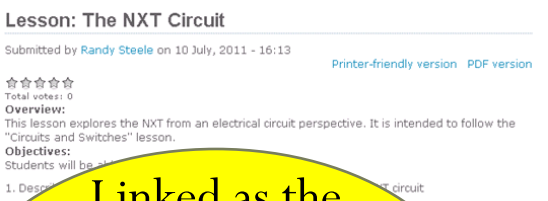
Introducing Canonical Structures over a Domain-Specific Collection

Scott Britell
Lois Delcambre (advisor)
Portland State University
Portland, OR, USA

Motivation


Lesson: The NXT Circuit

Submitted by Randy Steele on 10 July, 2011 - 16:13

Printer-friendly version PDF version

Total votes: 0

Overview:

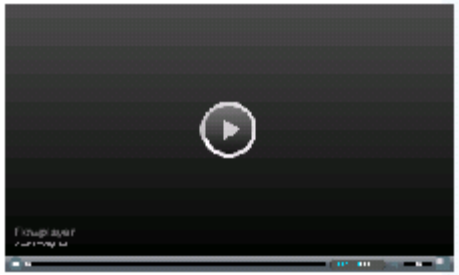
This lesson explores the NXT from an electrical circuit perspective. It is intended to follow the "Circuits and Switches" lesson.

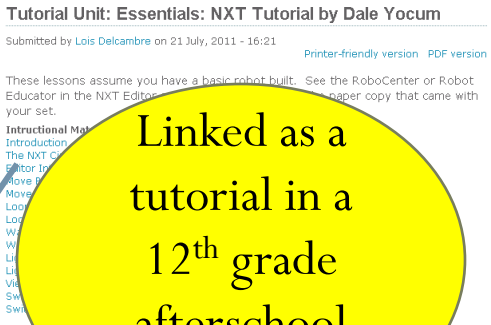
Objectives:

Students will be

Linked as the primary instructional material in a 7th grade course

NXT Circuit Video



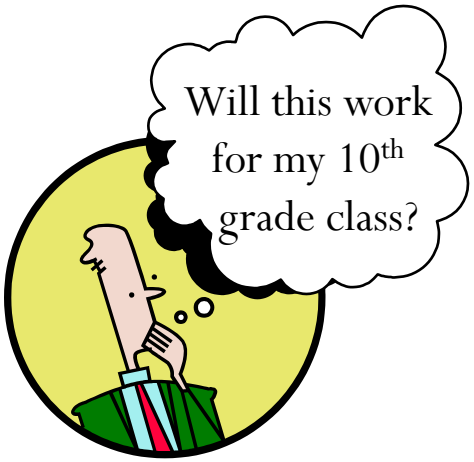

Tutorial Unit: Essentials: NXT Tutorial by Dale Yocum

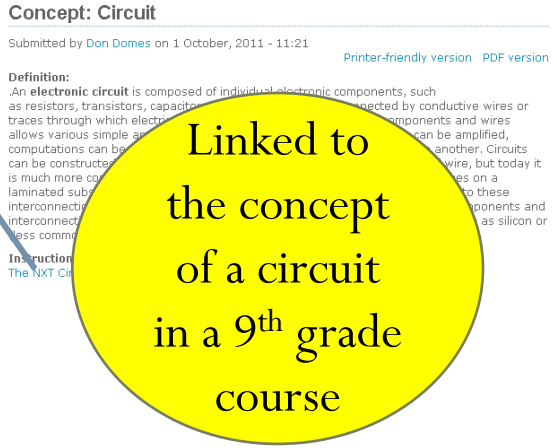
Submitted by Lois Delcambre on 21 July, 2011 - 16:21

Printer-friendly version PDF version

These lessons assume you have a basic robot built. See the RoboCenter or Robot Educator in the NXT Editor paper copy that came with your set.

Linked as a tutorial in a 12th grade afterschool program




Concept: Circuit

Submitted by Don Domes on 1 October, 2011 - 11:21

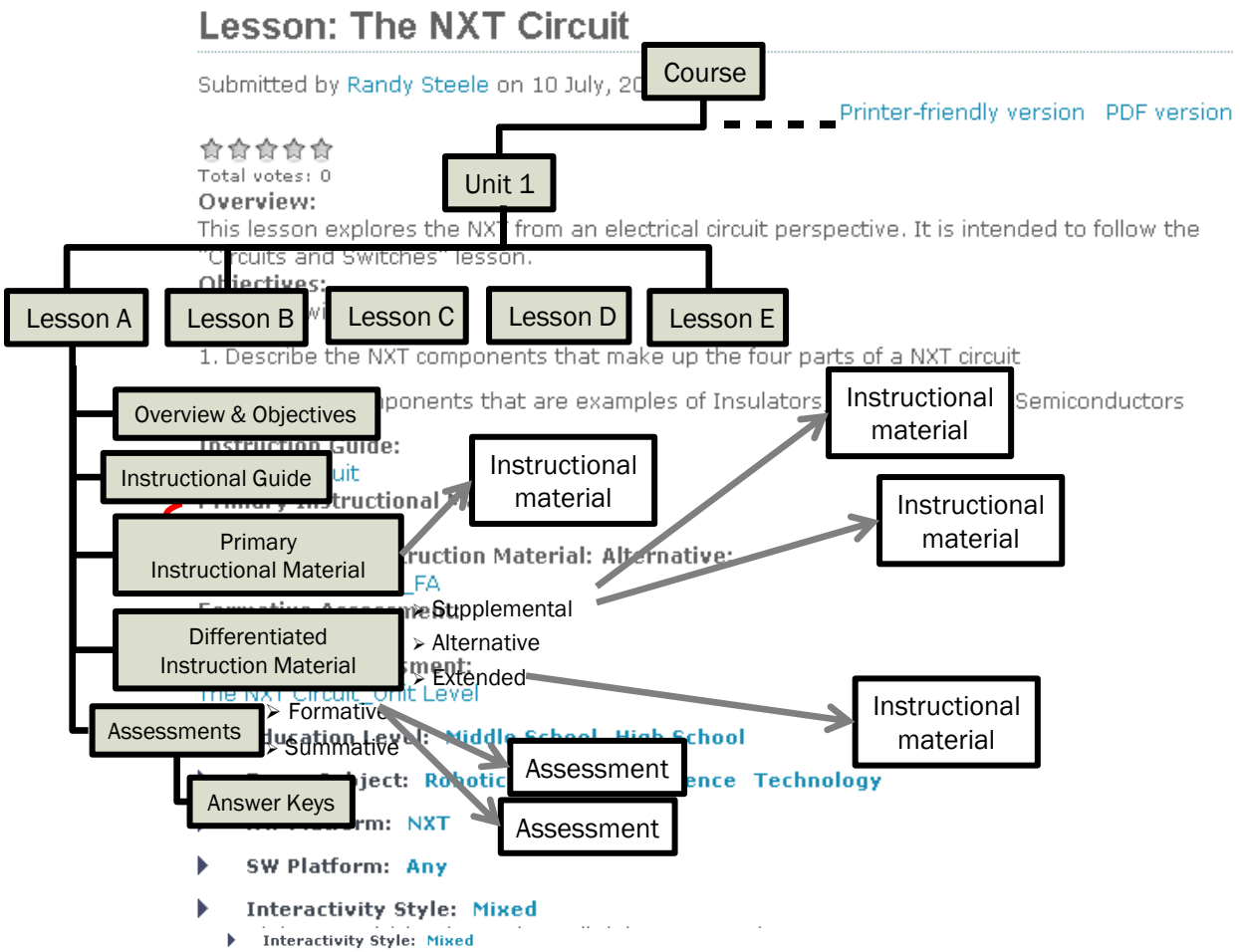
Printer-friendly version PDF version

Definition:

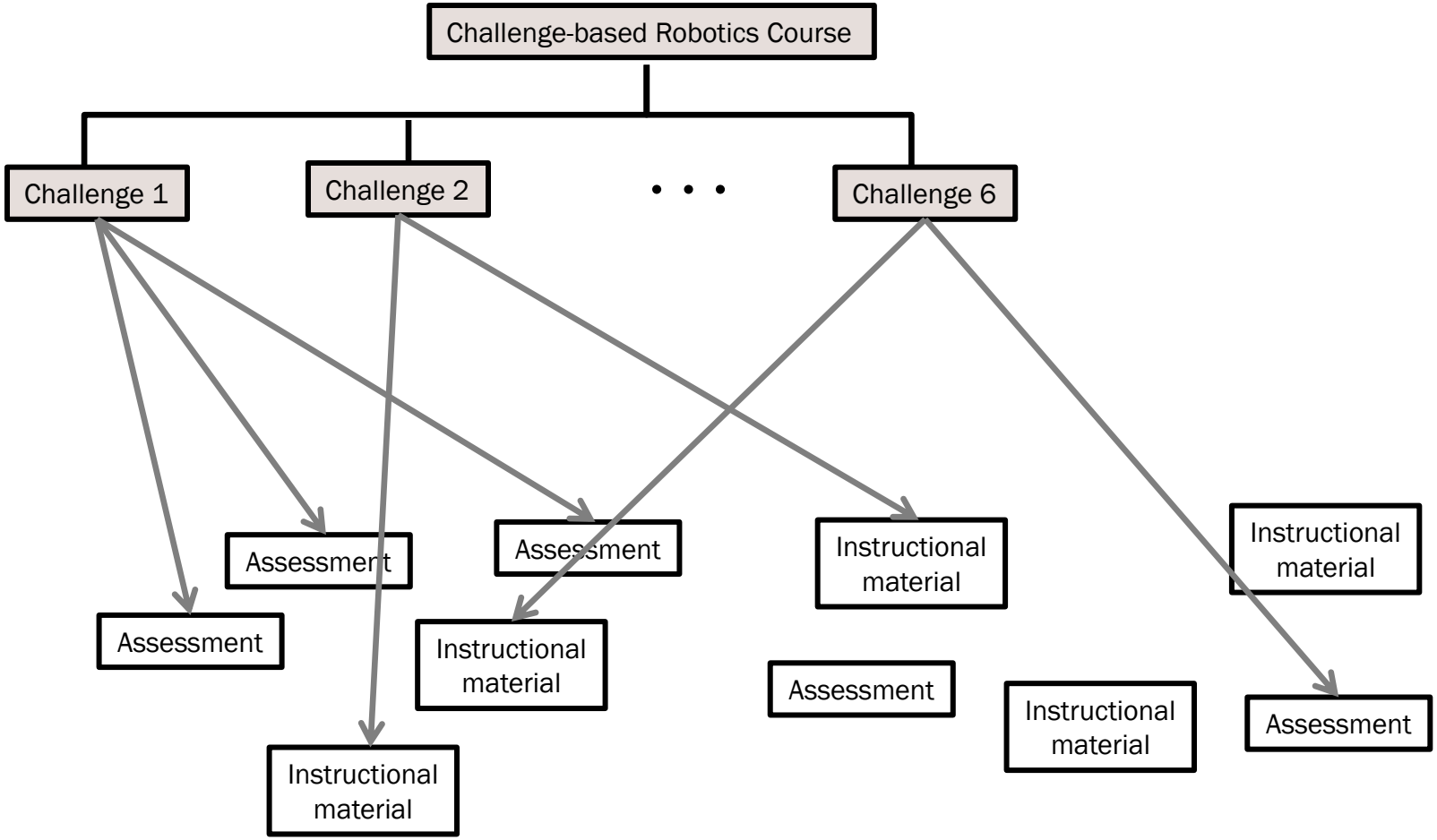
An **electronic circuit** is composed of individual electronic components, such as resistors, transistors, capacitors connected by conductive wires or traces through which electricity components and wires allows various simple and can be amplified, computations can be another. Circuits can be constructed wire, but today it is much more common laminated substrate to these interconnections components and interconnections as silicon or less common

Linked to the concept of a circuit in a 9th grade course

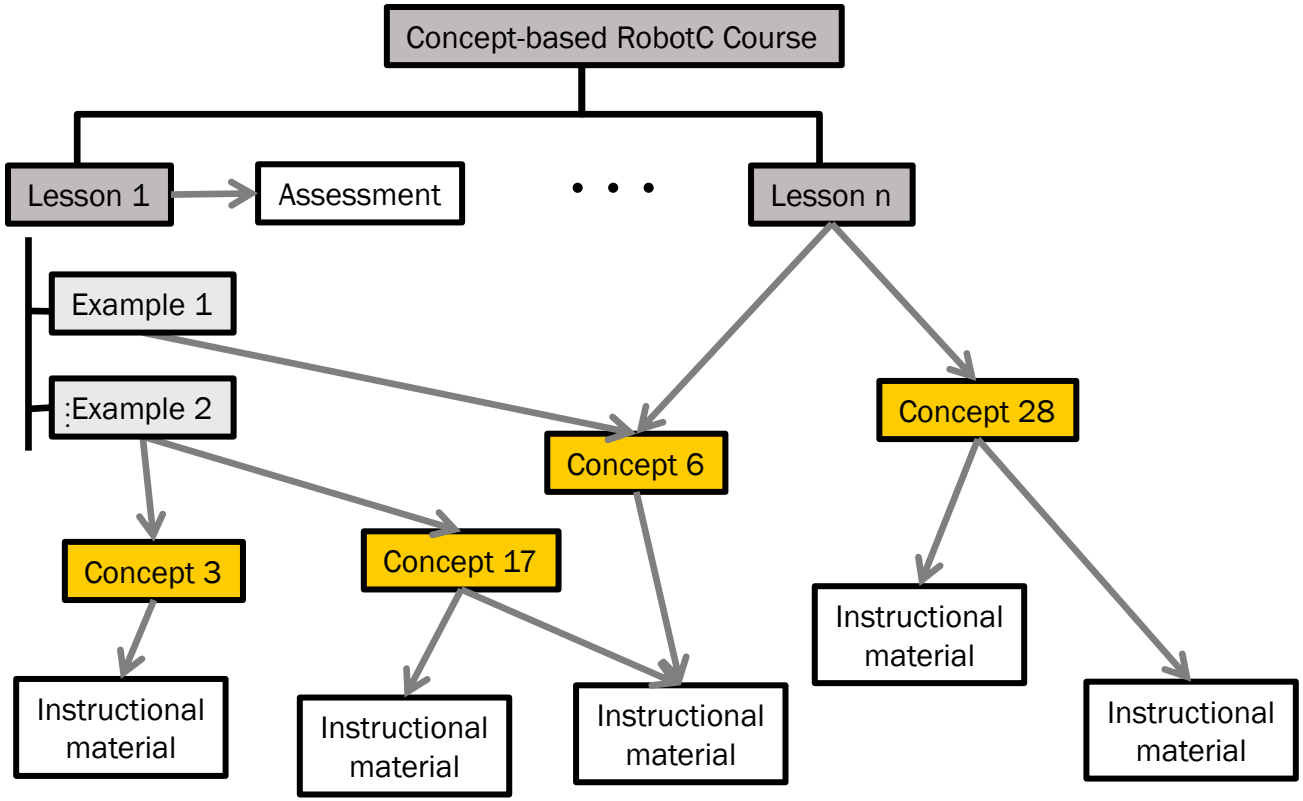
One possible schema for educational material



Another schema for educational materials



Yet another schema for educational materials



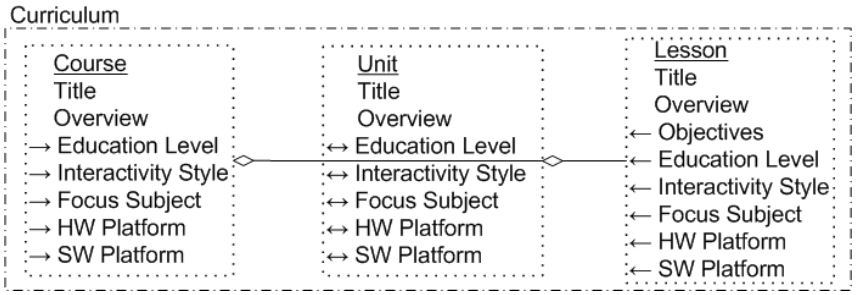
The problem/opportunity

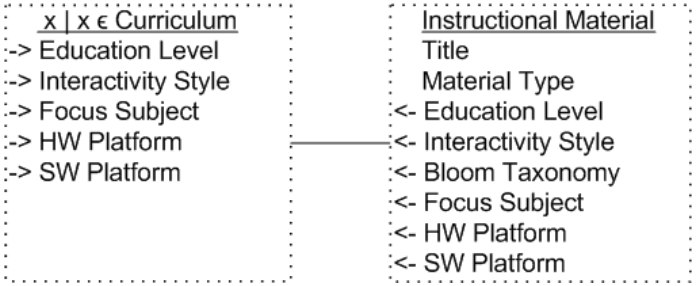
- Within a domain there are recurring structures
  - Courses, units, lessons …
- Yet these structures may be arranged in a range of different configurations
  - Lecture-based courses, Challenge-based courses, …
- Within a domain, objects are informed by the context where they reside. Descriptive information can be inferred from the contexts
  - From interrelationships between objects in the domain
    - Instructional materials referenced as extended differentiated material in a lecture-based course are only intended for advanced students
  - From the attributes of related entities
    - The grade level of an instructional material can only be inferred from the grade levels of the courses that reference it

Our approach

- Capture the inherent commonalities of a domain in a set of canonical structures that
  - Are schema fragments
  - Represent the notable entities, relationships, and attributes
- Map the canonical structures to the existing domain schemas in a pay-as-you-go fashion
- Exploit the canonical structures to
  - Reflect attributes
  - (Re)rank – for searching and browsing
  - Query the domain

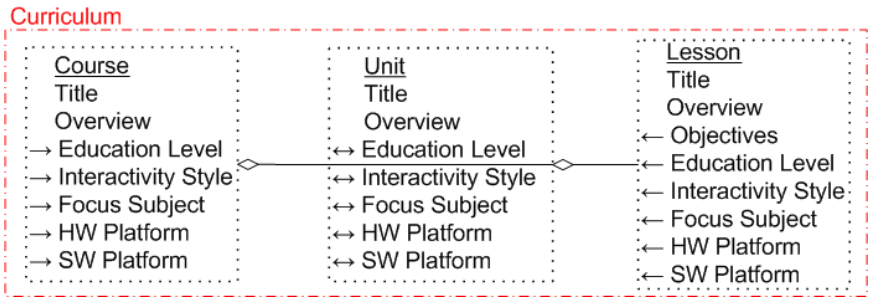
Some canonical structures for educational materials



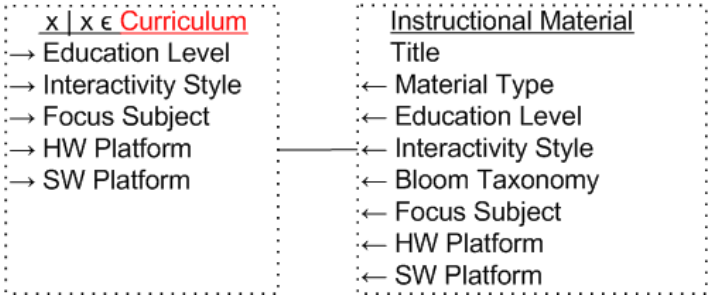


Canonical structure features

- Entities may be grouped



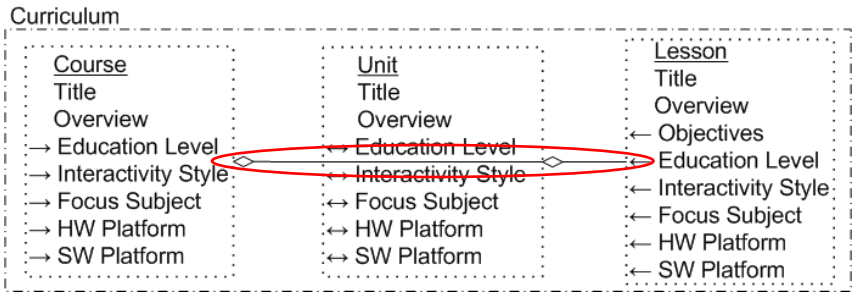
- Entity groups may be used in other structures



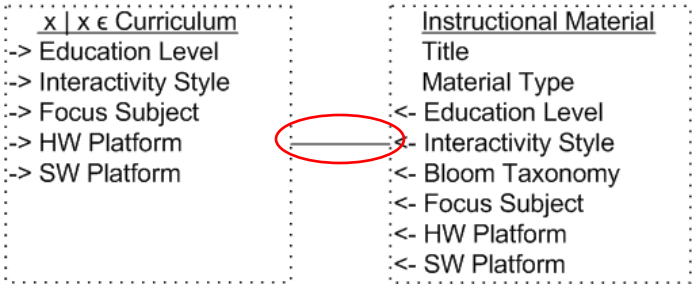
Canonical structure relationships

- Aggregation
  - May be many-many
  - May pass-through entities

    (i.e., entities may be missing)
  - Data must be acyclic

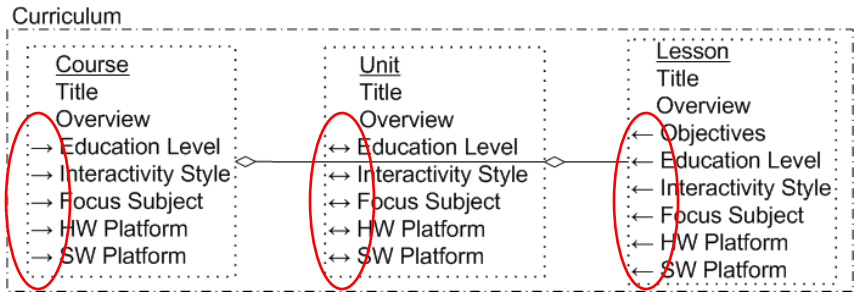


- Regular

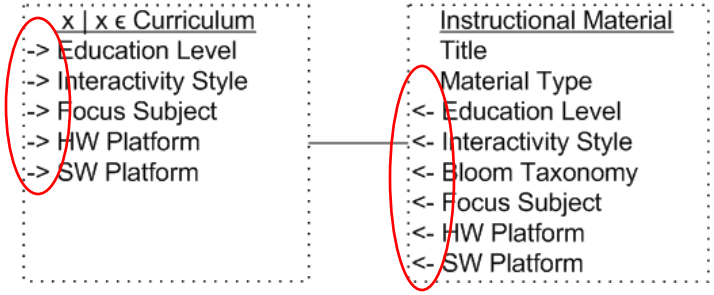


Canonical structure attributes

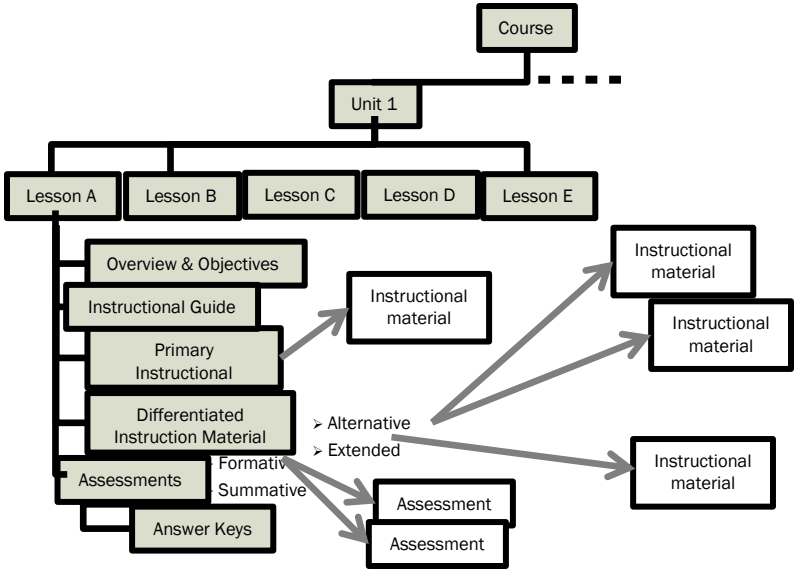
Attributes can reflect across relationships

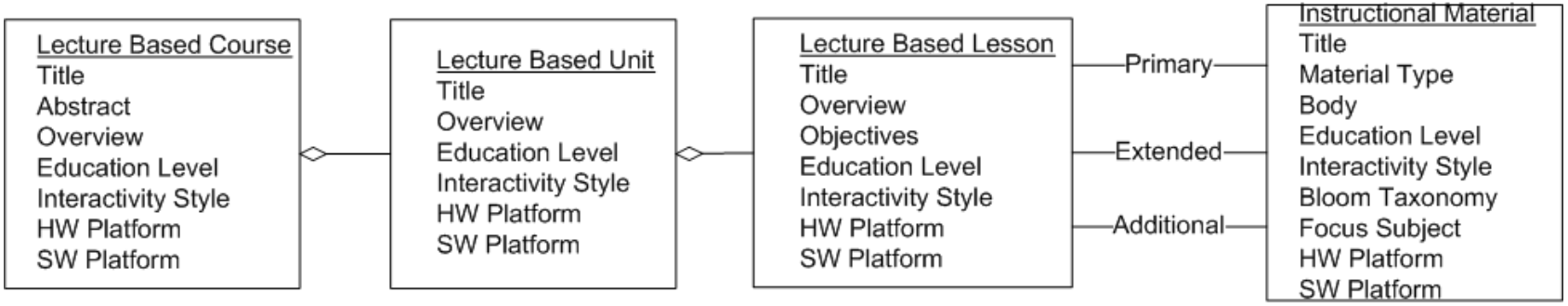


- Are accessible to (viewable by) related entities
- Can travel in both directions across a relationship
- Do not impose local values (i.e. reflection is not inheritance)

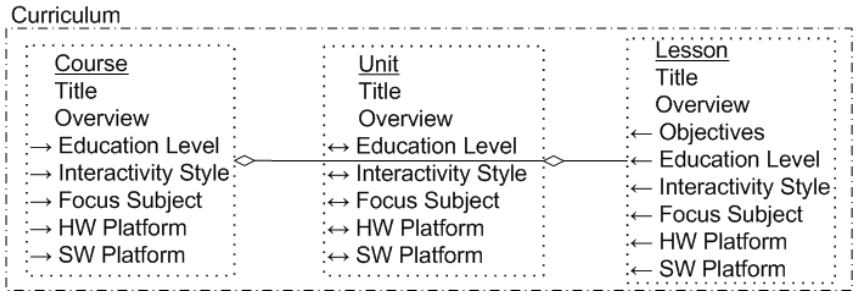


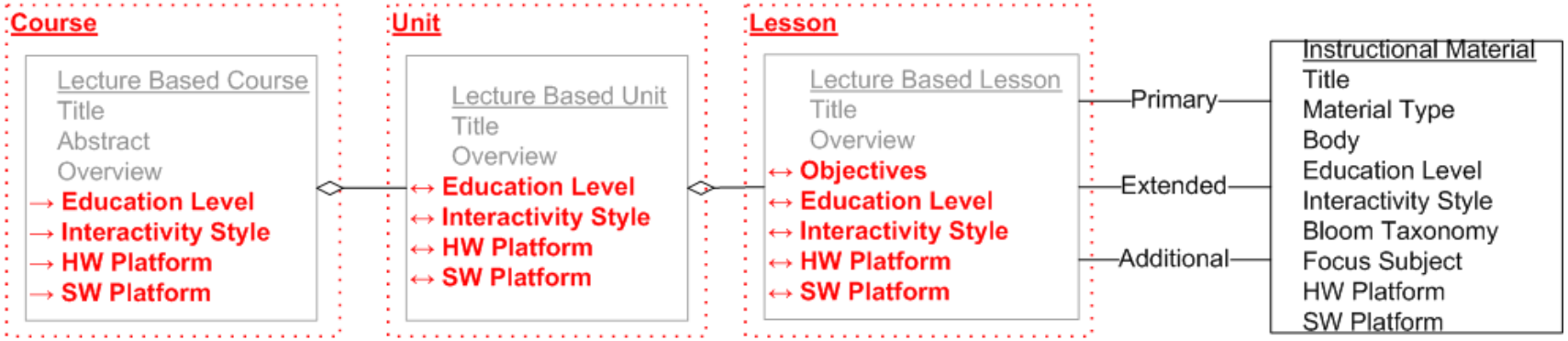
Mapping the Canonical Structures to the Domain Schemas



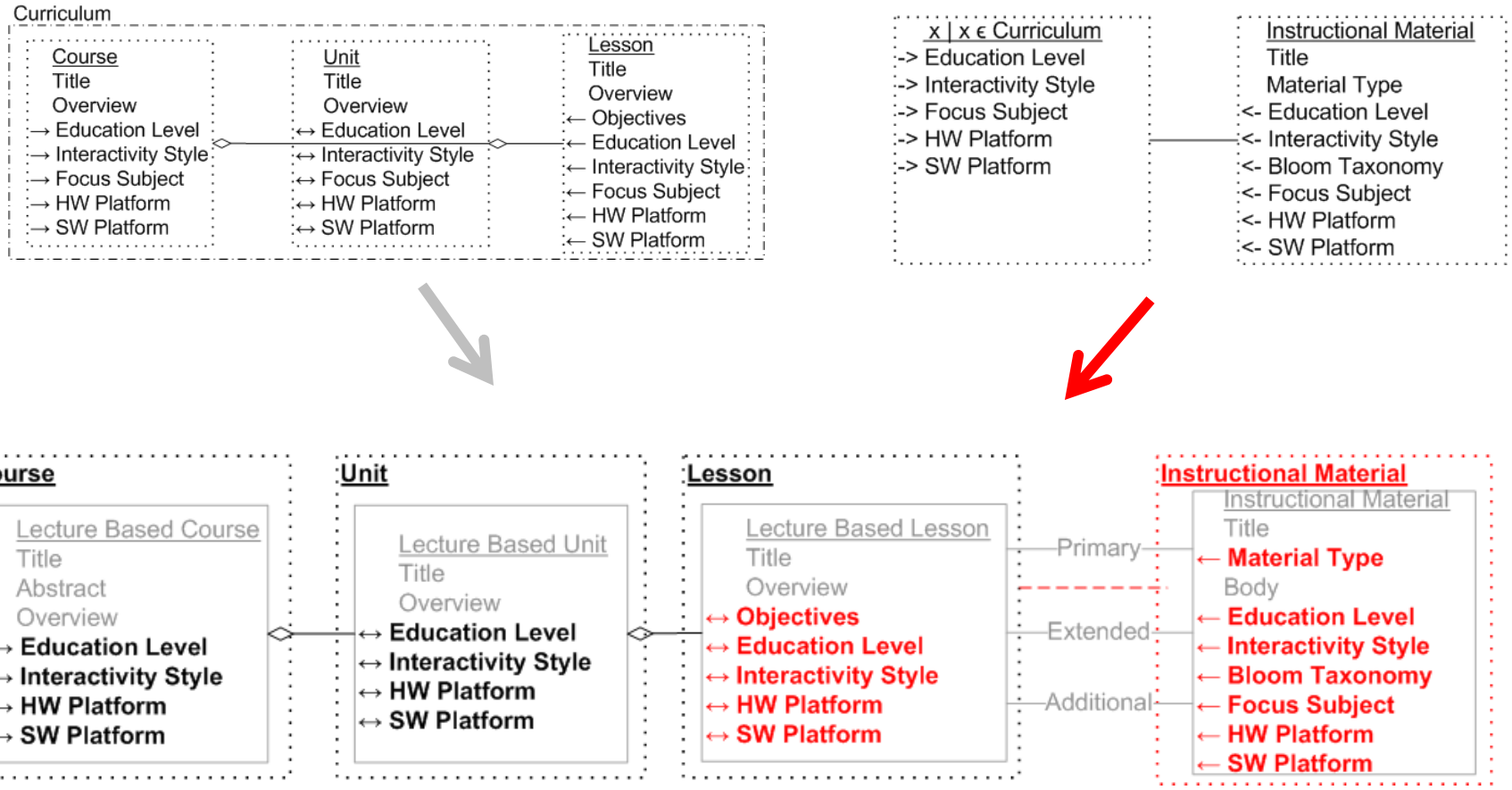


Mapping the Canonical Structures to the Domain Schemas

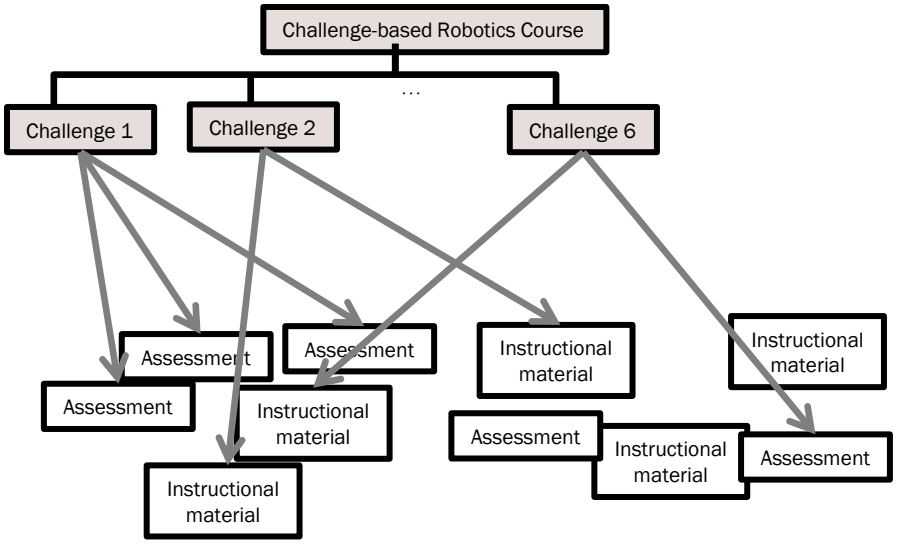


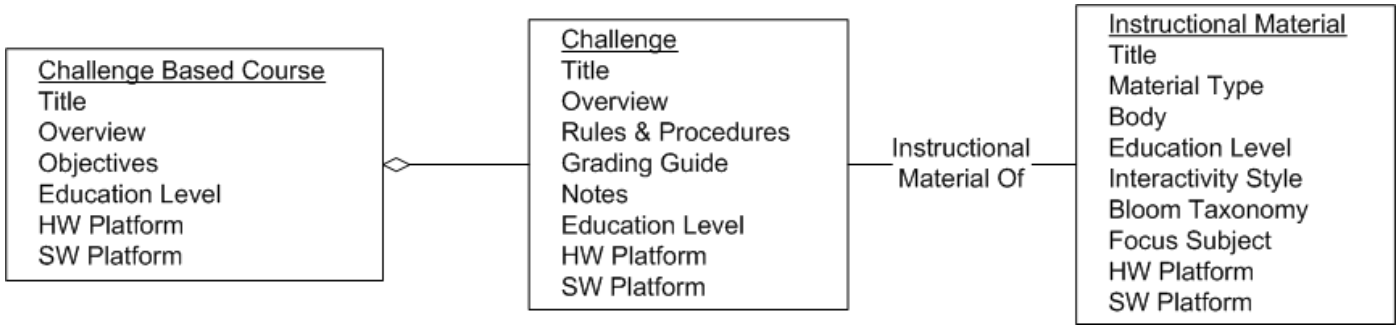


Mapping the Canonical Structures to the Domain Schemas

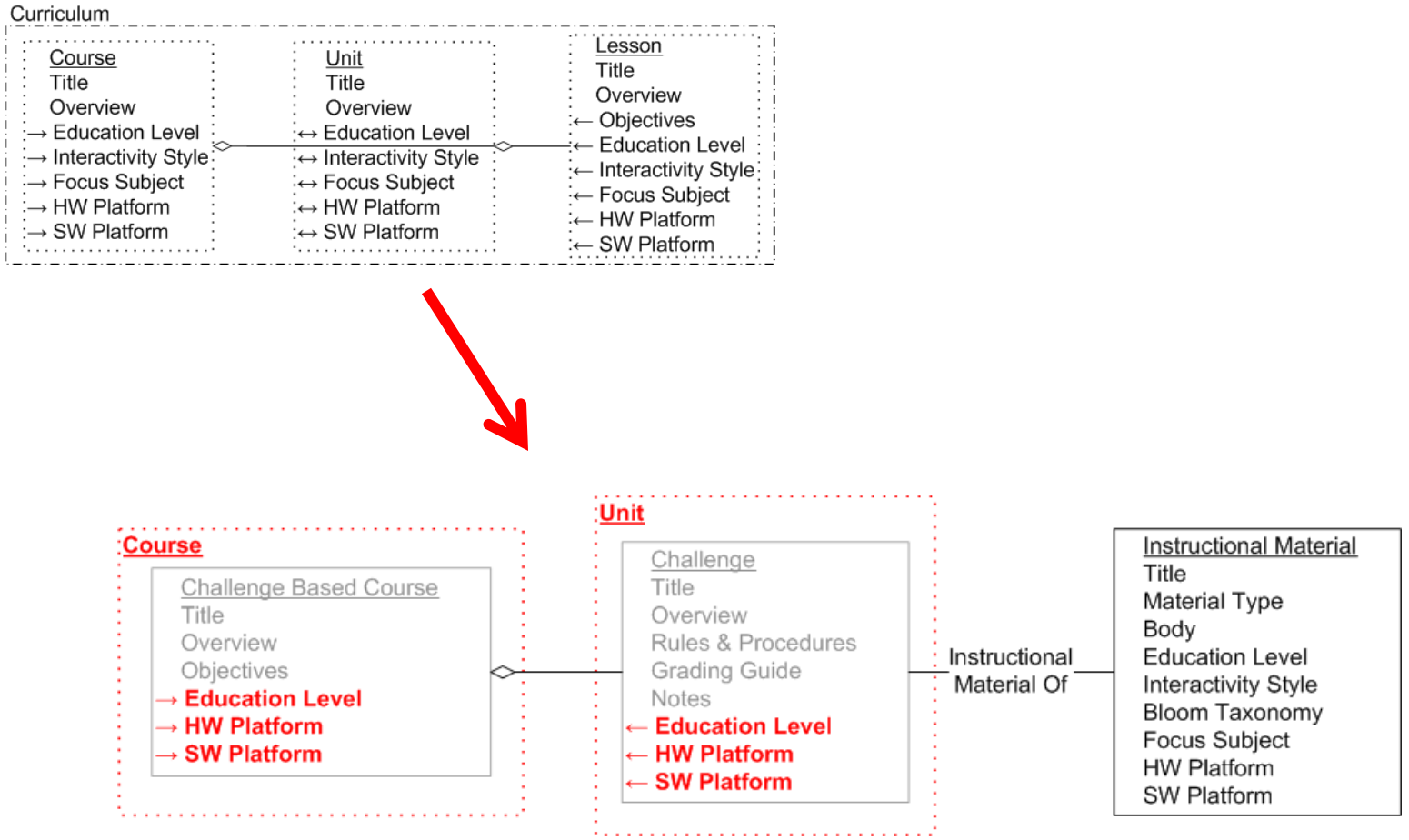


Mapping the Canonical Structures to the Domain Schemas

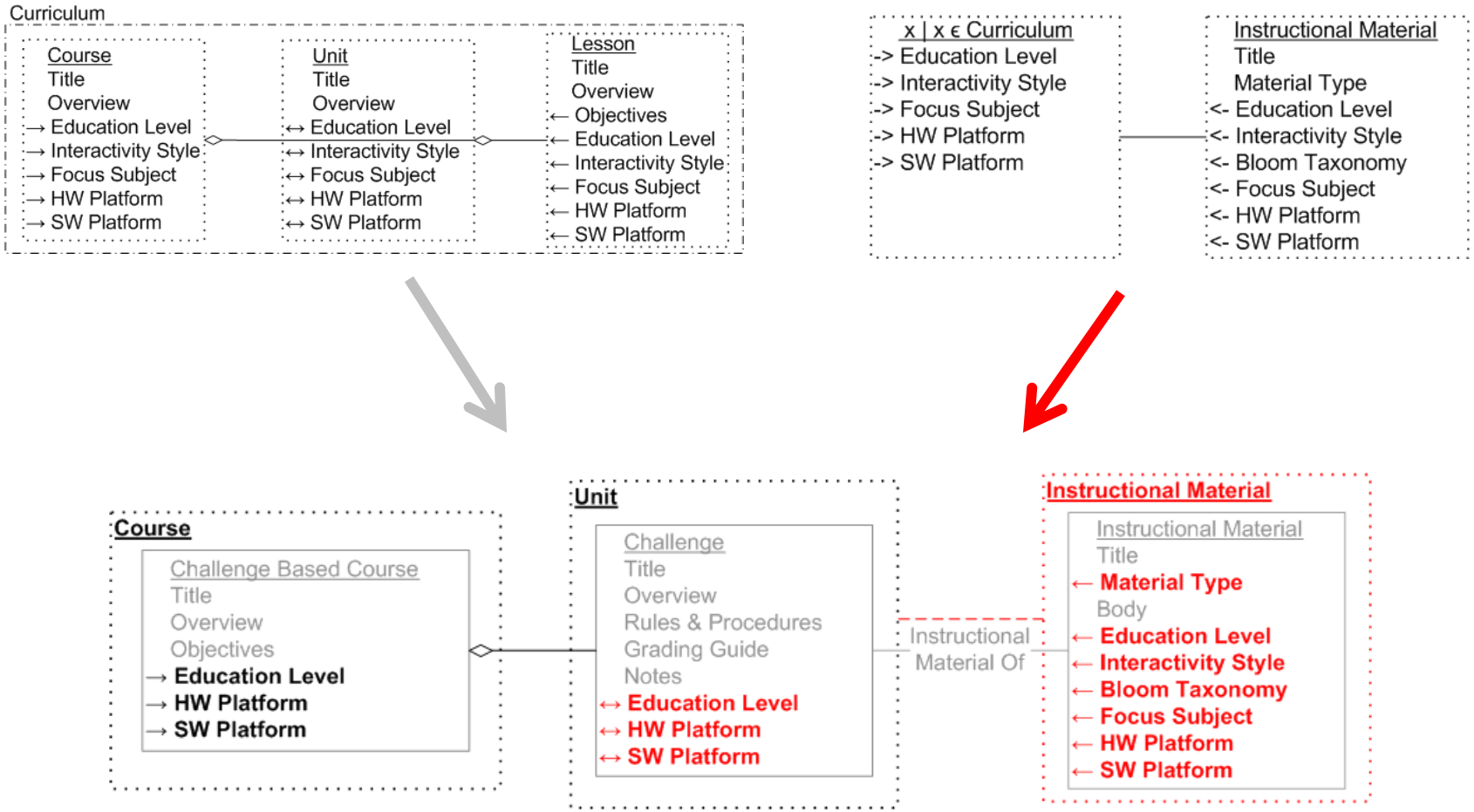




Mapping the Canonical Structures to the Domain Schemas

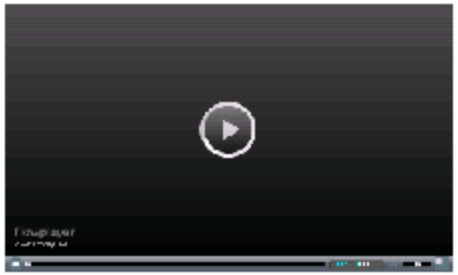


Mapping the Canonical Structures to the Domain Schemas

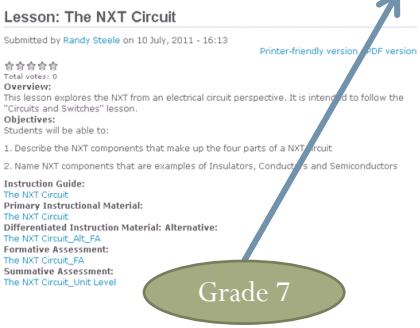


Leveraging canonical structures

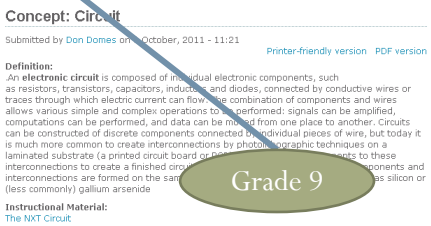
What are the grade levels of classes that use this video?



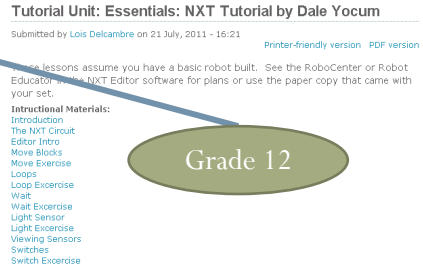
Grade 7 Grade 9 Grade 12 Middle School High School



Grade 7

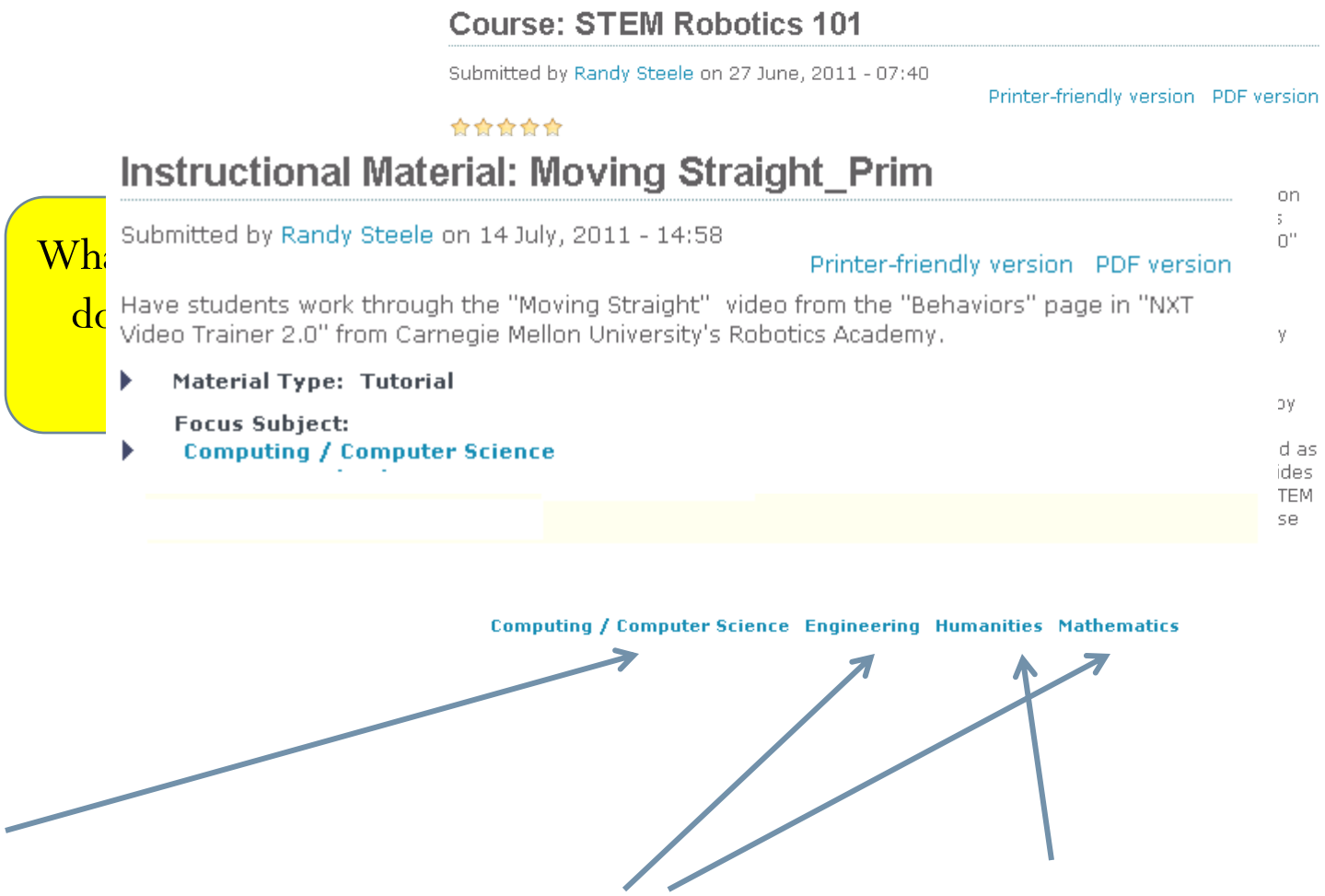


Grade 9



Grade 12

Leveraging canonical structures



Proposed Contributions

- New model
  - Built upon schema fragments
  - That captures the notion of attribute reflection
  - With appropriate schema mapping
- A formalism of that model
- An evaluation of the model, the formalism, the mappings, and the algorithms that exploit the model

Related work

- Modeling
  - Semantic Data Models
  - Meta-modeling
  - Ontologies
- Semantic Web
- Schema Mapping
- Data Integration
  - Dataspaces
- Design Patterns

Acknowledgements

- Collaborators:
  - Randy Steele Olympia School District, Olympia, WA
  - Rob Bryant - Gonzaga University, Spokane, WA
  - Richard Weiss - Evergreen State College, Olympia, WA
  - Don Domes and Devin Hunter - Hillsboro H.S, Hillsboro, OR

- This work is supported in part by NSF Project 0829651 and NSF Project 0840668

Thank you

- Questions, comments, and insights?