

**Selected aspects of the
development and implementation
of a GIS curriculum
for
prospective high school teachers
in Austria**

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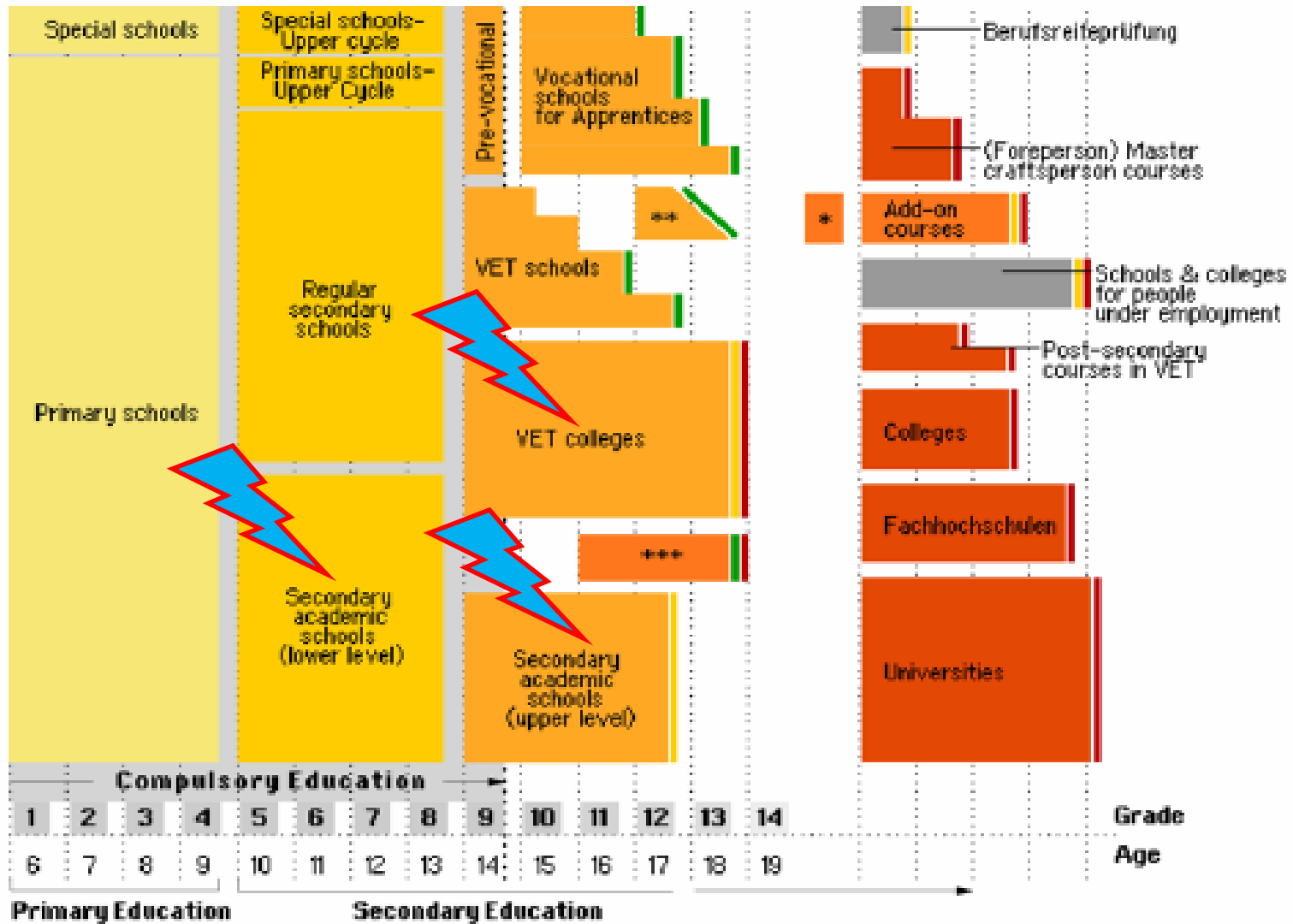
Where is Graz ?



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Austrian Educational System



School types - Organisational Structure

The eight-year AHS begins directly following grade 4 of "Volksschule" and consists of an "**Unterstufe**" (lower cycle, grade 5 to 8) and an "**Oberstufe**" (upper cycle, grades 9 to 12).

The "Oberstufenrealgymnasium" begins directly following grade 8 and consists of a 4-year "Oberstufe" (grades 9 to 12).

The different types of academic secondary schools:

- *basic types of AHS with "Unterstufe" and "Oberstufe"*

- * "**Gymnasium**" (classical academic secondary school)
- * "**Realgymnasium**" (academic secondary school with a focus on mathematics and science)
- * "**Wirtschaftskundliches Realgymnasium**" (academic secondary school with a focus on economics)

- *with "Oberstufe" only*

* "**Oberstufenrealgymnasium**" (ORG) (special type of upper-level academic secondary school)

* Special types of academic secondary schools

School types - Educational Objectives and Content (1)

Educational objectives

The *AHS* are designed to consolidate and **reinforce a comprehensive general education** and to **prepare students for university-level studies**. The principle of social integration of students with special educational needs is to be respected in the lower cycle of *AHS*.

Educational content

All types of *AHS* offer the following compulsory subjects: religion, German, a modern foreign language, history and social studies, **geography and economics**, mathematics, biology and **environmental studies**, chemistry, physics, music, arts, and physical education; plus technical or textile handicrafts and vocational guidance in the lower cycle; and IT, psychology and philosophy in the upper cycle.

"Gymnasium", *"Realgymnasium"* and *"wirtschaftskundliches Realgymnasium"*: There are **no differences** in the instructional content during the first two years (grades 5 and 6). From the third year onwards, these three types of academic secondary school have the following different focuses:

School types - Educational Objectives and Content (2)

"**Gymnasium**": Students learn Latin beginning in the third year and Greek or a second modern foreign language in the 5th (only **geography and economics**).

"**Realgymnasium**": The "**Realgymnasium**" offers more mathematics instruction and focuses on the natural sciences. Technical or textile handicrafts continue to be offered in the 3rd and 4th year, and geometric design is offered in the 4th year. In the upper cycle, students may choose between projective geometry or more biology and **environmental studies**, chemistry and physics.

"**Wirtschaftskundliches Realgymnasium**": This type of academic secondary school offers additional instruction in chemistry and in technical or textile handicrafts. In the upper cycle, it also offers **geography and economics** as well as psychology and philosophy with a period of practical training.

"**Oberstufenrealgymnasium**": Students may choose an education with

- * a focus on **the natural sciences**,
- * instruction in a musical instrument, or
- * a focus on the arts

Types of VET - schools (BHS)

(Vocational Education & Training)

- Schools and Colleges of Engineering, Arts and Crafts
- **Colleges of Business Administration and Business Schools *)**
- Schools and Colleges of Management and Services Industries
- **Schools and Colleges of Tourism *)**
- Schools and Colleges of Fashion and Clothing (Colleges of Artistic Design)
- Schools of Social Occupations
- Post-Secondary Colleges of Social Work
- **Colleges of Agriculture and Forestry *)**
- Nursery Teacher Training Colleges
- Colleges of Social Pedagogy
- Training firms & ACT (Austrian Center for Training Firms)

**) GIS relevant*

Training of prospective teachers

The IGR is responsible for the training of AHS- and VET - level teachers.

Legal basement of the training

Curriculum GWK (Curriculum for the geography and economics high-school teaching profession).

First implemented in 2002, last modified 2006

At the present time GIS and RS content is taught in a „2 hours per semester“ - course (Title: Introduction in Geographic Technologies).

Type of the course is a combination of lessons and practical units.

Preconditions of the candidates

Computing literacy of the students (30 - 50 starters each semester)

Several types observed: Students got **PC- skills...**

- (ECDL - level or better) at school
- (ECDL - level or better) as an autodidact
- (ECDL - level) as a consequence of the attendance of several non - school courses (NGO's,...)
- No sufficient computing literacy is given

Therefore in many cases the IGR has to provide **initial aid** (ECDL, EDV f. Studierende der Geographie...)

Technical infrastructure at the IGR

2 PC - Labs (for forty persons each)

15 resp. 12 seats; connected to three or four so called „teacher - PCs“

ArcGIS 9.2 and ArcView 3.x; plus additional Software (mostly GIS-/RS- and Geostatistical toolboxes)

Pentium 4 3.x GHz

1 Gb - 4 Gb on board memory

360 - 500 Gb harddisk drives

5 separate workstations for Students working on their master thesis or a PhD.

Basement defined by the RLP (1) (RLP = Rahmenlehrplan = table of contents)

Mediation/transfer of methodical competence

- ...an important demand is the use of computer - supported procedures in a more intensive way
- ... the analysis of topographic and thematic maps
- ... strengthening the use of space borne RS data and other modern information sources.

All these things can be done pretty well with GIS packages!

Basement defined by the RLP (2) (RLP = Rahmenlehrplan = table of contents)

Mediation/transfer of synthesis competence

From this point of view mainly three aspects/factors can push the use of GIS in high schools in a considerable way:

- **Modelling human behaviour** in space/ in the natural environment
- The **integrative approach** in most of the GIS - based problem solving scenarios should also be a characteristic element of teaching geography
- The use of GIS makes it easier to **discover hidden, often highly complex interactions** between physical and human factors of nature.

Outcomes of the curriculum

- Introduction into the concepts of GIS and the basic characteristics of GI systems.
- Processing of a pre-defined problem in a typical highschool scenario and based on „industrial standard“ spatially referenced datasets (*.shp)
- Upgrade /enrichment of the basic geodataset (but without amendment of geometry or topology)
- Processing simple steps of analysis (like geoprocessing wizard)
- Creation of layouts combining different views of a problem and the findings (as tables, charts, maps, texts,...)

(Self-) Evaluation (1)

Main purpose of this step: The students have to

- quantify the workload of the program and they have to
- give **feed-back** about their work to each other.

Therefore the complete project has to be split up into 6 **distinct work packages**.

- (1) Effort of getting into the software (in most cases Arcview 3.x or Arcview 9.x); this step is supported by short introducing lessons, demos and tutorials.
- (2) Import of additional geodata, linking „MS Office - borne“ data to existing geometry and enrich existing tables
- (3) Design and composition of a thematically correct analysis and production of maps or map-like output.

(Self-) Evaluation (2)

- (4) Documentation of data and results in a way derived from the FGDC-standard guidelines.
- (5) Production of a 5 - 6 pages laboratory report describing the technical aspects of the project (or the problem solution).
- (6) Development and design of a teaching curriculum describing the content and explaining methods and media employed to set up the course in the classroom.

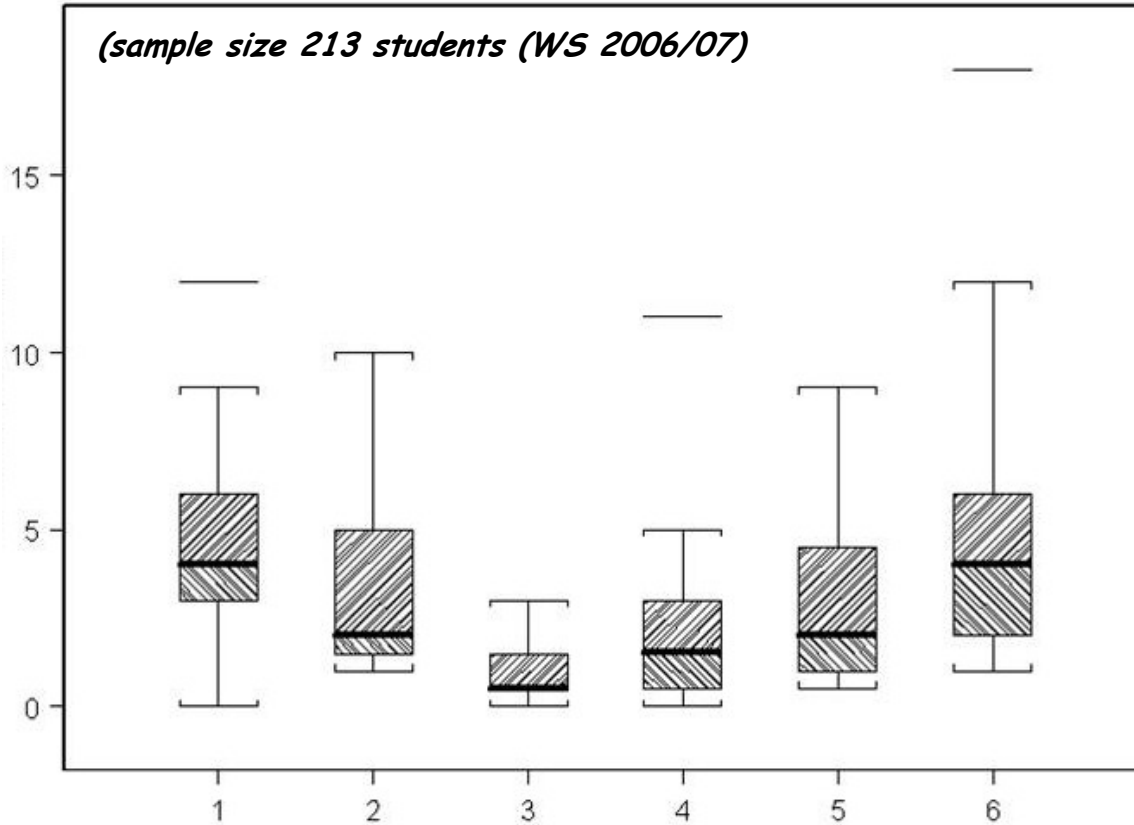
Last but not least the students have to reflect critically the potential use of GIS in different types of high schools.

(Self-) Evaluation (3) - Time expenditure (hrs)



(sample size 213 students (WS 2006/07))

Average time needed (in hours)



Work packages

Work packages

- 1 Introduction
- 2 Data preprocessing
- 3 Analyses & Visualization
- 4 Data documentation
- 5 Documentation of methods applied in project
- 6 Development of a teaching curriculum

Schedule (1)

Timespan	Content
1. week	<p>Kick-off-meeting; introduction into the concepts of the lesson (plenum)</p> <p>Discussion of distinct problems</p> <p>Outline of the program and definition of pre-requisites</p> <p>Proposal of a GIS project with given structure; key criteria:</p> <ul style="list-style-type: none">• Relevance to RLP• Taking into account the teaching of GIS• Relevance to geography• Tools and infrastructure needed for putting the concept into action

Schedule (2)

2. week	Presentation of preliminary results Discussion and suggestions for improvement Additional units (plenum): GIS Basics (with focus on projects of the individual groups)	max. 8 groups of students (with 2-3 persons)
3. week	Improvement of project proposals, re-working of the presentations In plenum: selected topics of data acquisition	max. 8 groups of students (with 2-3 persons)

Schedule (3)

4. week	<p>Introductional into ArcView 3.x or 9.x supported by tutorials, ppp's, demos, and guided tours</p> <p>In plenum: Fundamentals of GIS - analysis tools</p>	max. 8 groups of students (with 2-3 persons)
5. week	<p>Examples (different scenarios of GIS Analysis)</p> <p>Finishing and acceptance of the group's project proposals</p> <p>Definition of the project guidelines</p>	max. 8 groups of students (with 2-3 persons)

Schedule (4)

<p>6. week</p> <p>until</p> <p>1 week before end of semester</p>	<p>Work in progress</p> <p>Design and making of media for teaching (ppp's, pictures, posters, animations,...)</p> <p>Discussion of problems which had come up so far</p> <p>(feedback from the teacher)</p>	<p>max. 8 groups of students (with 2-3 persons)</p>
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Schedule (5)

<p>1 week before end of semester</p>	<p>Transmission of the completed projects including:</p> <ul style="list-style-type: none">• Scientific discussion of the project's topics (including references)• Discussion of relevance for high schools• Teaching curriculum• Supporting media (films, organigrams, PP-slides,...)• GIS-technical implementation plan• Layout/map/poster (presentation of the findings) <p>Exchange of the completed projects for evaluation by other groups.</p>	<p>max. 8 groups of students (with 2-3 persons)</p>
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Schedule (6)

<p>At the end of the semester</p>	<p>Discussion of the evaluation results from the other groups</p> <p>Justification of the remarks</p>	<p>Plenum</p>
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The strong points so far...

- The prospective high school teachers accept GIS as an interesting and valuable toolbox
- Even under sub - optimal circumstances it is possible to bring GIS knowledge to future geography teachers
- Integration of GIS in „regular“ high schools education is possible but the teachers will need sufficient help (especially suitable data, technical assistance,...).
- ...

The weak points so far...

- A huge amount of time might be necessary for...:
- understanding the basic concepts of GIS
- understanding the GIS Software
- Design of integrative/multidisciplinary projects with strong regional background
- Acquisition and pre-processing of spatially referenced data
- ...

Thesis 1

„More realistic conditions in education“

University scenarios are not good enough to simulate realistic high school teaching/learning environments. Additionally: It's a fact, that it will take a while before most of our recent students will enter the schools.

Thesis 2

„Better networking with active teachers“

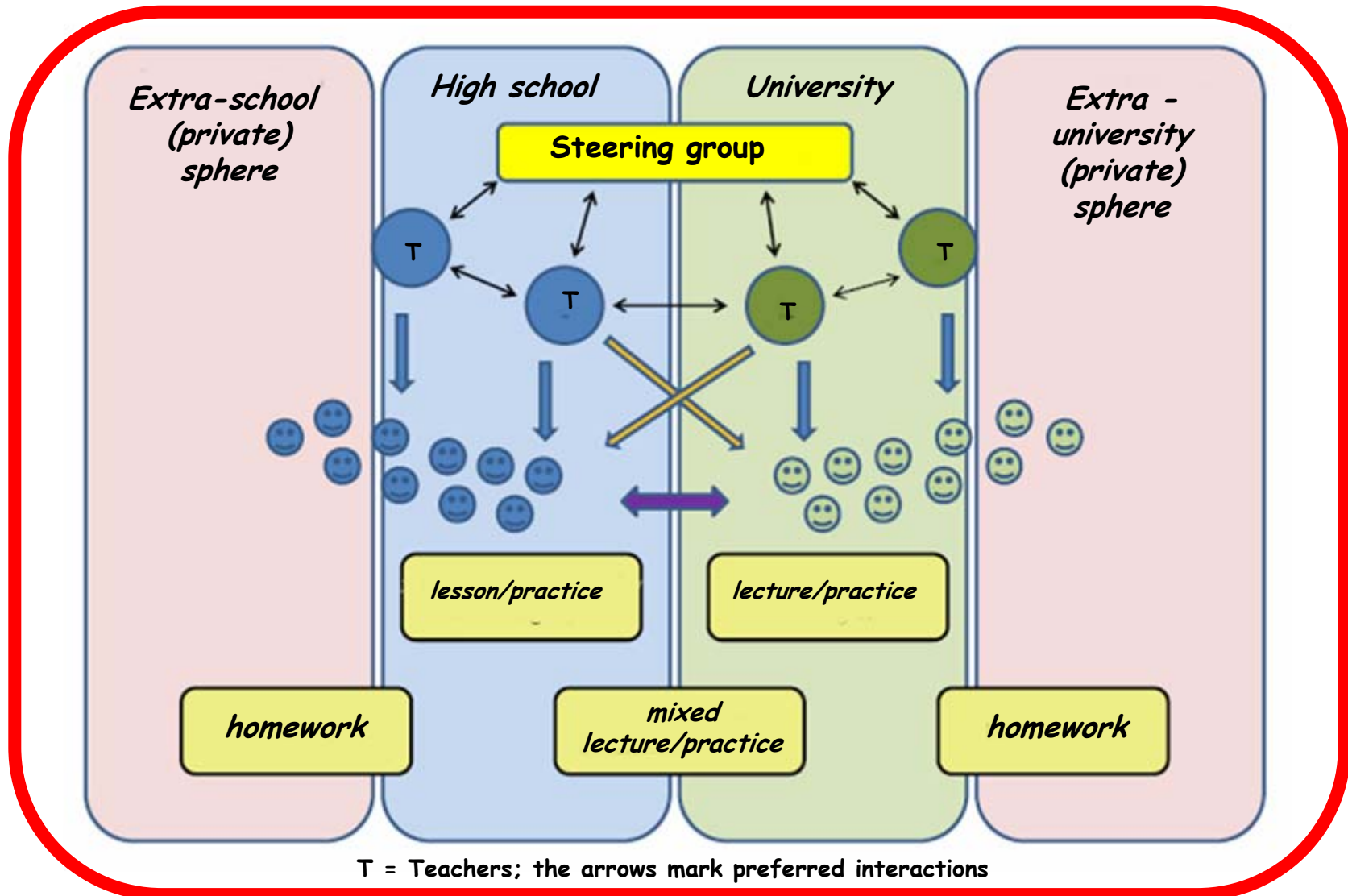
Until now, the concept of the curriculum only concerns University teachers and their students; but it is also a fact that many of the active high school teachers have resentiments against GIS in classrooms. (...GIS is expensive software; no time, no money for that,...)

Thesis 3

„ Better networking with high school students“

Until now there is a lack of „high school life“ in our course.

Maybe the Solution...



T = Teachers; the arrows mark preferred interactions

Medium term aims and criteria of success

- Compilation of a public domain regional data pool
established from
High schools/Students/Teachers and Universities
for
High schools/Students/Teachers and Universities.
- Compilation of a public domain regional metadata pool
- Compilation of a public domain collection of schoolbook compatible best-practice-examples

**Thank you
for
your
attention**

