    Lots of formal process, well developed

Problems "in the small": Puzzles, homework
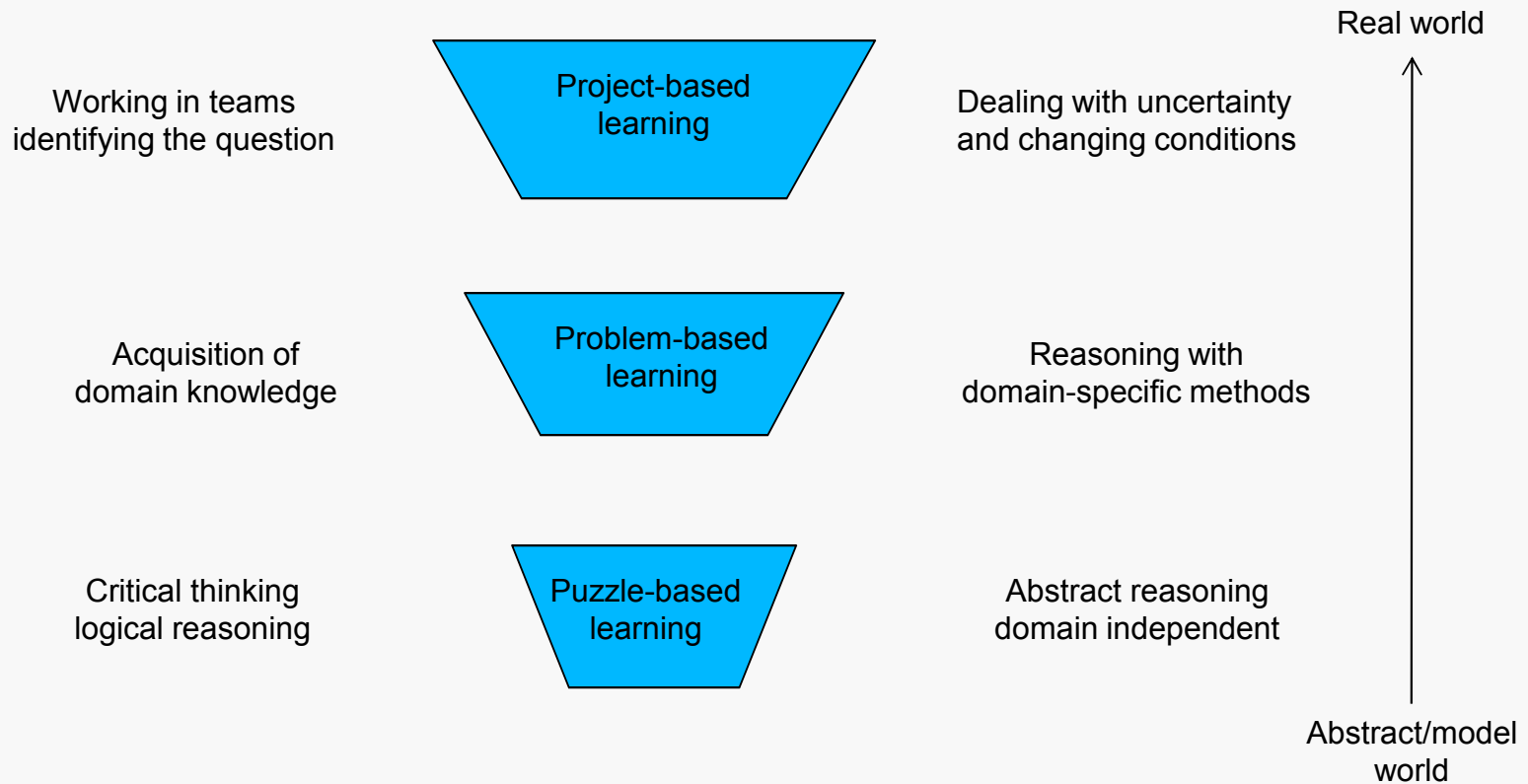
    Heuristics

Success as a student

Interpersonal problems

    Take a "problem-solving" stance

Analysis, construction, organization, process, understanding

Communication skills

Real world

Working in teams
identifying the question

Project-based learning

Dealing with uncertainty
and changing conditions

Acquisition of
domain knowledge

Problem-based learning

Reasoning with
domain-specific methods

Critical thinking
logical reasoning

Puzzle-based learning

Abstract reasoning
domain independent

Abstract/model
world

N. Falkner, R. Sooriamurthi, and Z. Michalewicz, "Puzzle-based learning for engineering and computer science," *IEEE Computer*, 43(4), 2010, pp. 20--28.