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# **Ontology-aware Course Management for Curriculum Evolution Process in Higher Education**

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# Outline

- Background and Goal
- Proposed Solution
  - Requirements of multi-stakeholders
  - A Scenario
- Evolutionary Process of Curriculum
  - The Conceptual Model
  - Development of On2C system
  - The Scenario (cont'd)
- Conclusion and Future Works

# Background

- Curriculum changes over time. In practice, however, it is not easy to keep curricular system updated and to provide students with trustworthy course services that reflect and correspond to the evolutions of curriculum:
- The information related to curriculum design and organization may be lost or interpreted in different ways due to the *distribution of time and space* in communication among different stakeholders;

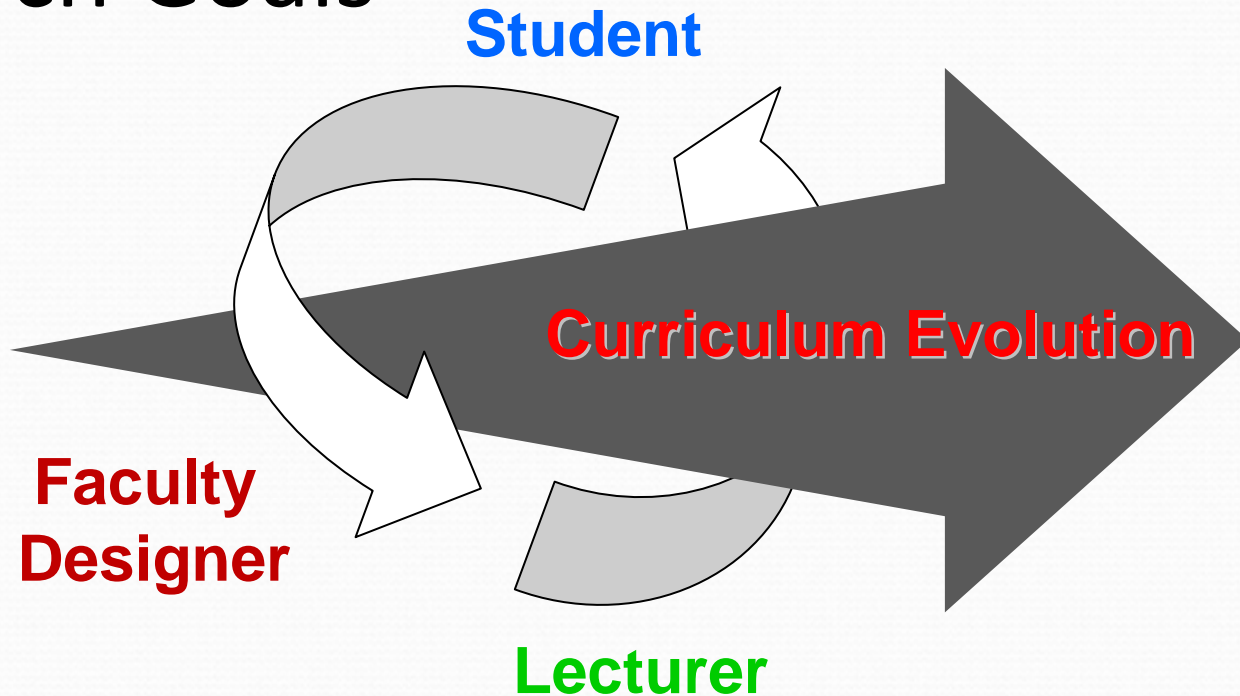
# Background (cont'd)

- The lack of the shared vocabulary about domain knowledge for different stakeholders to communicate about the curriculum;
- The majority of current strategies need time-consuming and labor-intensive works.



# Two Research Goals

It is necessary to balance social needs and different concerns of multi-stakeholders in order to make curriculum evolution smooth.



## GOALS

- To establish a conceptual framework for explicitly and fluently share each concern and understanding among multiple stakeholders, and effectively tracking the history of curriculum change;
- To implement an ontology-aware course consulting system to meet the requirements of stakeholders involved in curriculum evolution.

# Proposed Solution

- A conceptual model of evolutionary process reflects essential structure of curriculum and provides

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**Our research aims to demonstrate a possible solution for smoothness of evolutionary curriculum *step by step* with ontological engineering approach.**

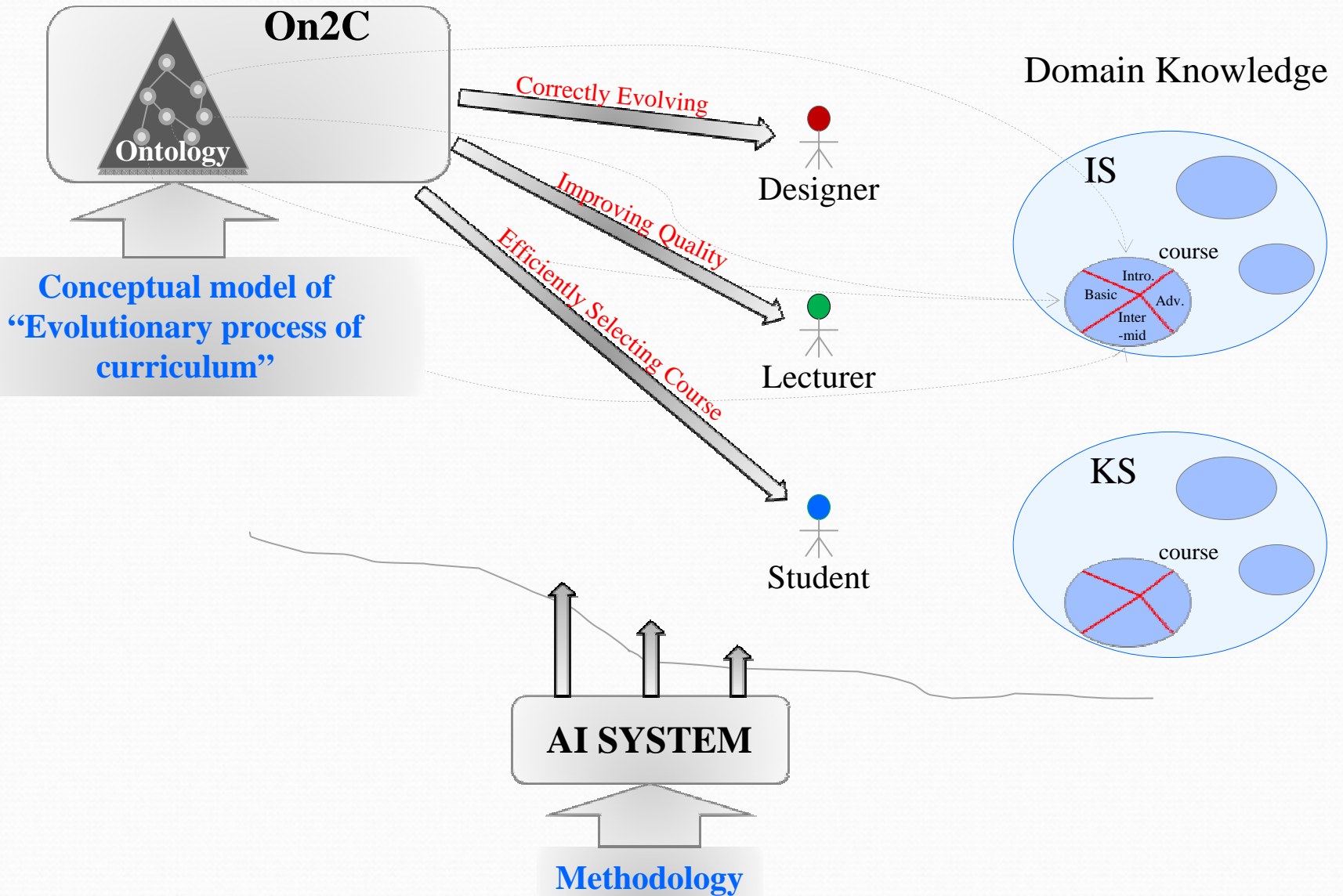
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predict the generic components of curriculum so it can be reused in situation-dependent curriculum system.

- Ontology-aware Course Consulting system (On2C)

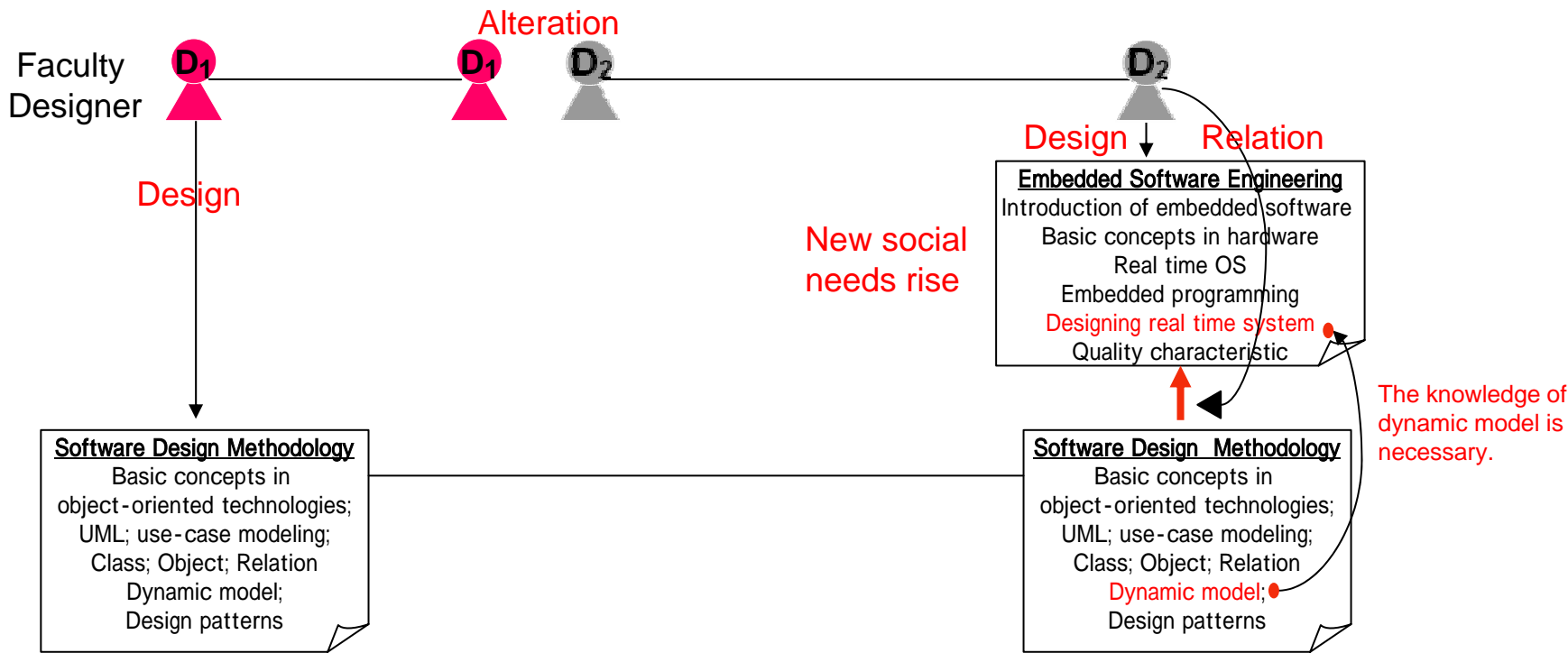
# Diagram

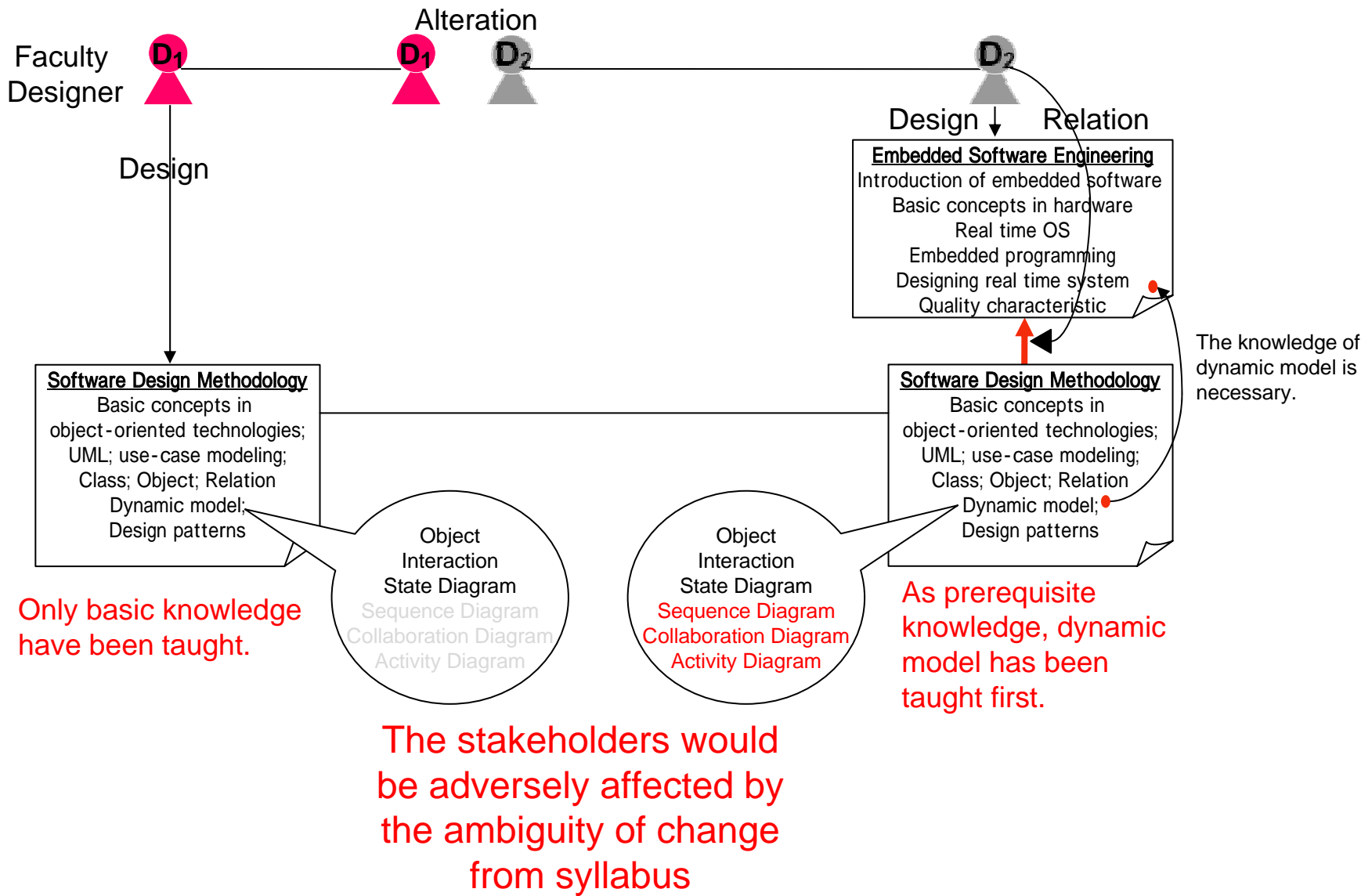


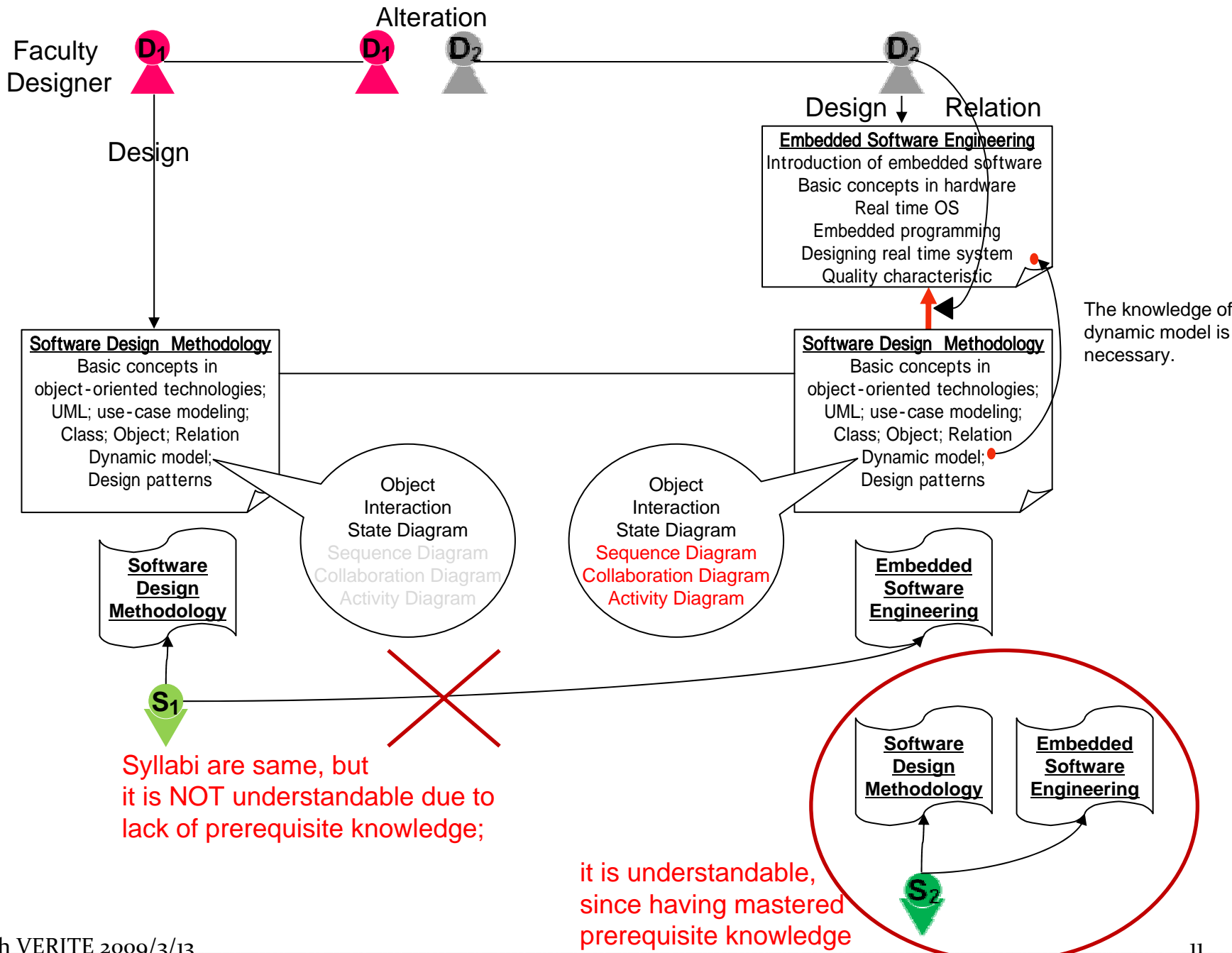


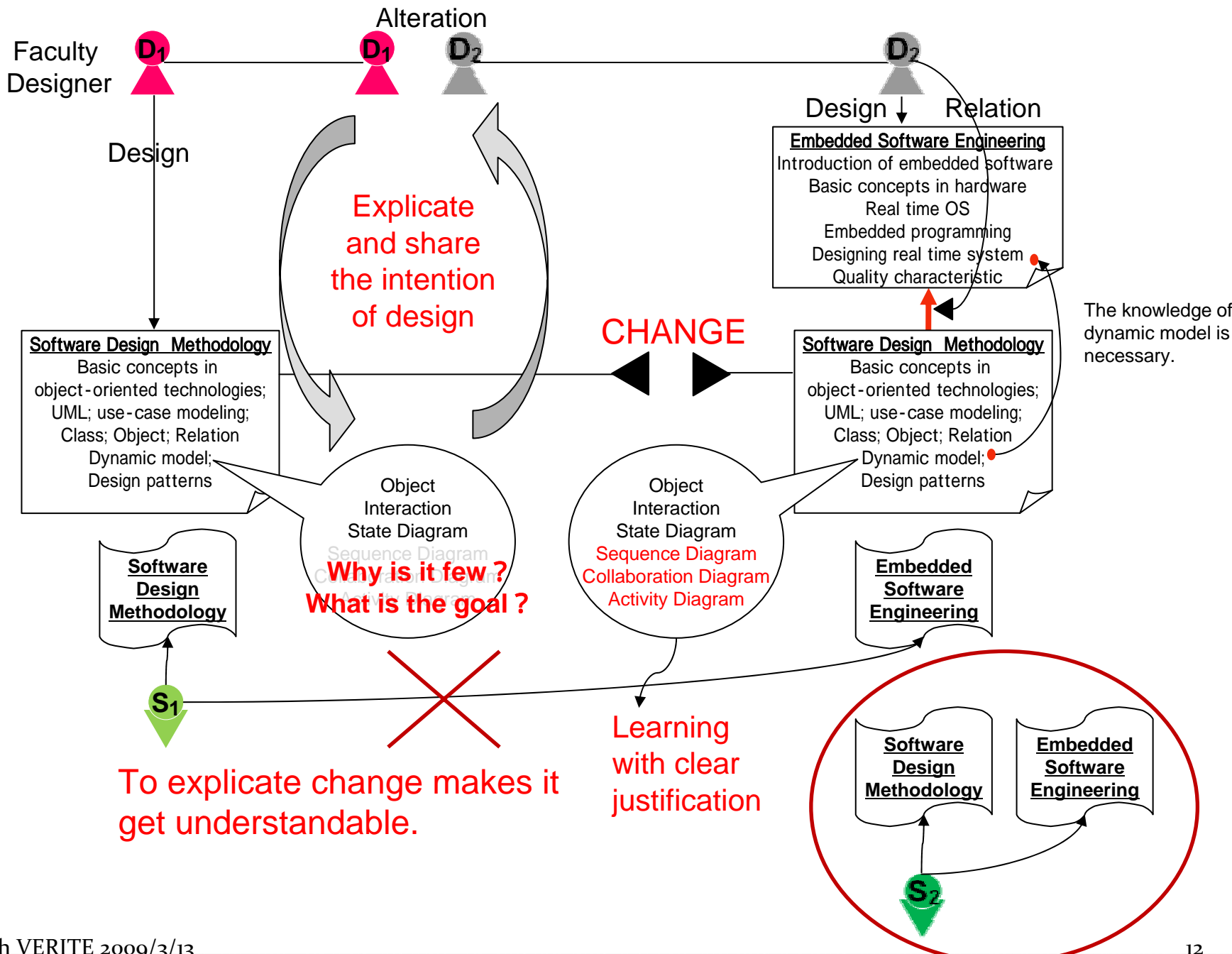
# Requirements of multi-stakeholders

- Requirements of faculty designer and lecturer
  - The evolutionary change of curricula should be divided into manageable, more familiar steps. Both faculty designer and lecturer want to familiarize themselves with the changes by taking small steps first.
  - It is necessary to adopt instruction design approach and include one quality circle composing planning and evaluation.
  - Have a clear rationale for change that is grounded in pedagogical practices, which is considered as background knowledge for reflection, such as during practicing evaluation of course process.
- Requirements of student
  - Study plan maintenance



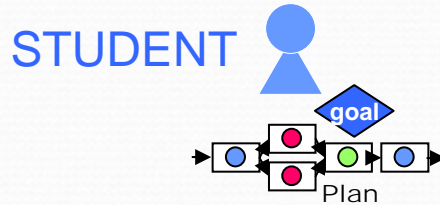




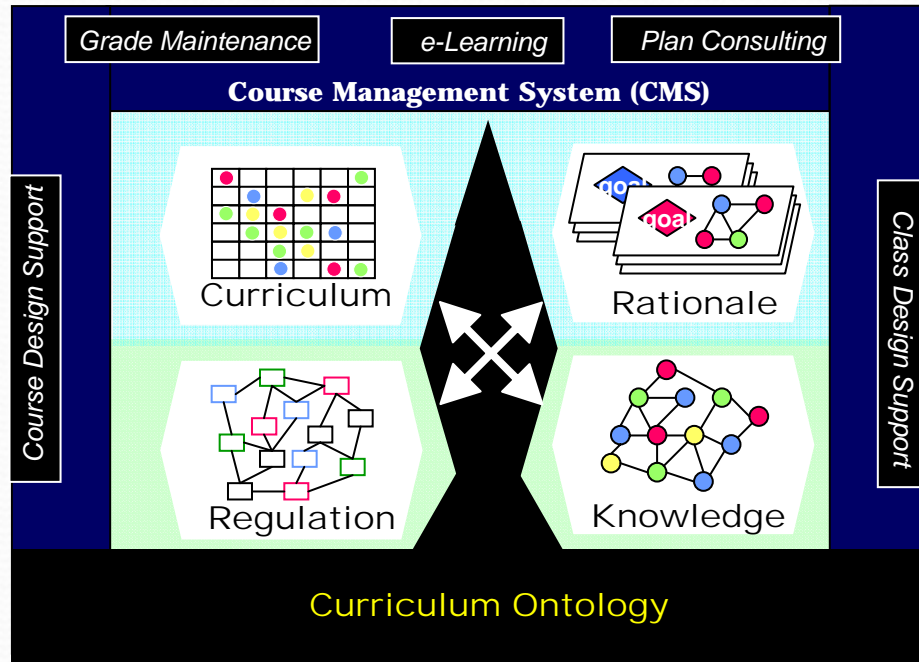




# The architecture of On2C system :



Select courses;  
Take a course;  
Evaluation



FUCULTY  
DESIGNER



Organize knowledge of  
learning contents  
Design regulation and  
curriculum  
Record rationale



LECTURER

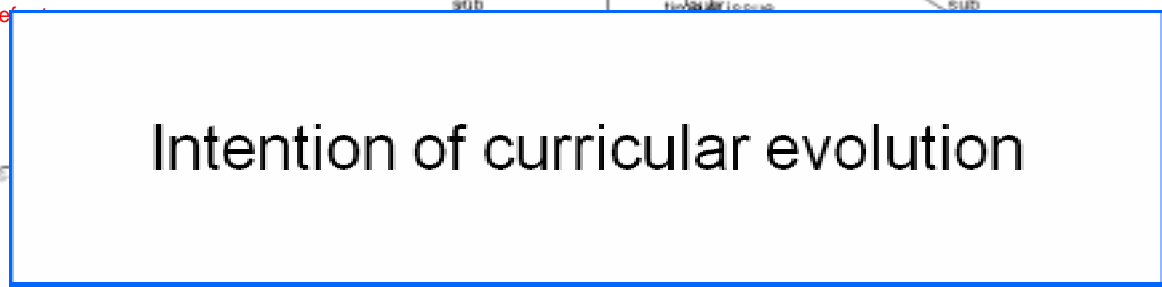
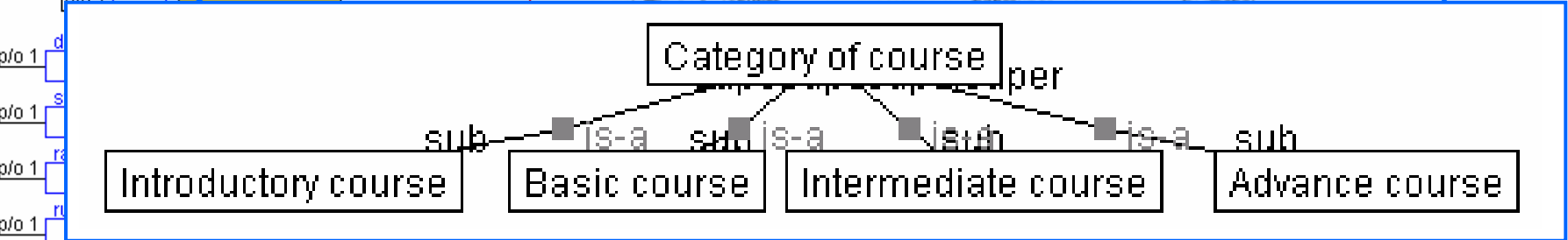
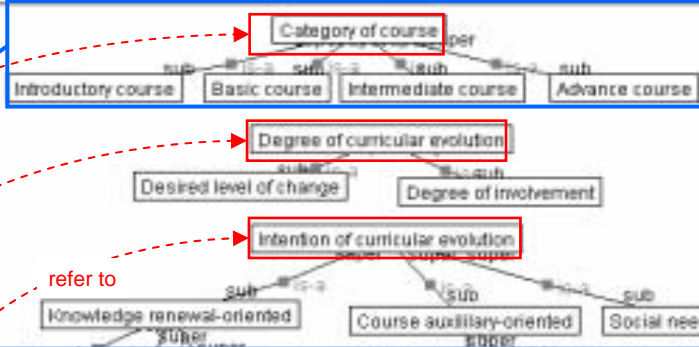
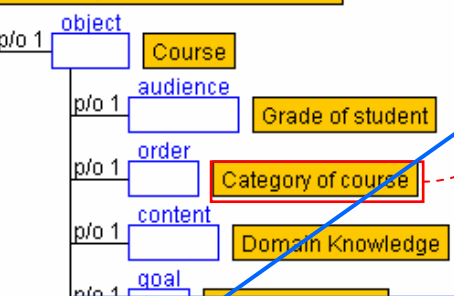
Make course plan  
Design teaching strategy  
Select examples  
Assessment

On2C includes *CMS* and *Curriculum Ontology*  
for coping with the requirements from different stakeholders

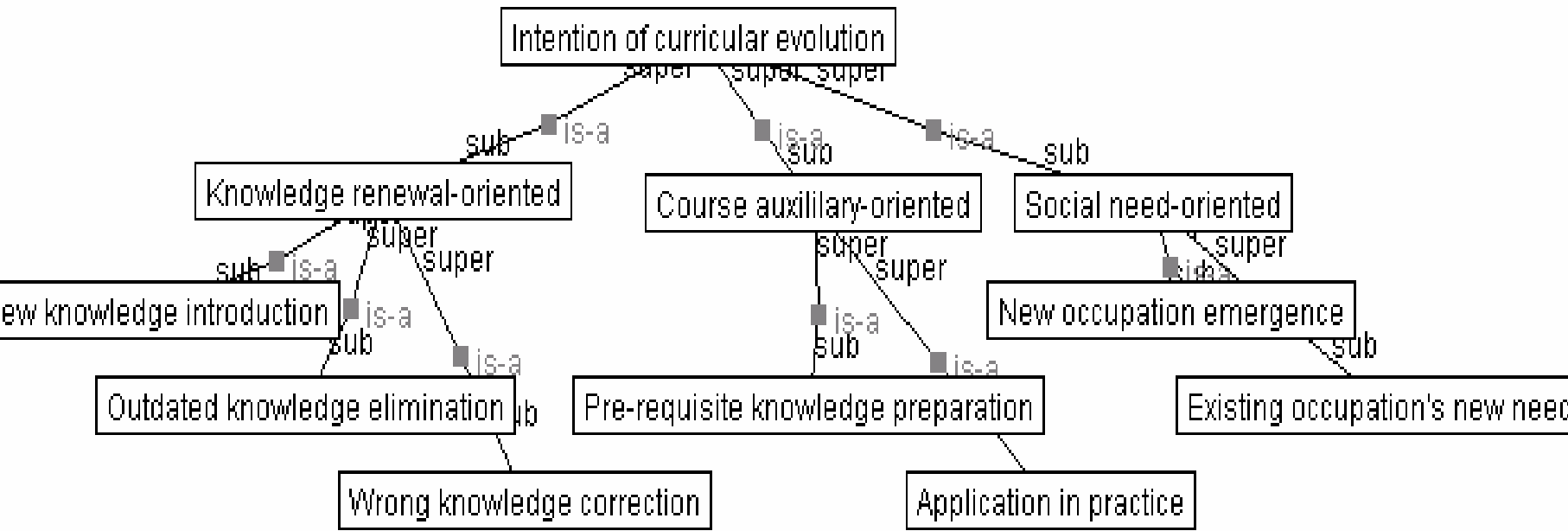
# Description of Evolutionary Process of Curriculum-- Curriculum Ontology

- “Evolutionary process of curriculum” indicates two aspects of curriculum in higher education:
  - (1) a designed sequence of changes and development of properties or attributes of curriculum;
  - (2) intention behind the designing, which initiate a series of intentional behaviors of people involved in such process.

# Evolutionary Process of Curriculum



# Intention of curricular evolution



# “Regulation” in Curriculum Evolutionary Process

- *Regulation* is considered as a sort of **social rules**, which plays a crucial role in curriculum evolutionary process:
  - it is the **rule of curriculum** to control
    - the way curriculum is designed, revised, and evaluated  
*OR*
    - the way stakeholders behave;
  - it should be always **INSPIRED** by or **MEET** with “*Intention of curricular evolution*”.



# Four Spaces of Relationship during Course Change:

	Single Course	Contextual Courses
Intra-Term	<p><b>1<sup>st</sup></b></p> <p><b>Component Relationship</b></p> <ul style="list-style-type: none"> <li>•Realized by</li> <li>•Goal of</li> <li>•Guaranteed by</li> <li>•Consist with</li> </ul>	<p><b>2<sup>nd</sup></b></p> <p><b>Sequence Relationship</b></p> <ul style="list-style-type: none"> <li>•Pre-requisite</li> <li>•Co-requisite</li> </ul>
Inter-Terms	<p><b>3<sup>rd</sup></b></p> <p><b>History Relationship</b></p> <ul style="list-style-type: none"> <li>•Extend from</li> <li>•Narrow down</li> <li>•Adapt to</li> <li>•Accessorize with</li> <li>•Facility-equip with</li> </ul>	<p><b>4<sup>th</sup></b></p> <p><b>Effect Relationship</b></p> <ul style="list-style-type: none"> <li>•Cause effect</li> <li>•Influence effect</li> <li>•Initialize effect</li> <li>•Finalize effect</li> </ul>

# On2C system Development

- Interface of On2C system

## A) Domain knowledge viewer

Tree list of domain knowledge in each discipline

To provide lecturer and student with domain contents and structure

## B) Rationale viewer

To explicate the basic information and intention of curriculum design

Well-structured concepts related to the intention of curriculum design, and relationship between them

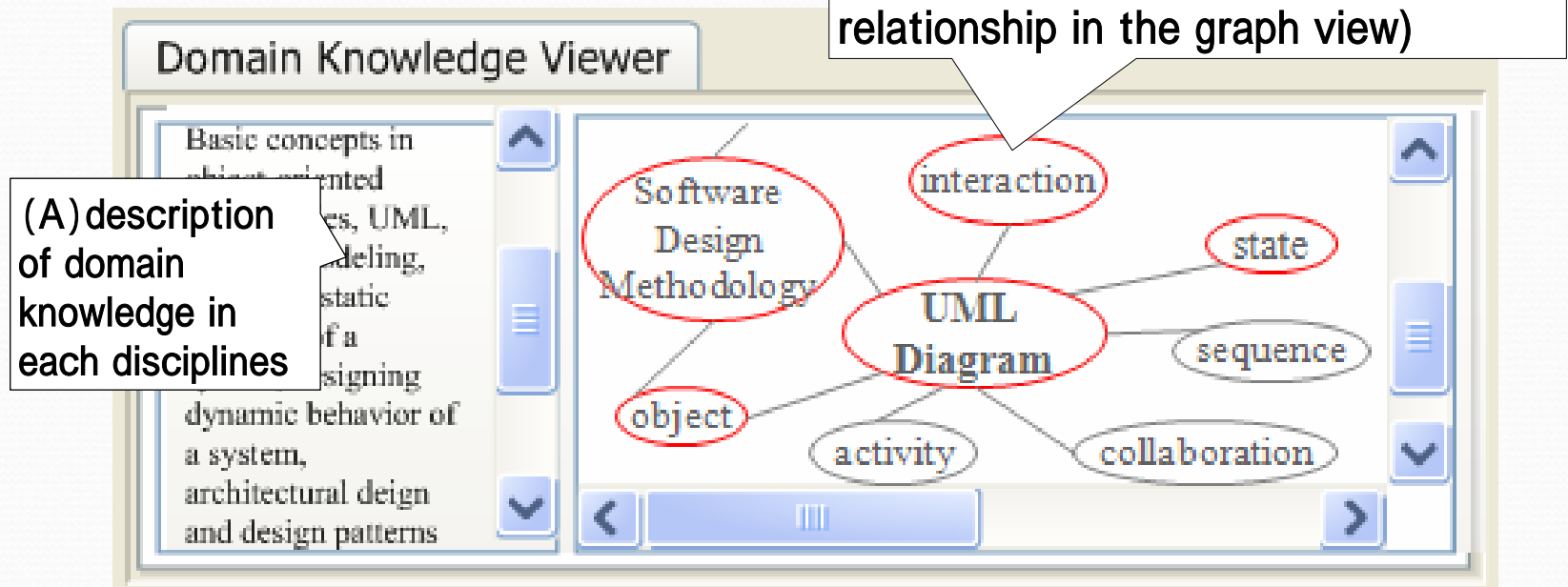
The screenshot displays the CurriculaConsultant software interface. The main window is titled "CurriculaConsultant" and contains several panels:

- Domain Knowledge Viewer:** A central panel showing a conceptual map with nodes like "UML Diagrams", "state", "sequence", "collaboration", "activity", "design", "methodology", and "software design". A red box highlights this panel.
- Rationale Viewer:** A panel below the domain knowledge viewer, divided into "Hierarchical Structure of Rationale" and "Intention of 'Add new class'". A red box highlights this panel.
- Process Task Viewer:** A panel on the right with sections for "Student modeling", "Authoring", "Delivering/Teaching", and "Evaluation".
- Grade info:** A panel on the far right with dropdown menus for "Student ID", "Motivation", "Education status", and "Learning style".
- Check condition:** A panel on the far right with dropdown menus for "Pre-condition" and "Graduate".

At the bottom of the window, there is a status bar showing "KANAI (L)", "Fri Mar 23 14:22:56 IST", and buttons for "Okay, Save" and "More detail, Continue".

# On2C system Development (*cont'd*)

- Domain knowledge viewer
  - (A) the details of the domain knowledge are displayed;
  - (B) the details of the domain knowledge are displayed in the graph view



# On2C system Development (*cont'd*)

- Rationale viewer
  - (A) as a part of Curriculum Ontology, it offers the vocabularies to describe the intention of curricular evolution

The screenshot displays the 'Rationale Viewer' interface. It is divided into two main panels. The left panel, titled 'Hierarchical Structure of Rationale', lists several categories of rationale: 'New knowledge introduction', 'Outdated knowledge elimination', 'Errors correction', 'Course Auxiliary-oriented', 'Pre-requisite knowledge preparation', 'Application in practice', 'Social need-oriented' (highlighted with a red box), and 'New occupation emergence'. The right panel, titled 'Intention of "Add new class"', contains the text: 'Add the new course I474E "Embedded Software Engineering" as a requirement of Social need'. A callout box on the left points to the 'Social need-oriented' category.

(A) to show the intention of curricular evolution

# On2C system Development (cont'd)

- Conceptualized “intention” in Curriculum Ontology

to offer the vocabulary



To explicit that the intention of add the new course of “Embedded Software Engineer” is for the new social need.



# Organizing guidance knowledge of design to make evolution smooth

## Intention & Activity of Faculty designer

In order to **meet with** the **change** of **social needs** to **add** **new course**

**AND**

**Intention**

**Activity**

In order to **master** **prerequisite knowledge** of the **new course**

**Intention**

to **add** the necessary **new learning items** in **related existing course**

**Activity**

**THEN** **student** who has taken the **related existing course** will be **suggested** to **learn** **new learning items**

try to eliminate adverse effects

# Organizing guidance knowledge of design to make evolution smooth

## Intention & Activity of Faculty designer

In order to **meet with** the **change** of **social needs** to **add** **Embedded Software Engineering** **AND**

**Intention**

**Activity**

In order to **master** **prerequisite knowledge** of the **Embedded Software Engineering**

**Intention**

to **add** the necessary **Sequence Diagram, Collaboration Diagram, Activity Diagram** in **Software Design Methodology**

**Activity**

**THEN** **student** who has taken the **Software Design Methodology** will be **suggested** to **learn** **Sequence Diagram, Collaboration Diagram, Activity Diagram**

try to eliminate adverse effects

# Conclusion and future work

- In this work we propose the model of evolutionary process which reflects essential structure of curriculum for offering a better ways to tracking the history of curriculum change;
- Curriculum ontology we developed serves as a fixed conceptual system to fully predict the generic components of curriculum so it can be reused in situation-dependent curriculum system.
- Next step is refinements of the evolutionary curricula model for ontology support to intelligent curriculum authoring and consulting. We are mainly interested in exploring which further functionalities are needed and wanted by different stakeholders.