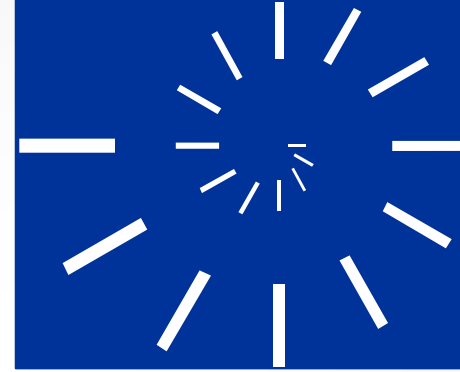
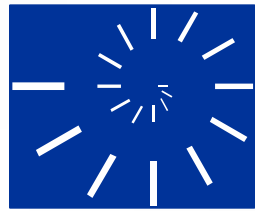


Prof. Dr. Astrid Beckmann,
University of Education Schwäbisch Gmünd, Germany



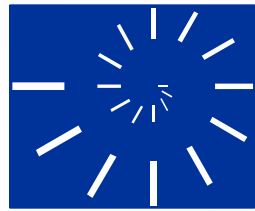
A Conceptual Framework for Cross-Curricular Teaching*

*According to the special issue of The Montana Mathematics Enthusiast
ISSN 1551-3440, www.math.umt.edu/TMME



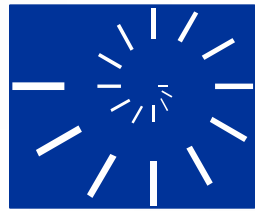
Programme

- Presentation *Astrid Beckmann*: The model
- Own work: Developing examples according to the cooperation forms
- Presentation *students* and discussion



Presentation

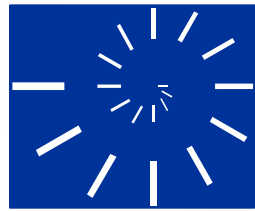
- Background and Arguments for Cross-curricular lessons
- A model / conceptional framework
including 4 cooperation-forms,
explained by examples



Modern European Curricula:

Demand for interdisciplinary lessons resp. Cross-curricular teaching!

Why?



Background:

Educational Progressivism (turn 19th/20th century): Learning should be human.

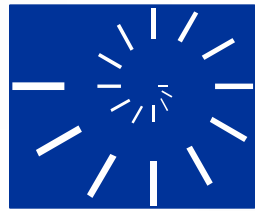
Humboldt's idea of general education: individuality, totality, universality

Herbart's „circle of ideas“:

Blankertz writes about Herbart's students:

„With their idea of concentrating teaching they wanted to avoid overcharging the curriculum through too many subjects, an attempt that led to some absurd concentrations:

... from the sea that Columbus crossed (history and geography) to the characteristics of water (physics and chemistry) and from there to Schiller's poem The Diver (literature):“



Arguments:

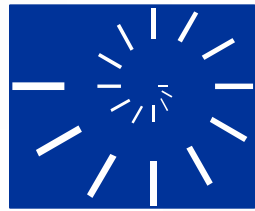
There are many arguments for cross-curricular teaching; Some:

Cross-Curricular Teaching can initiate Holistic Learning

„Learning with head, hart and hand“ (Pestalozzi´s famous triad)

= emotional learning and learning by doing as important components of humen development

Cross-curricular Teaching offers approaches for experience-, sense- and action-oriented learning and holistic teaching forms.



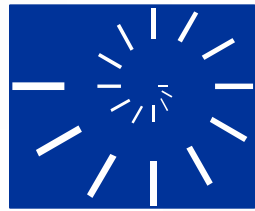
Cross-Curricular Teaching can initiate a New Way of Thinking

„Linked Learning“

Mainzer says:

„The multiply linked global problems of mankind do not only call for technical, scientific or sociological, philosophical knowledge, but more than ever for holistic thinking, that knows how to integrate the different subject perspectives.“

Cross-curricular Teaching offers multiplicity and links,
because it integrates methods, ways of thinking etc
of different subjects
and it allows the view onto the whole/
onto the phenomenon (Wagenschein).

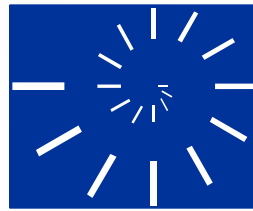


Cross-Curricular Teaching is an Aid in Integrating and Structuring Learning

Reality is holistic.

In order to unlock life's reality, subject elements have to be connected.

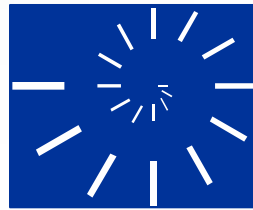
Cross-curricular Teaching offers the opportunity
to integrate and structure these separated learning experiences.



Arguments

Cross-curricular/ interdisciplinary teaching

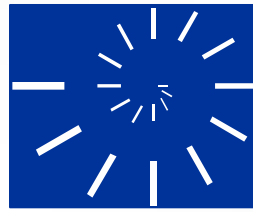
- as an opportunity for students' orientation,
- as a field for holistic learning,
- as a particular opportunity for motivation,
- as field for a new way of thinking,
- as an opportunity to reflect on subject-specific methods,
- as a "counterpart" to specialisation,
- as an (additional) opportunity for learning important basic mental techniques,
- as a field in which to experience the social reality of science,
- as an aid in integrating and structuring learning,
- as a field for the improved practice of general competencies,
- as an opportunity to develop ways to deal with heterogeneity,
- as a contribution to general education,
- as a special opportunity to deal with topical issues,
- as a special opportunity to disclose the importance of interdisciplinary
co-operation in the solution of problems,
- as an opportunity to solidify subject knowledge,
- as an opportunity to experience the particular importance of a given subject,
- as a special opportunity to tackle the problems of a particular subject.



A Model

First Definition:

Cross-curricular/ interdisciplinary teaching is instruction within a field in which subject boundaries are crossed and other subjects are integrated into the teaching (how and for whatever purpose or objective)

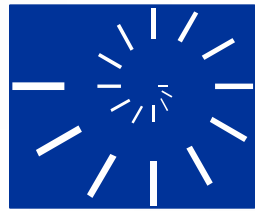


A Model

There are many forms of interdisciplinary teaching:

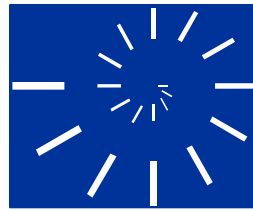
It could take place

- only for to show a short **example**,
- during a teaching **sequence** or a teaching **module**,
- in a **project**



It could concern to

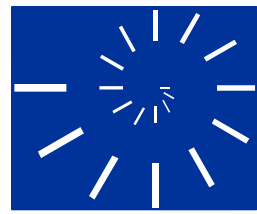
- a **subject's theme** which is enriched
by methods and contents of another subject
- a **common theme** of different subjects
- a theme which does not relate to a special subject



Interdisciplinary teaching is especially motivated by the alien-ness of the cooperating subjects. The combination of the **alien aspects** enrich the learning!

The alien aspects can be

- used
- integrated
- mixed.



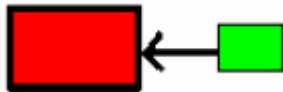
Cooperation Forms for Cross-Curricular Lessons

TM-Form

Topic and Major Subject-related Form

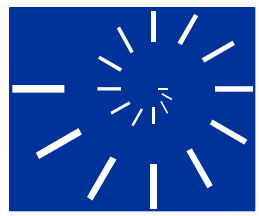
Characterisation:

Aspects (contents, methods...)
from another subject (physics, sports ...)
used in mathematics lessons.

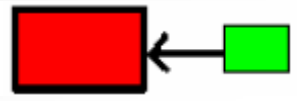


Organisation:

Initiative: mathematics teacher,
Communication with colleagues teaching scientific subjects,
Colleagues support mathematics teacher.



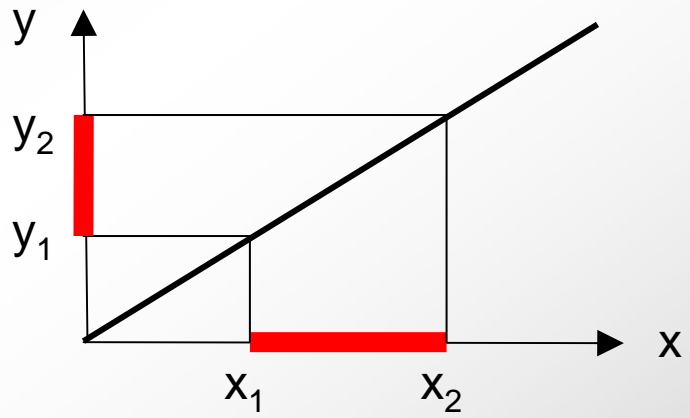
TM-Form: Topic and Major Subject-related Form

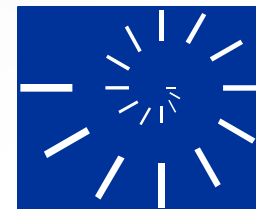


Subject: Mathematics
Topic: Concept of function

Learning the concept of function includes learning of all concept's aspects.

- Correspondence aspect
- Covariance aspect





TM-Form: Topic and Major Subject-related Form



Subject: Mathematics, Topic: Concept of function

Cooperation subject: Physics – Using physical experiments

Corresponding aspect: Aquisition of data

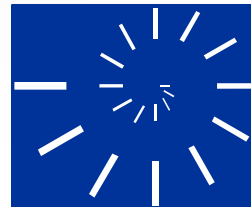


Dipping a ball
with a special radius

a concrete water volume
will be displaced.



Correspondence: radius – water volume



TM-Form: Topic and Major Subject-related Form



Subject: Mathematics, Topic: Concept of function

Cooperation subject: Physics – Using physical experiments

Covariation aspect

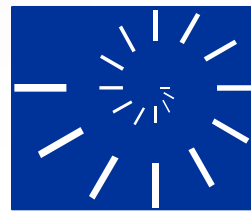


The time goes by and simultaneously we experience that the distance the car goes arises continuously.



Covariance: time – distance

→ Measurements, Graphs etc

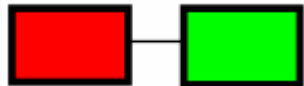


PT-Form

Parallel Topic - related Form

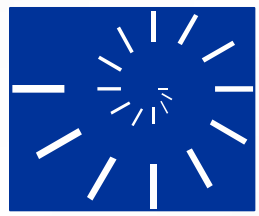
Characterisation:

					School year
Mathematics Aspects of the theme concerning mathematics learning	Physics Aspects of the theme concerning physics learning	Chemistry	Biology	Geography ↓

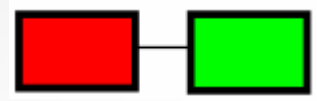


Organisation:

Initiative: one or more teachers,
 Communication and common planning
 of the school year or parts of it,
 Parallel teaching of the same theme and permanent exchange
 between the teachers during this period.



PT-Form: Parallel Topic - related Form



Mathematics

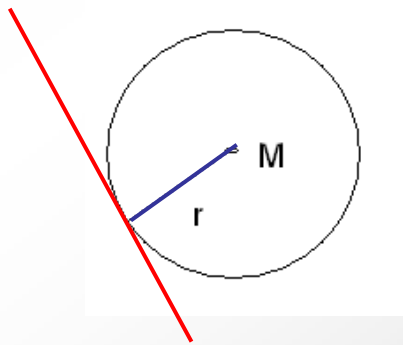
Physics

Circle

Circle Movement

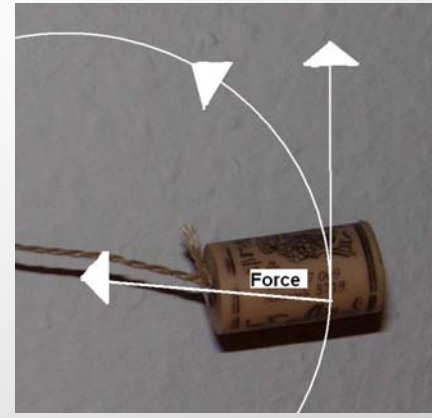
Theorem

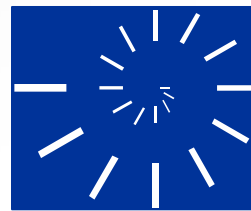
A **tangent** to a circle is at **right angles** to the radius of the circle at its point of contact.



Experiment

The force acts **right-angled** to the **direction of motion**.





PP-Form Parallel Planning Form

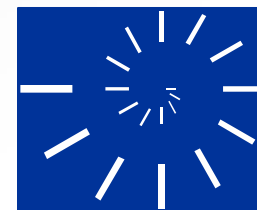
Charac- terisation:

				Possible example
Mathematics – physics – chemistry – biology Introduction – approaching the theme (in common)				
Mathematics Special aspect of the theme	Physics Special aspect of the theme	Chemistry Special aspect of the theme	Biology Special aspect of the theme	
Mathematics and Physics Mathematical modelling of the physical phenomena				
Mathematics – Biology Using mathematics argumentation in biology			Physics Deepening of the physical aspects	
Mathematics Deepening the mathematics aspects	Biology – Chemistry Discussing common aspects of the theme			
Mathematics – physics – chemistry – biology Results (in common) and summary				

Organisation:

Initiative: one or more teachers,
 Permanent communication and common planning
 before and during teaching the module,
 Partly: common teaching according to the needs of the theme.





PP-Form: Parallel Planning Form



Subjects: Mathematics and Sports

Teaching Sequence:

Sports:
Discussing
Long jump

Mathematics and Sports:
Discussing the optimal
Conditions for a very long jump,

Helpful: mathematising

Sports:
Long jump,
Measuring
angles and
height of the jump

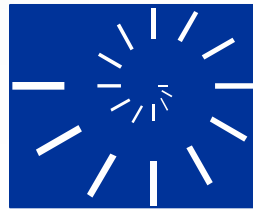
Mathematics:

Calculations
and graphs



www.sportpaedagogik-online.de

Mathematics and Sports: Evaluating and answering the questions:
Best: 45° and high velocity etc.



JP-Form Joint Planning Form

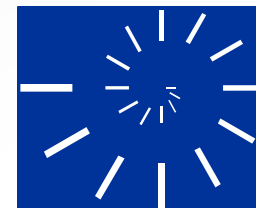


Characterisation and Organisation:

Initiative: one or more teachers,

Team teaching: **All subjects melt together to one subject!**

Possible: project-oriented teaching with subject-oriented project parts.



JP-Form: Joint Planning Form



Subjects: Mathematics and Biology

Teaching Sequence:

Task: Write down what you ate in one day (in grams).

Bread:.....
Vegetables:....
Fruit:..
Milk:.....
Meat:....



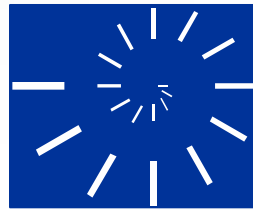
Nutrition Circle

Do my eating habits conform to this diet?

Transfer the information (*Task*) into a **pie chart!**

Compare with the diet

Draw a personal perfect Nutrition plan!



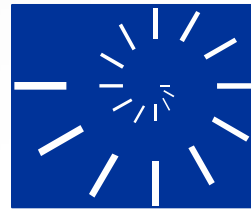
Second (detailed and summarising) Definition:

Cross-curricular teaching (TM, PT) and subject-integrative instruction (PP, JP) means dealing with a (subject-related or non related) topic, In which the subject borders are exceeded and other subjects are integrated.

The instruction is done in *co-operation*.
(cross-curricular or subject-integrated)

Exceeding subject borders results in *contact* (use, integrate, mix) with other subjects.

The interest lies in an *enrichment* of learning in each of the subjects.



Now: Your Task

1. Get aware with the material.
2. Develop different interdisciplinary teaching sequences/modules
 - according to suitable cooperation forms.

Especially answer the questions:

- Which subjects (could) cooperate?
- Which part does each specific subject play?
- Which topics are concerned? And in how far?
- Are there advantages for the specific learning?
- Which of the arguments for cross-curricular teaching fit to the sequence?

3. Present your ideas/ the sequences in the group.