Innovative Education Enabled by Knowledge Organization and IT:

Goal-directed, Flexible, Individualized, Collaborative

Dagobert Soergel

Department of Library and Information Studies
Graduate School of Education, University at Buffalo

Future of Education Conference 8. Florence, Italy 2018-06-28

The paper gives the general ideas, the slides give examples.

Best viewed in PowerPoint with speaker notes and audio (Click on the audio symbol when present)

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

1

Transform learning

Transform the learning environment
in higher education.

Enable new ways of learning

   - for a changing population of students

   - preparing for a changing world of work

Create opportunities for students of all abilities, social classes, and ethnicities

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

2

Approach

Take existing practices, pilots, ideas as seeds

Grow them into large trees

Put the trees together

Get a tall new forest

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

3

Outline

0 New challenges in higher education

System components

1 Classification of learning goals and objectives

2 A large database of learning opportunities / learning units
   for customized learning path creation

3 Detailed tracking of learning outcomes for assessment

4 A comprehensive integrated IT infrastructure

Diversity

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

5

Arthur, 28-year old high school educated, enrolls in a Psychology program.

Laura,23 year old deaf student, is completing her M.A. in Education.

Bethany, 35 year old MBA student, works 40 hours a week while taking class online.

Gigi, 27 year old single mother, celebrates completing her B.S. in Nursing.

Tomas, 23 year old Senior with disabilities, is completing a B.S. in Biochemistry.

Rodney, 38 year old, explores returning to school for a 2nd Bachelor's degree.

0 New challenges in higher education

- **Celebrate diversity** by adapting materials to each student's background, configuration of abilities. and interests to **unlock the potential of all students** and close the opportunity gap resulting from inequalities in society

- Provide **24/7 access**

- Let students **learn on their own time at their own pace**

- Provide **microcredentials** that let students acquire just-in-time, just-what-is-needed information

- Assessment: capture and **report mastery of specific items of knowledge and skills**

- Lower cost while increasing quality

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

13

0 Achieving the impossible

Knowledge and IT infrastructure to

- **Facilitate the creation of learning units**
  (from seated or online courses to small modules, including individual lectures, assignments, and exams),
  - Reuse and adapt materials
  - Create customized learning paths for each student
- **Deliver learning experiences**. Adaptive delivery
  - Adapt learning path to student progress
  - Let students explore,
- **Administer assessment**.
- **Support collaborative learning** and exploration

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

14

1 Classification of learning goals and objectives

**Integrates many sources, multiple perspectives
Contrast to monolithic closed schemes
such as
Common Core standards in the US**

Example

Master of Information Science Program

1 Graduates understand the foundations of library and information studies.

2 **Graduates have the domain knowledge and skills required to carry out information functions**

3 Graduates have general knowledge and skills needed across professions

4 Graduates understand the nature of the information profession

5 Understand importance of personal qualities conducive to professional success.

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

16

Master of Information Science Program

2   **Graduates have the domain knowledge and skills required to carry out information functions.**

2.3   **understand / can apply principles of knowledge organization** for a wide range of applications — organizing a collection, expert searching, support for learning.
(*American Library Association, A*LA)

2.3.1,0.1   understand how data need to be structured to allow automatic reasoning *(One of several instructors of the course INFO 601*)

2.3.1,1.1   understand/apply entity-relationship (E-R) modeling (*Information Architecture microcredential*)

2.3.1,1.1.2 understand linked (open) data (LOD) (*IA microcredential*)

2.3.1,2.1   understand hierarchical inheritance of information (*agreement of all instructors of course INFO 601)*

Master of Information Science Program

2   Graduates have the domain knowledge and skills required to carry out information functions.

2.3   understand / can apply principles of knowledge organization

2.3.1,4 understand the internal structure of documents and text (*instructor*)

understand the structure of and means of expression / knowledge representation used in graphic novels **(*individual student*)**

2.4.3   able to organize a collection of books and other learning materials to support the curriculum and students' learning
(New York State Library Media Specialist Certification Content Specialty Test)

2.3.5.1 able to catalog books and learning materials from the perspective of children and use in the curriculum
(American Association of School Librarians , AASL)

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

18

One-minute course in E-R modeling

Domain: Medicine. Reasoning for prescribing drugs	
Entity types (nouns)	Examples
Person	Fred
Disease	Asthma, LiverDisease
Drug	Aspirin, Prednisone
Scale for Severity & Effectiveness	Scale 0 - 4
Relationship types (verbs)	
Person *<hasDisease>* (Disease, Severity)	Fred *<hasDisease>* (LiverDisease, 2) Fred *<hasDisease>* (Asthma, 4)
Disease *<treatedWith>* (Drug, Effectiveness)	Asthma *<treatedWith>* (Prednisone, 3)

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

19

1 Classification of learning objectives Summary

Knowledge infrastructure – core of the entire system

Classification of knowledge items, concepts, understandings, competencies, skills, opinions, behaviors, habits, attitudes, and dispositions

Used to specify learning objectives (desired) and learning outcomes (achieved)
Learning objectives are specified in learning unit descriptions. Learning outcomes are specified in student assessment records.

Deep hierarchy, many sources, cross-linked
As illustrated in slides 16 - 18

2 A large database of learning opportunities / learning units

for customized learning path creation
Highly indexed, interlinked

2 Database of learning units

Learning Unit ID	15	Inherits from	
Title	Practice with entity-relationship modeling		
Subject	Knowledge organization; Databases		
Learning objectives	2.3.1,1.1understand/apply entity-relationship (E-R) modeling		
Prerequisites	Unit 9. (Getting acquainted with info systems and info structure)		
Format			
Audience			
Other units w/ same content			

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

22

2 Database of learning units

Learning Unit ID	16	Inherits from	15
Format	Seated lecture w/work on the board and student participation. Sign language interpretation for deaf students		
Audience	Primarily on-campus students who both see and hear		
Other units w/ same content	Units 17, 18		

Content is specified in Unit 15 and is inherited.
Format for specific audience
Following slides show more formats

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

23

2 Database of learning units

Learning Unit ID	17	Inherits from	15
Format	Online lecture w examples using slides with audio explanation. No talking head		
Audience	Primarily remote students who both see and hear		
Other units w/ same content	Units 16 and 18		

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

24

2 Database of learning units

Learning Unit ID	18	Inherits from	15
Format	Online lecture w examples on slides using written explanations in a separate window		
Audience	Remote students who are deaf but can see		
Other units w/ same content	Units 16, 17		

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

25

2 Database of learning units

The system uses this database to **construct a learning path**, a sequence of learning units:

- Get the **student** ● **from her present state of knowledge**

    ● **to mastering the desired learning objectives.**

- **Assemble the learning units** that <u>together</u> **cover the learning objectives.**

- **Use prerequisite relationships to arrange these units into "strands".**

- For the unit at the "bottom" of each strand, check whether the student meets all prerequisites. If not, use prerequisite relationships to **find a learning path that leads from the students existing knowledge to knowledge of the missing prerequisites.**

- All this happens at the conceptual unit level (such as Unit 15). Then **select the format appropriate for the student.**

3 Detailed tracking of learning outcomes for assessment, feedback, and credentials

Common method of assessment

Assignment x		Final		Paper		Course
Rubric	Pts	Question	Points	Rubric	Pts	
R1 10	9	Q1 15	10	R1 50	40	
R2 10	10	Q2 15	12	R2 25	23	
R3 60	55	Q3 20	16	R3 25	22	
R4 20	18	Q4 20	18			
		Q5 30	25			
Total	92	100	81		85	

Points for the final, paper, and assignments computed separately for each,
Questions and rubrics may or may not be connected to learning objectives.

Course grade computed as weighted average across the bottom row.

Course grades aggregated into GPA .

Please click on the audio symbol to listen to the explanation

Proposed method of assessment
Focus on learning objectives

Objective	Ass	Final	Ppr	Score
2.3.1,1.1 E-R modeling (*IA*)	A1: 98	Q7b: 60		B+
2.3.1,1.1.2 LOD (*IA*)	A6: 95	Q7c	86	A
2.3.1,2.1 hierarch.inheritance	A4: 50	Q2: 88		A
Graphic novels (*ind. Student*)			93	A
Course grade (if needed)				A

Collect all evidence from all activities from all courses for reaching a learning objective. **If done right, this is no more work for the instructor.**

Student can always follow his or her progress through the program, towards a credential, or preparedness for an external test

Please click on the audio symbol to listen to the explanation

4 A comprehensive integrated IT infrastructure

To enable all of the above
Support the work of students and faculty
Make the impossible possible

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

30

Example. IT for collaboration

- **Needs first-rate team ware:**

  - **Live screen sharing:
    Several people work on the same screen from their own computers while communicating by voice**

  - **Messaging**

  - **Easy access to search**

- **Social tagging & reviewing in the university library catalog**

- **Book discussions synchronous or asynchronous**

- **Business simulations online or in class**

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

31

More IT functions

1 Support collaborative development and maintenance of the classification of learning objectives
Also exploration and search of the classification

2 Support authoring, presentation, and management of learning units

2.1 Authoring in a combination of different media, including support for creating interactive units

2.2 Support for presentation of learning units in many different formats on different devices

2.3 Manage database of learning units

3 Support assessment

3.1 Managing submission and return of students' work

3.2 Reading and assessing students' work and recording assessments

3.3 Manage the assessment database and permission-controlled access

Take home messages

Higher education must change.

**New challenges can be met
with knowledge organization and IT.**

Grand ideas need meticulous, carefully thought-through detailed implementation.

To convince faculty and students, the new system must be easier than the old one.

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

33

Acknowledgments

Thanks to Catherine Dillon for her help in preparing this presentation, especially for finding and preparing the diversity images.

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

34

Thank you

Questions?

Dagobert Soergel <dsoergel@buffalo.edu>

www.dsoergel.com

Soergel, Innovative Education. Future of Ed. Conf. 8. Florence, Italy 2018-06-28/29

35