

A "Know-How vs. Know-What" Approach in the Teaching-Learning of Competences in Physical Chemistry

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INTRODUCTION

Knowledge can be acquired from a series of **perspectives**, mainly: "**know-what**" (**concept**), where facts and descriptions of (natural or social) phenomena are pursued; "**know-how**" (**procedure**), where methods and procedures for their application are described; and "**know-why**" (**competence**), where general principles and laws that explain both the facts and their applications are sought. The depth of student's acquired competences will be directly affected by the teaching-learning perspective, traditionally aiming to a "know-why" approach. In this work, we discuss a suitable **teaching-learning methodology** for evaluating whether a "**know-how**", a "**know-what**" or a **combined approach** is better for enhancing competence learning.

KNOWLEDGE

Acquisition

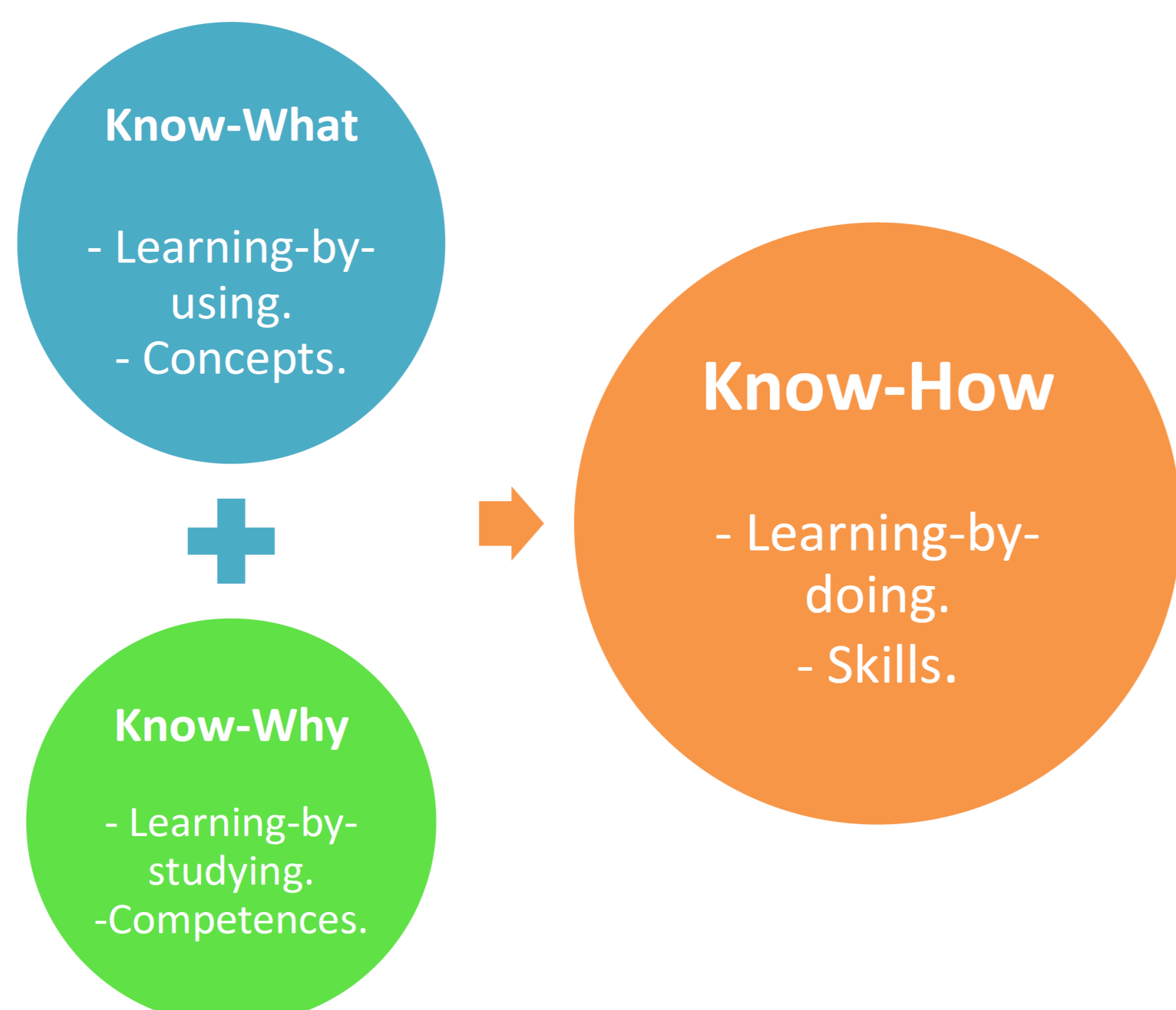
Accumulation (concepts / skills):
pre-Bologna process

Application with a strategy (competences):
European Higher Education Area
(after Bologna process)

TRANSITION:
new teaching-learning
paradigm

Types

Know-What: concepts, facts and descriptions.
Know-How: skills, procedures and methods.
Know-Why: competences, theories and experimentation.



CHEMISTRY LEARNING

Approach

Surface learning (Know-What):

- Mere reformulation of concepts.
- Lack of chemical principles understanding.

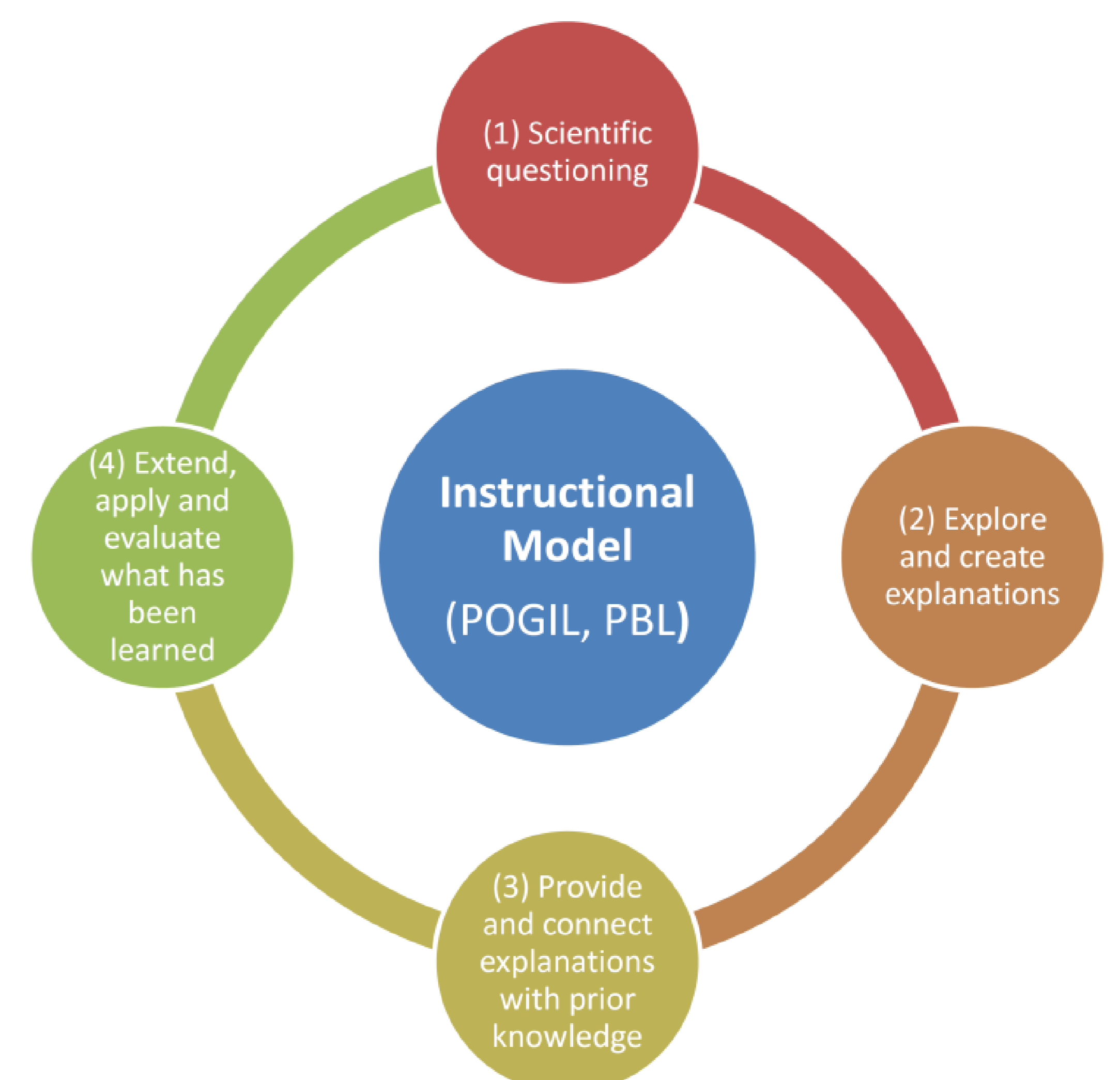
Deep learning (Know-Why):

- Elaborated reasoning.
- Causal relationship between phenomena.

Instructional Model

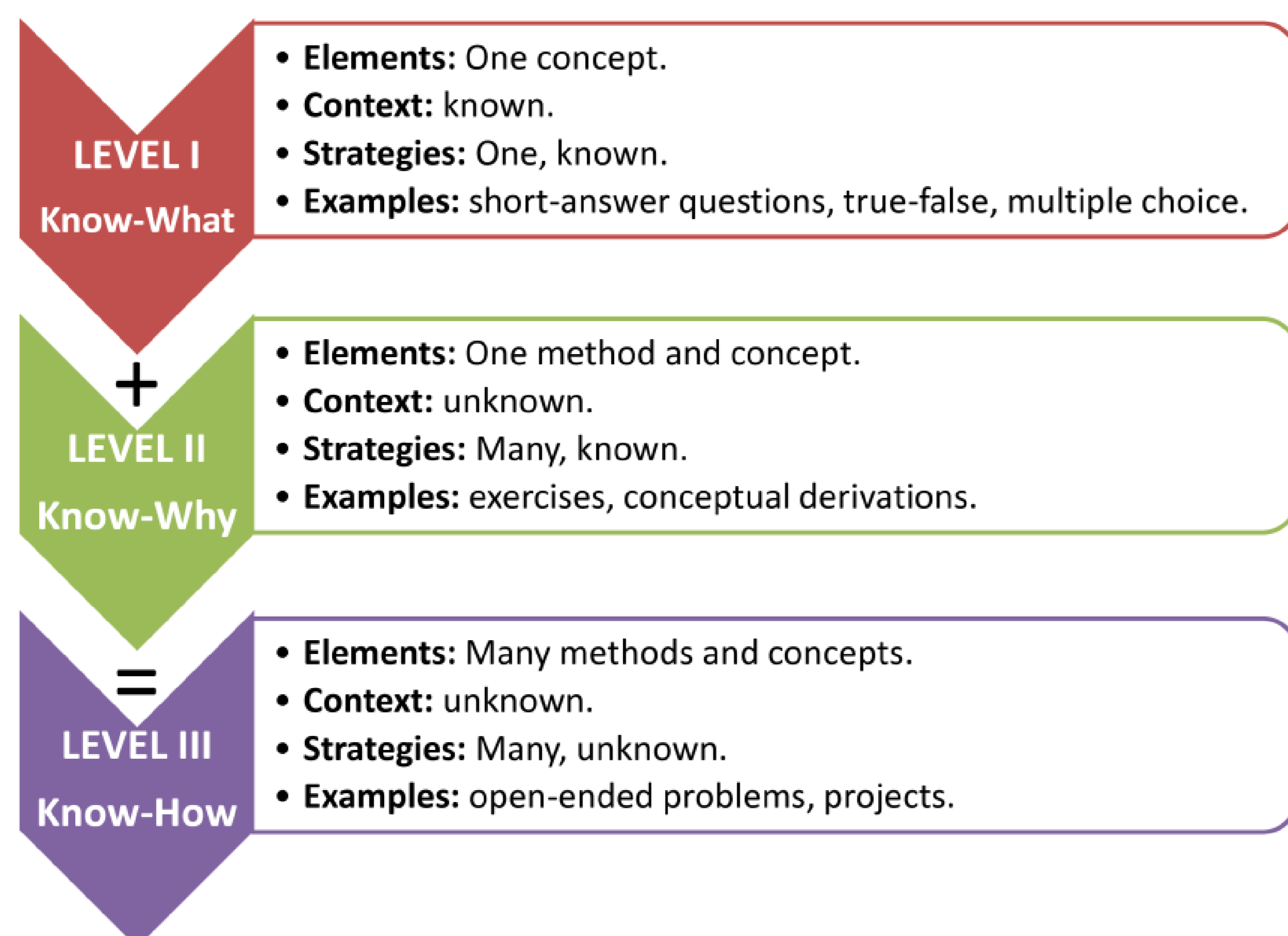
POGIL
Process Oriented
Guided Inquiry
Learning

PBL
Problem-Based
Learning



PROBLEM-BASED LEARNING MODEL

Problem Levels



Teaching Protocol

A. Control groups:

Group 1 (bottom-up):

Know-What (concepts) $\xrightarrow{\text{Know-Why}}$ Know-How (project)

Group 2 (top-down):

Know-How (project) $\xrightarrow{\text{Know-Why}}$ Know-What (concepts)

Assessment tool:

STUDENT'S
PORTFOLIO

B. Multi-course assessment:

1 st course	What (50%)	Why (50%)	
2 nd course	What (30%)	Why (50%)	How (20%)
3 rd course	What (20%)	Why (40%)	How (40%)

CONCLUSIONS

- A **protocol for assessing** which type of knowledge is more appropriate for competence acquisition ("**know-what**" -concepts-, "**know-how**" -procedures- or "**know-why**" -competences-) is proposed.
- In a **class, two control subsets** are defined: **bottom-up learning** (Group 1, from "know-what" to "know-how") and **top-bottom learning** (Group 2, from "know-how" to "know-what").
- A **3 course assessment** is proposed to study the **student's maturity effect** on competence learning, where the **weight of "know-how"** is progressively increased.