

Adapting to Different Types of Target Audience in Teaching Formal Methods

Antonio Cerone

Department of Computer Science, Nazarbayev University, Kazakhstan

antonio.cerone, @nu.edu.kz

Karl Lermer

Department of Computer Science, ZHAW, Switzerland

lrka@zhaw.ch

Contents

- **Set up the Context** for Teaching FM
 - Formal Methods and Maths
 - Students' Perspective
 - Industry's Perspective
- **Our Strategy:**
Motivations, Fun, Practice with Tools,
Choice of FM
- **Types of Target Audience**
- **Conclusion**

Formal Methods and Maths?

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- they are maths that **cannot be applied** to real world situations

Are Students Right?

They are as **difficult** as maths

They make computer science **not understandable**

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No, they make computer science in some way **independent of computers**

Are Industry People Right?

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No, they **can be applied** to many **practical disciplines**: physics, chemistry, biology, ecology, psychology, cognitive science and economics

Formal Methods and Maths!

Formal methods

- define a **formal model** of a computer program
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Formal Methods Audience

Formal methods

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- make computer science in some way **independent of computers** (**students** and **pupils**)
- provide an effective way to **analyse** critical, non functional properties of software (**industry**)
- **can be applied** to many **practical disciplines**: physics, chemistry, biology, ecology, psychology, cognitive science and economics (**multidisciplinary research**)

Context of FM Education

Formal Methods

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- have the potential to address a **very wide audience**

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We need a strategy to **reverse this trend** and **keep the learner engaged**

Strategy for Teaching FM

Based on five dimensions:

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- **Choice** of the **formal methods approach**
- **Presentation** of the concepts at a **level of formality appropriate for the audience**

Building Motivations

How to start a course on formal methods?

Building Motivations

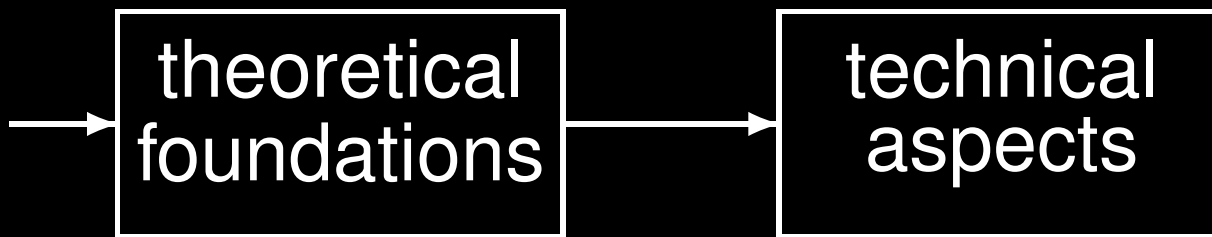
How to start a course on formal methods?



— common approach —

Building Motivations

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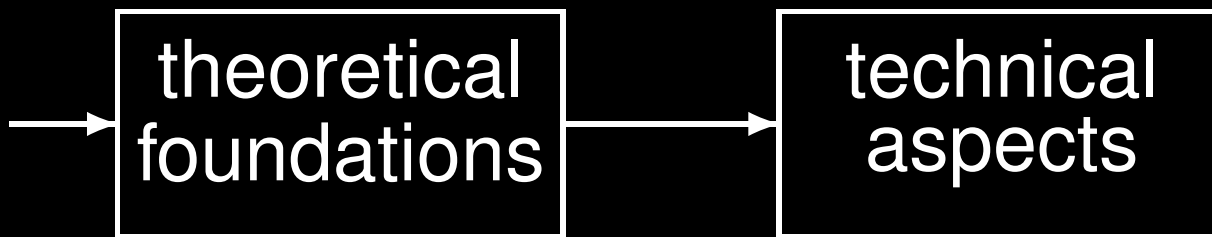


— common approach —

Building Motivations

How to start a course on formal methods?

more skilled students get bored



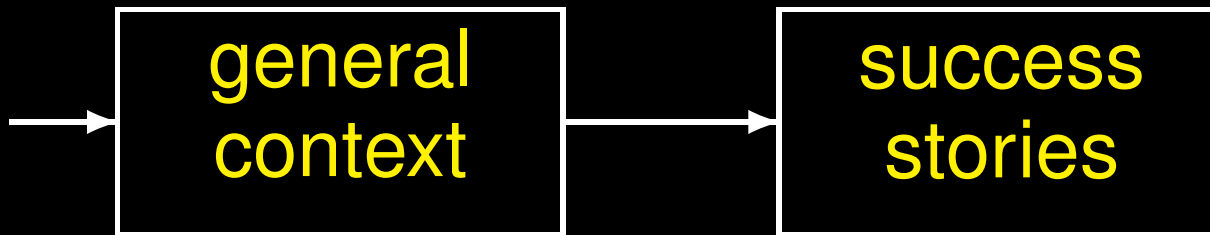
less skilled students run away

— common approach —

Building Motivations

How to start a course on formal methods?

university
students



industry
people

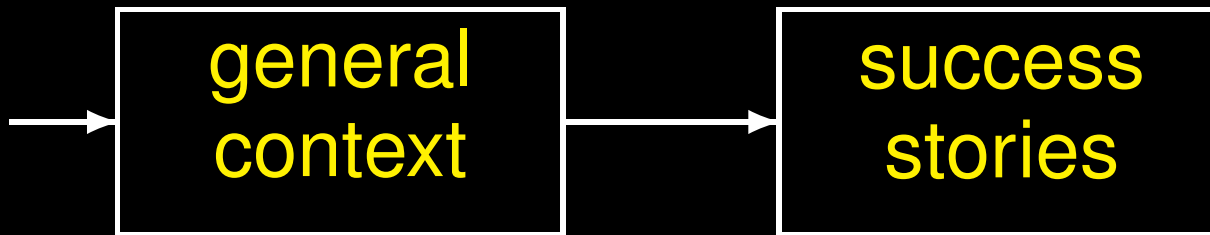
— our approach —

Building Motivations

How to start a course on formal methods?

Starting early — even with **school pupils**

**skilled university
students**



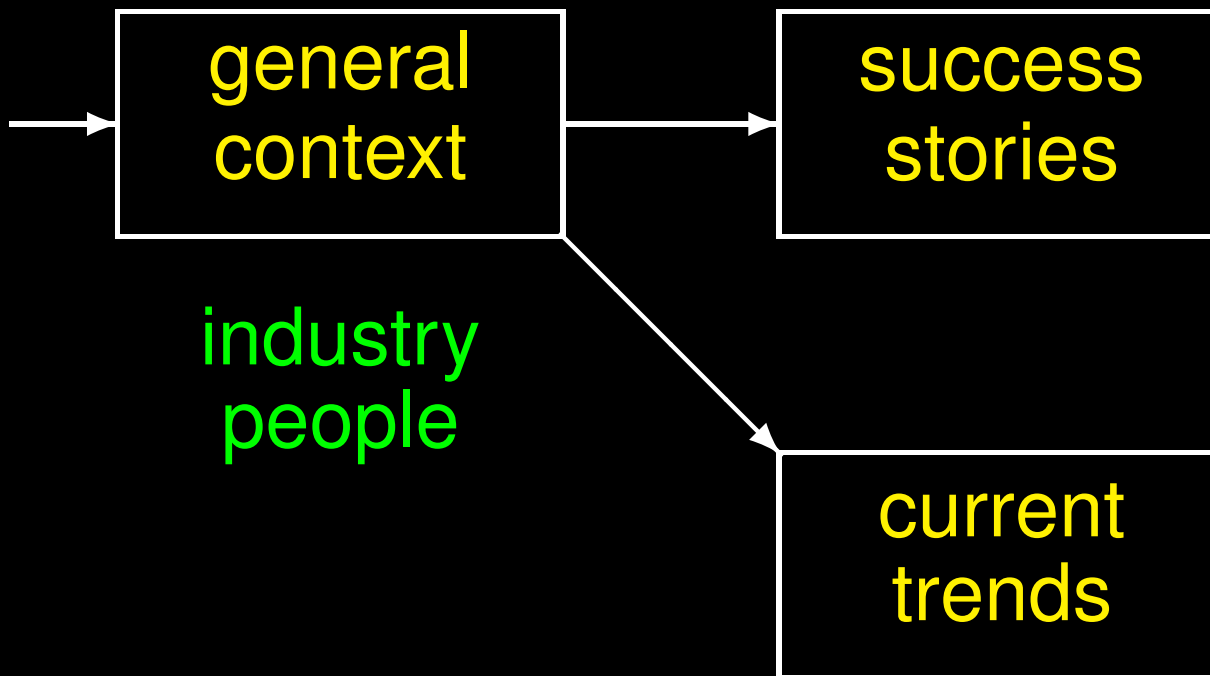
**industry
people**

Building Motivations

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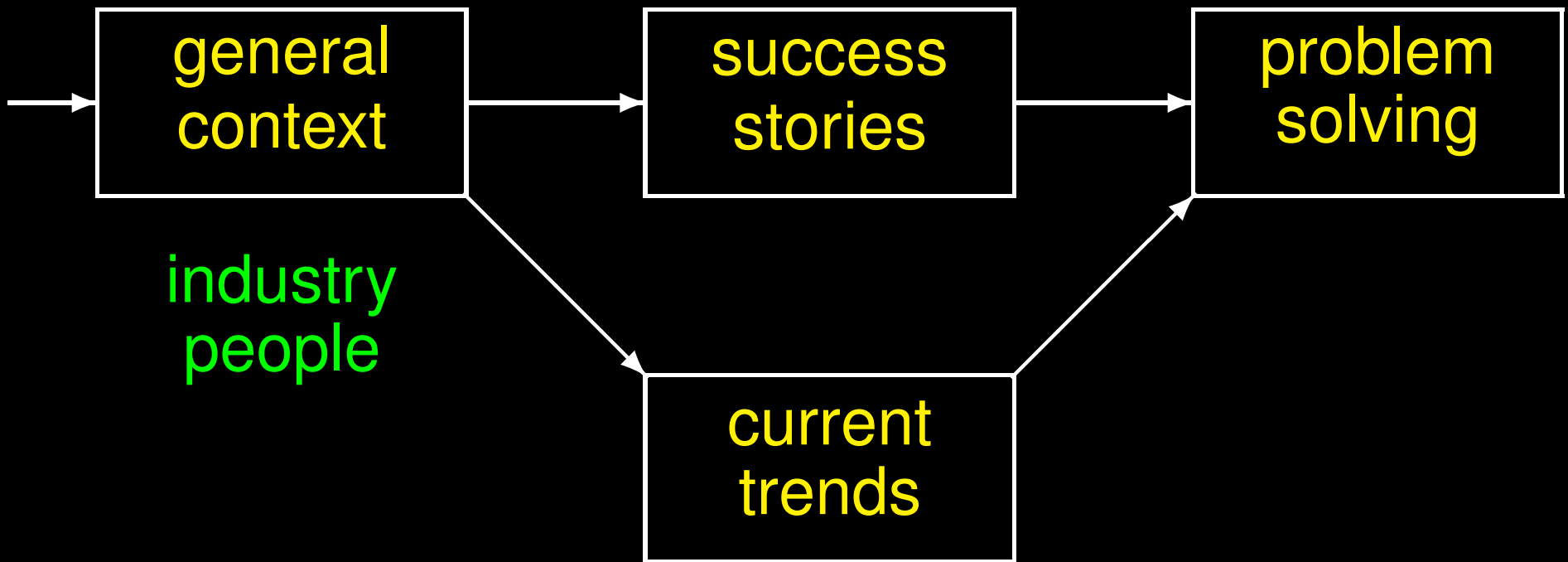
skilled university students



Fun

school pupils

university
students



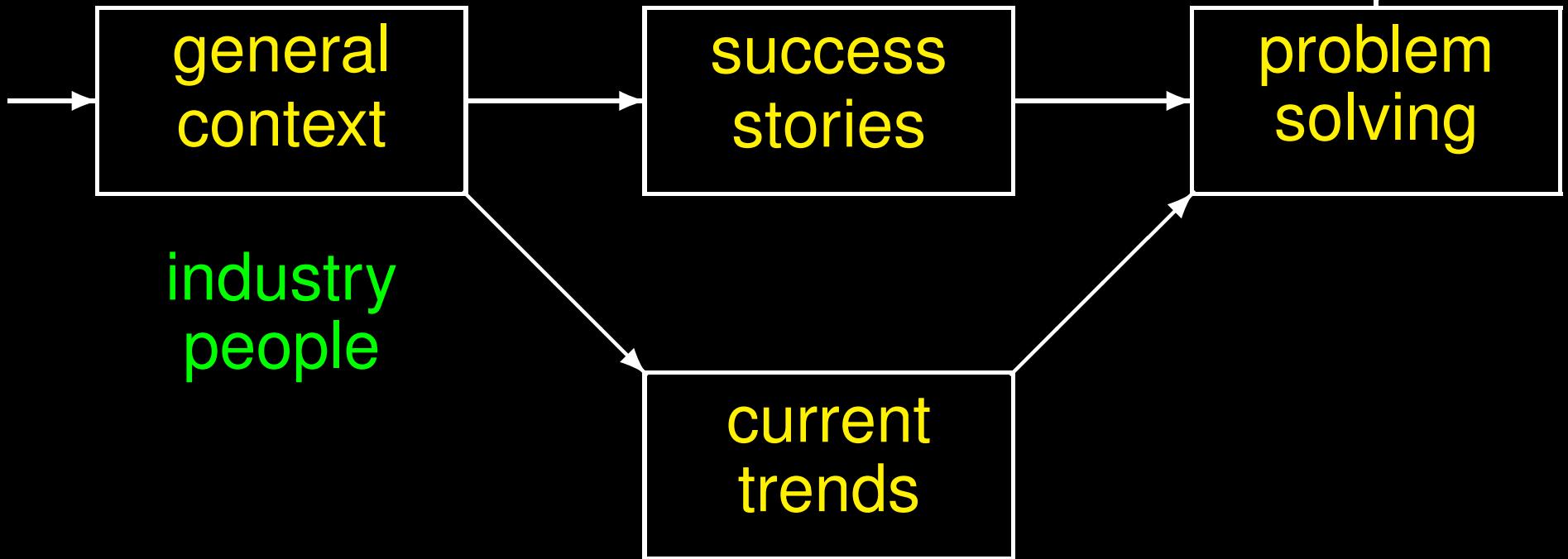
industry
people

Fun

school pupils

university
students

computer science problems
dining philosophers
protocols
distributed algorithms



Fun

school pupils

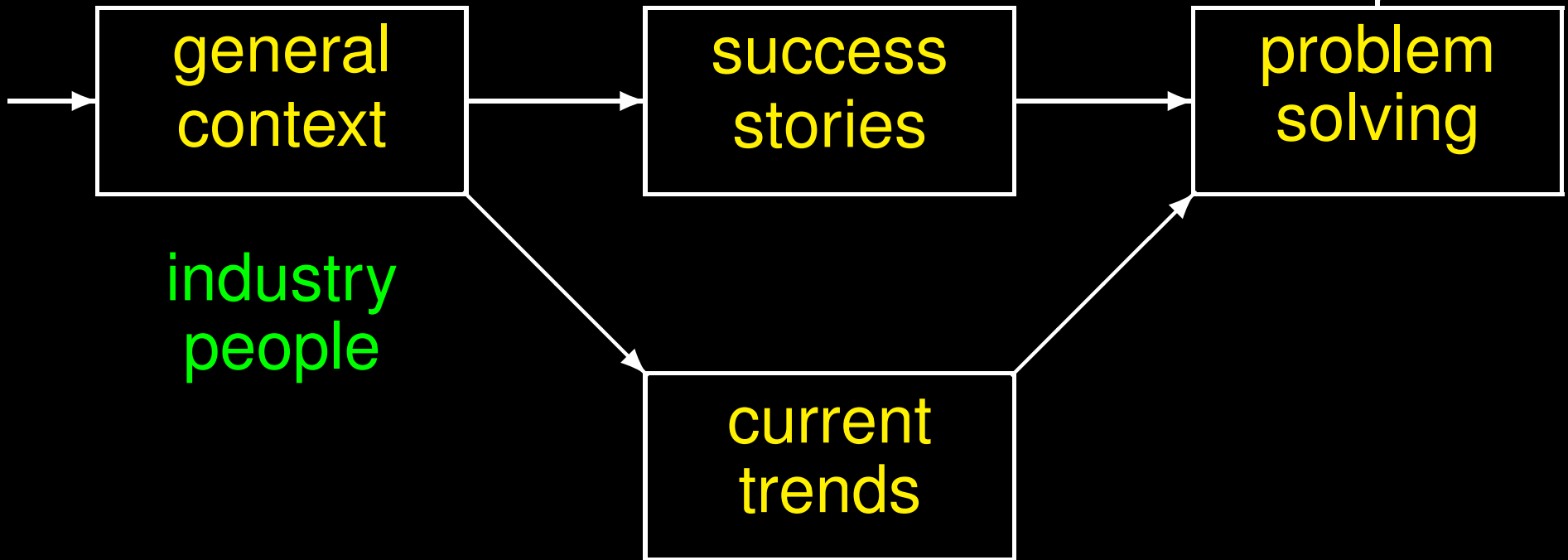
university
students

computer science problems

mathematical puzzles
(river crossing puzzle)

games
(sudoku, card games)

videogames



industry
people

Fun

school pupils

university students

industry people

computer science problems

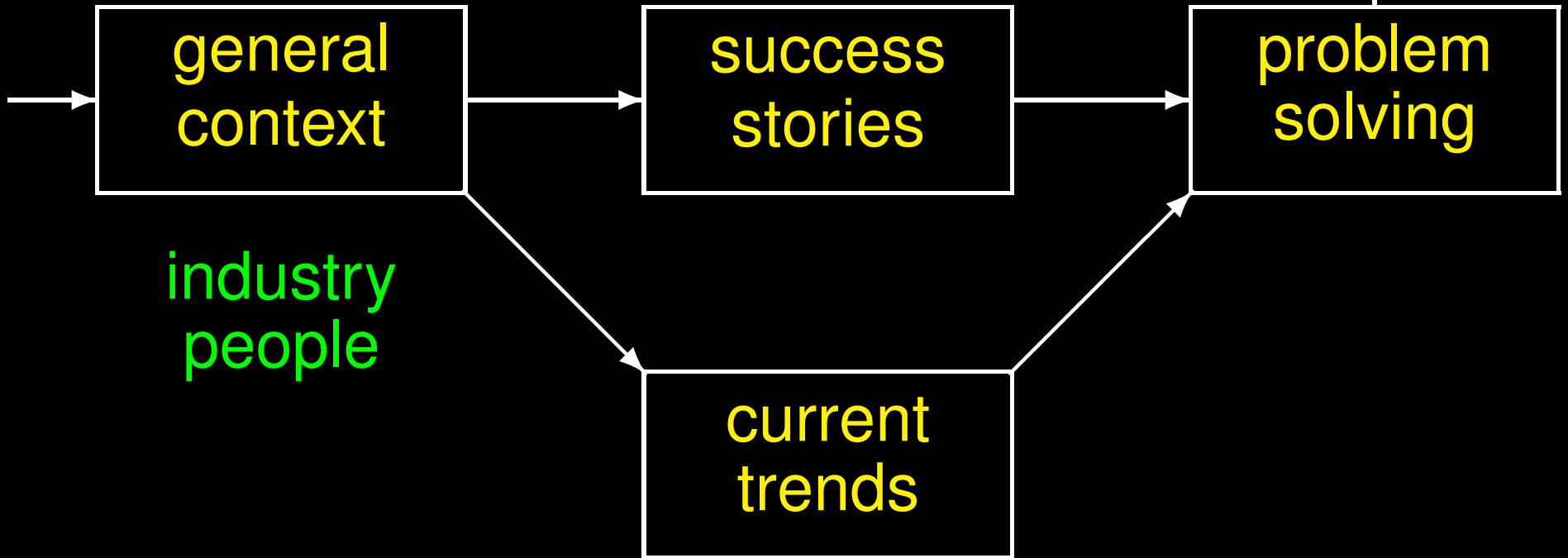
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games
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videogames

challenge ←

interest ←



Fun

school pupils

university students

industry people

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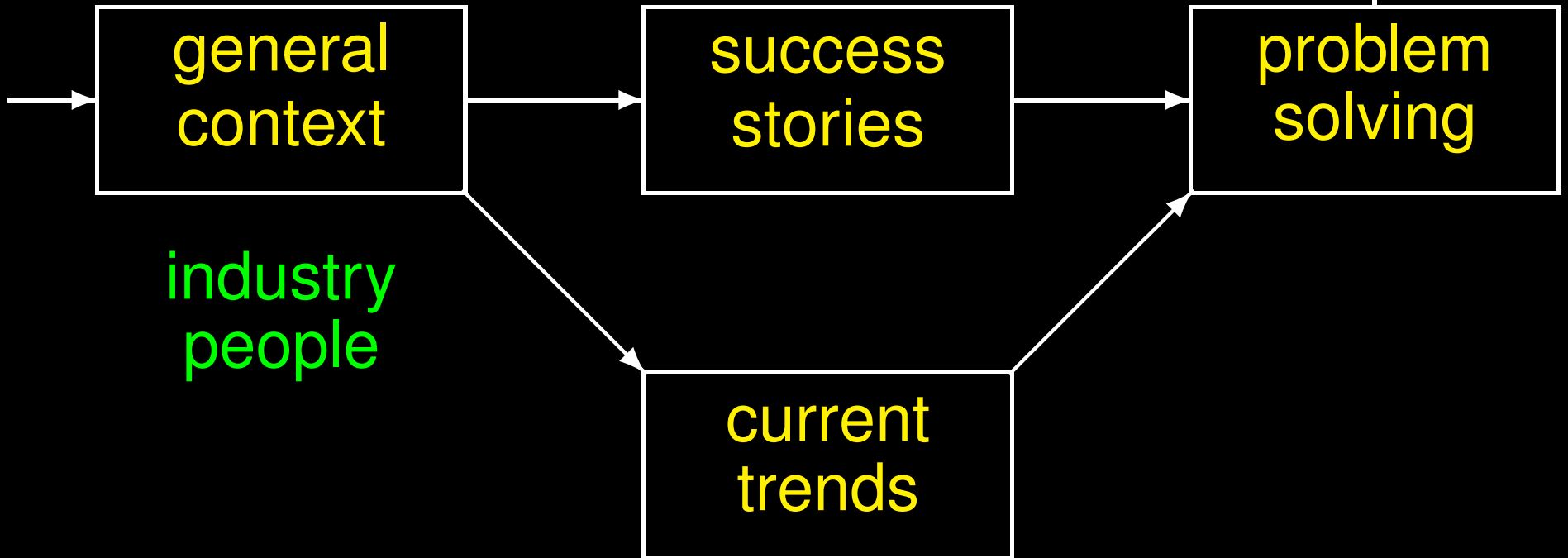
games
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videogames

creativity →

← challenge

← interest



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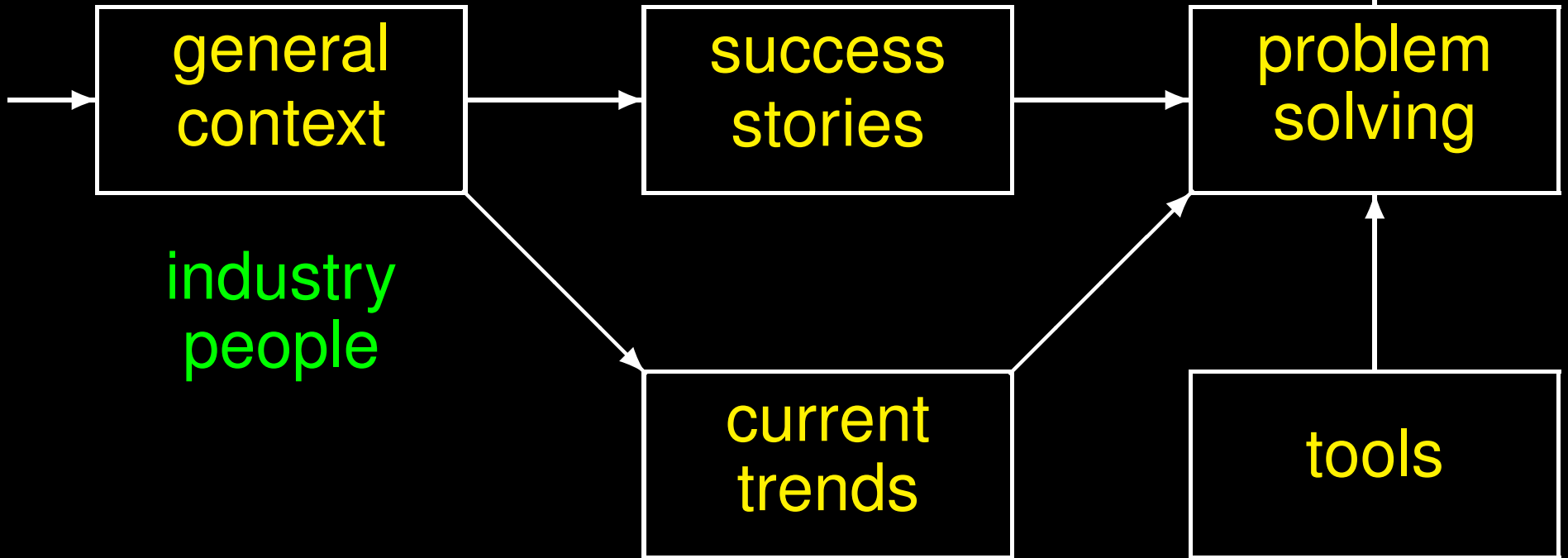
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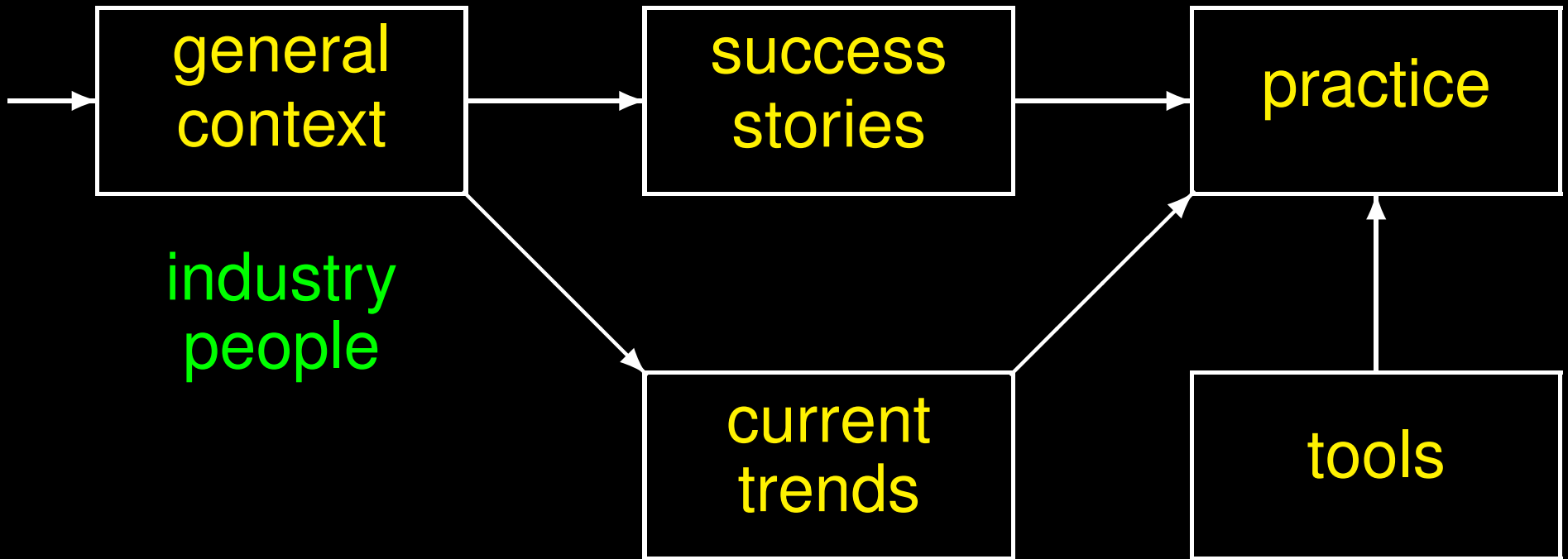


Practice with Tools

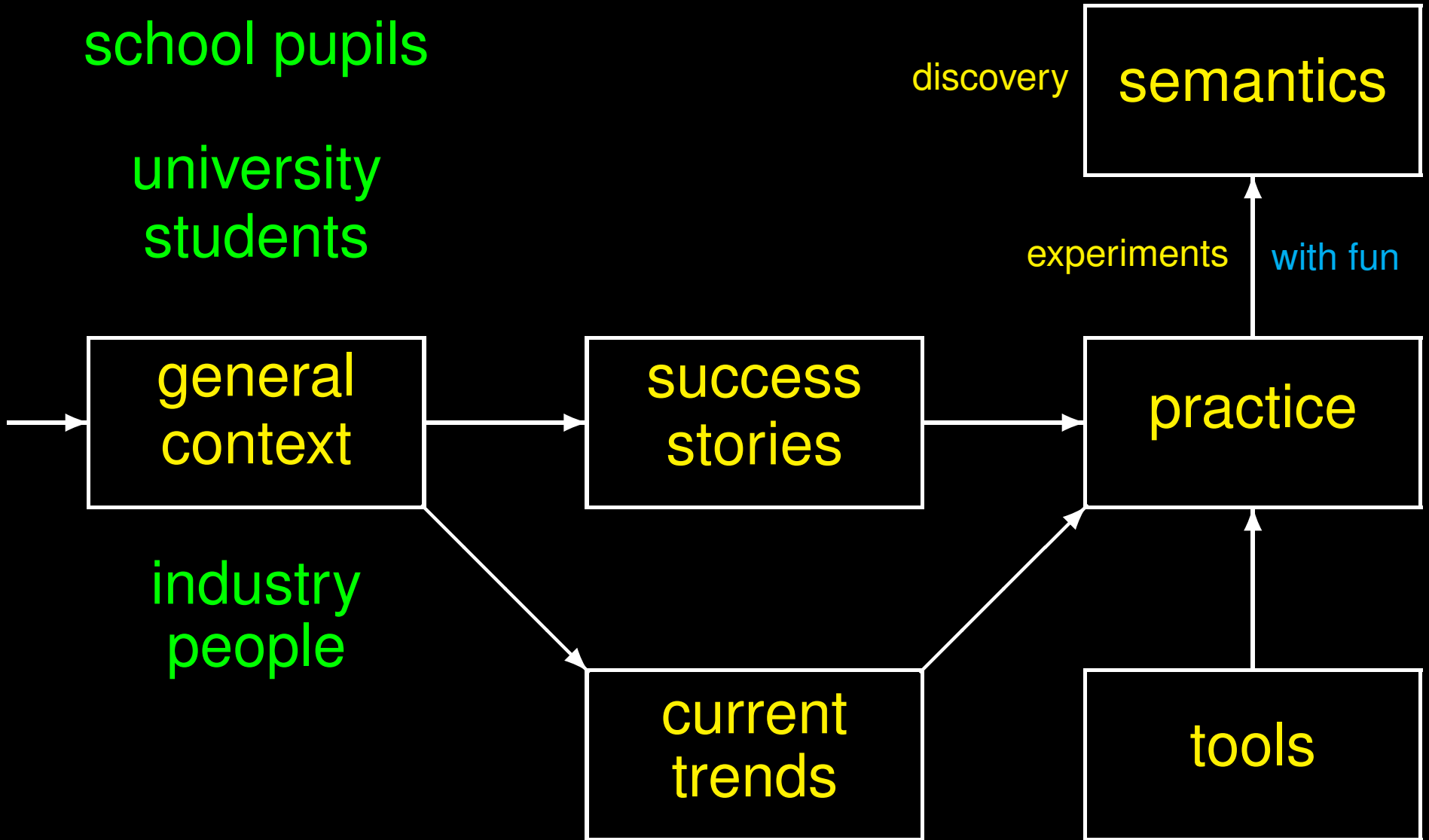
school pupils

university
students

industry
people



Practice with Tools



Choice/Presentation of FM

The **choice** of FM is based on the following parameters:

- the **age**, **level** and **background** of the learner;
- the **application domain**, which may be identified with the taught subject in the case of university students
- the availability and features of **software tools**

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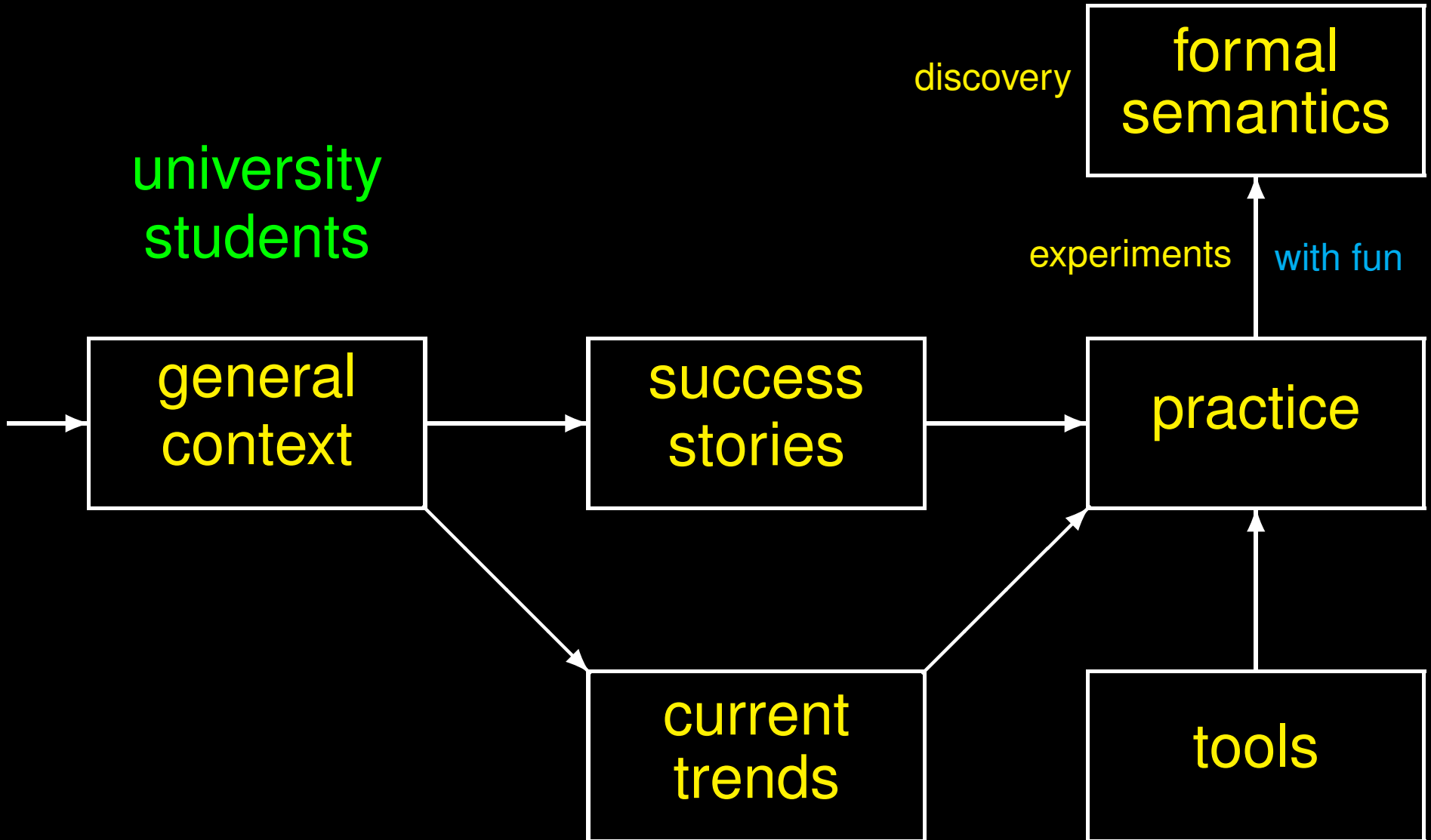
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The **presentation** of FM can be

- either **textual**
- or **visual**

Audience: University Students

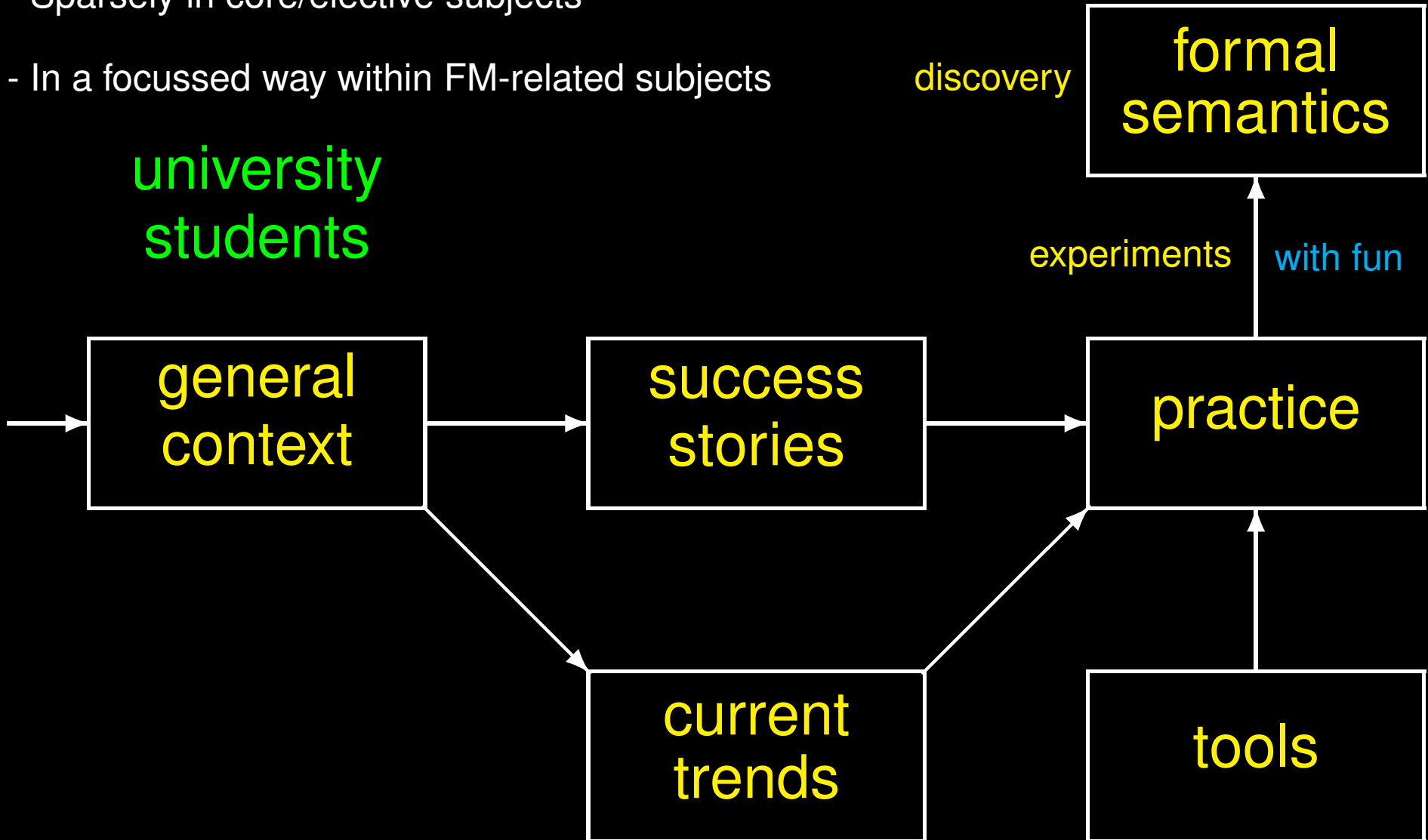
university
students



Audience: University Students

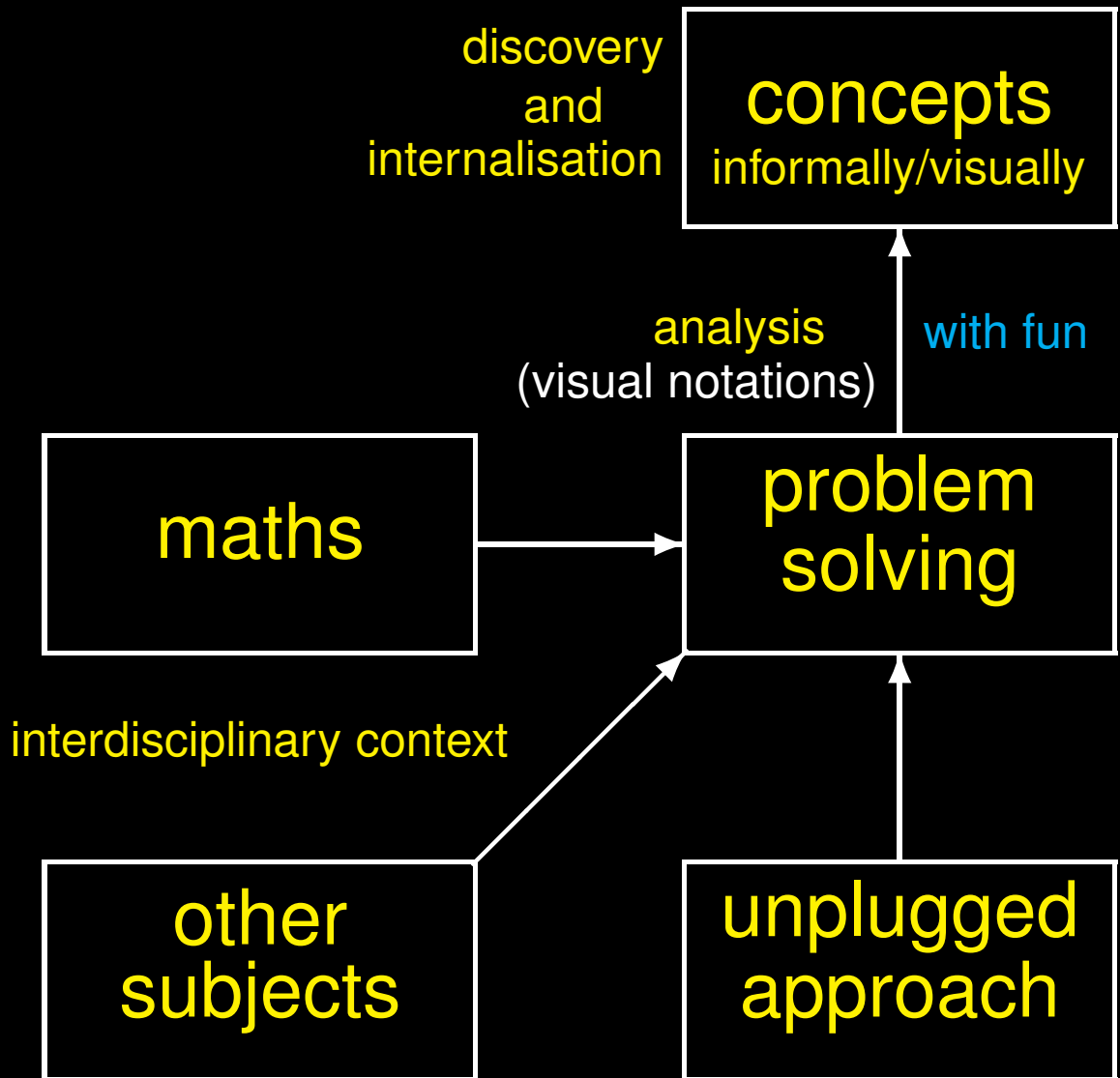
- Sparsely in core/elective subjects
- In a focussed way within FM-related subjects

university
students



Audience: School Pupils

school pupils



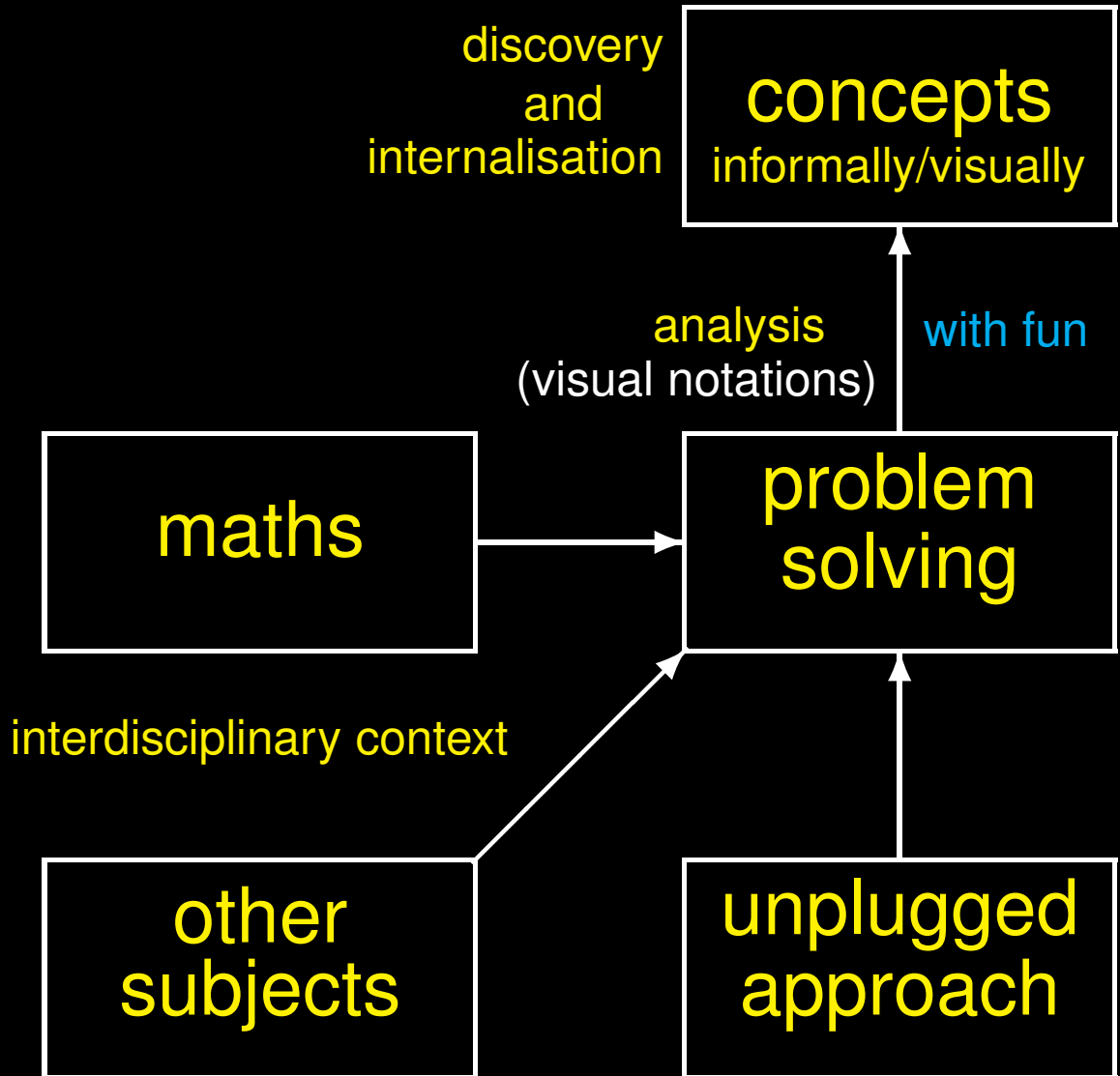
Audience: School Pupils

school pupils

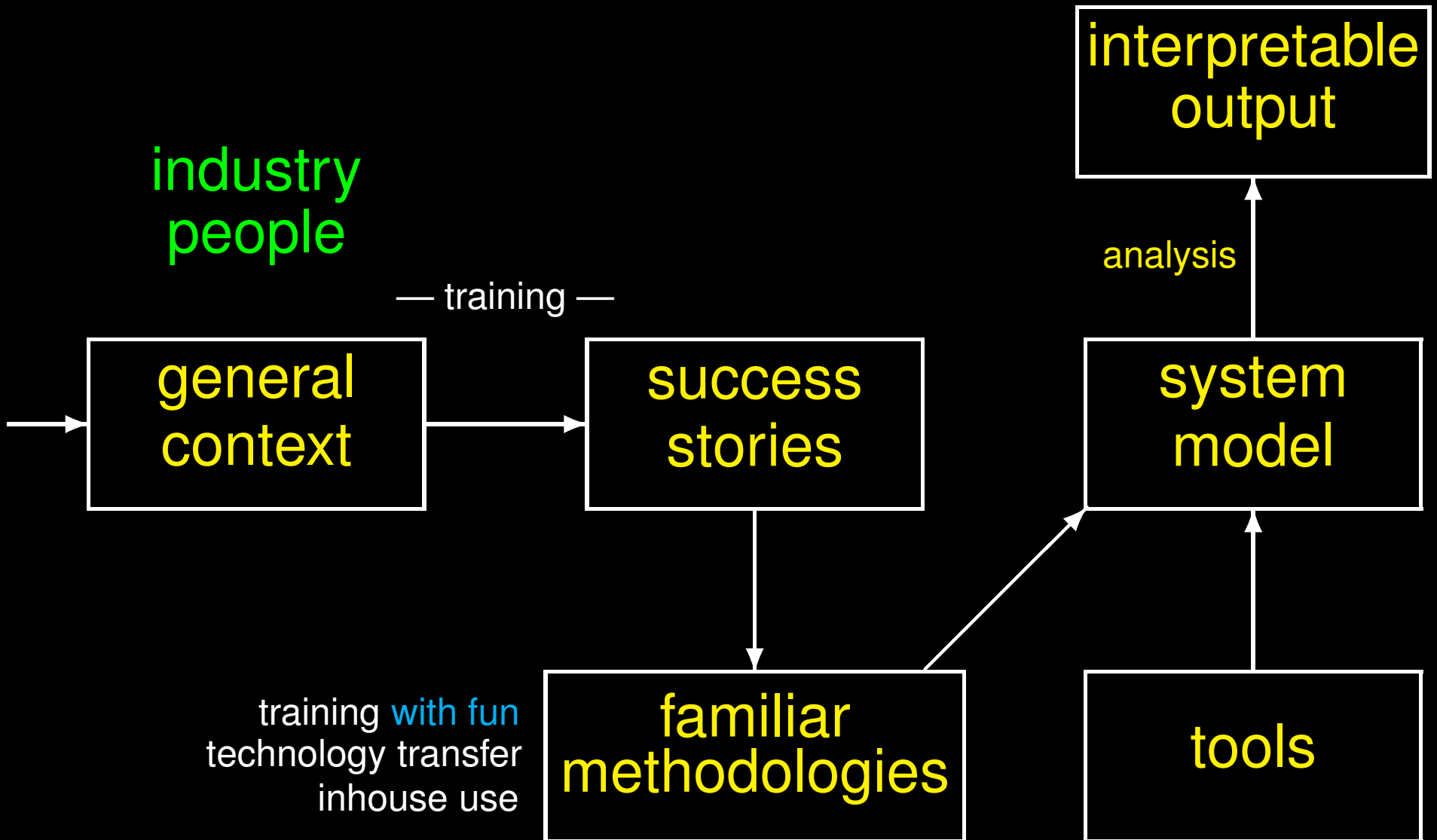
Primary School

intrinsic motivations
(fun, challenge, competition)

Intermediate and High School
also some extrinsic motivations

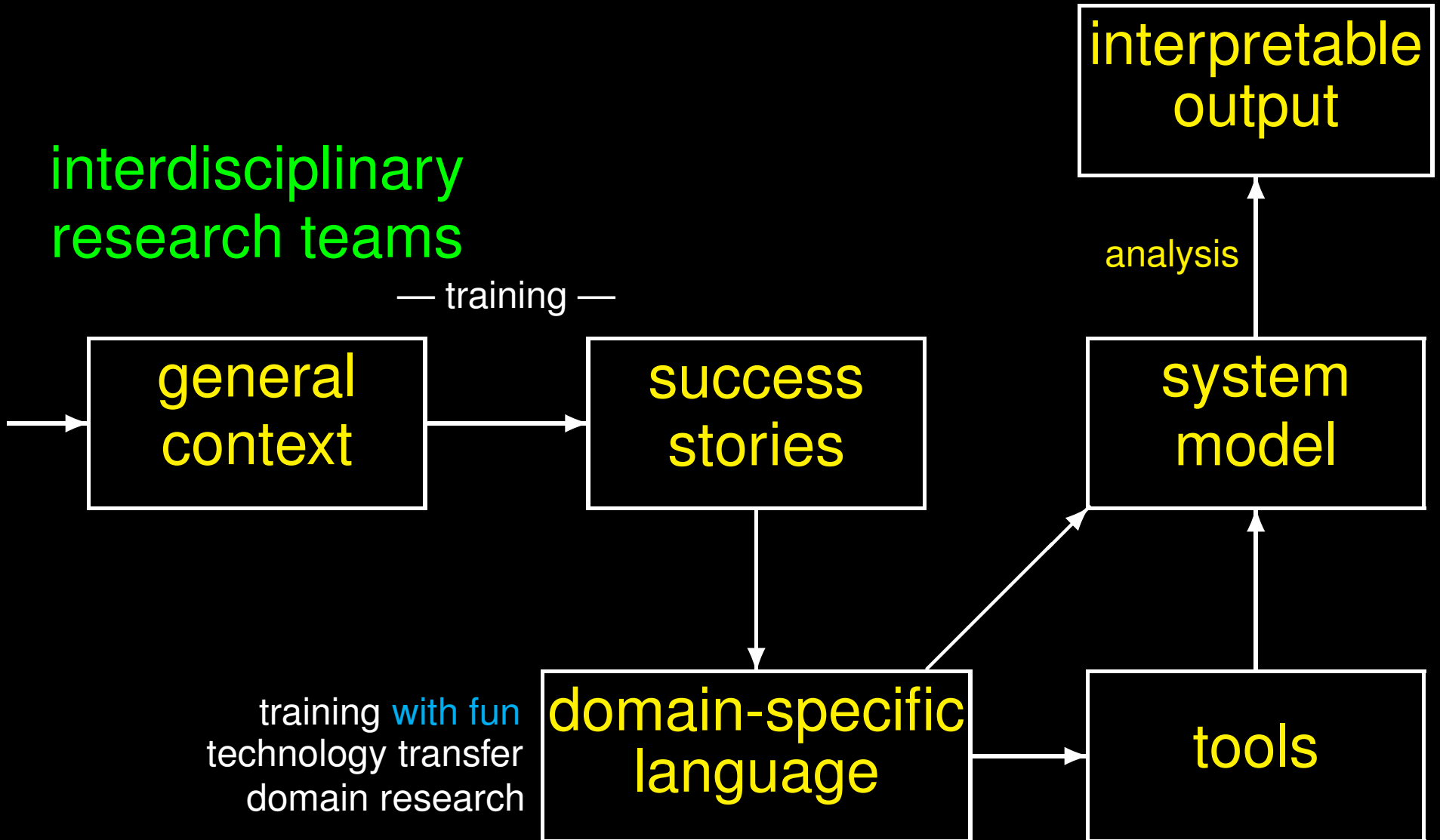


Audience: Industry



Audience: Research Teams

interdisciplinary
research teams



training with fun
technology transfer
domain research

Conclusion and Future Work

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Future Work

- Develop FM tools for different audiences
- Embed FM within methodologies that are widely accepted in industrial contexts