Research Design for Educational Technologists

(1/4/05)

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Originals: http://tecfa.unige.ch/guides/methodo/edu-tech/

Description:

- This is a "crash course" on Research Design and Research Methodology.
- Some practical issues for the making of a Master thesis are also addressed.
- Target audience are Master Students in Educational Technology from various backgrounds.

This is just teaching materials for class-room teaching

- You may use it for self-study (but it is not meant for it)
- To project in full-screen mode, load into Acrobat outside your Web browser (!) and hit ctrl-l
- Students should do exercises or at least work on their own research design in stages

Objectives:

- Know about fundamental principles of an academic project
- Be familiar with three major classes of research designs: (1) Theory-testing approaches, (2) Qualitative and new theory-creating research, (3) Design-science research.
- Be aware of the fundamental elements of a Research Design: (1) Definition of a subject, (2) Research Goals and Questions, (3) Short Literature Review and selection of theoretical and conceptual frameworks, (4) Approach and Methodology: Operational Research Questions, Analysis frameworks and methodological techniques.
- Master the basics of a few selected research methodologies, e.g. data gathering, sampling, simple quantitative and qualitative data analysis.
- Deliverable: A draft project for your master thesis

Disclaimer

- This is a first round (several parts need corrections, modifications, expansions)

Copyright notice:

Contents

What is an academic piece of work ?

(version 1.0, 1/4/05)

Code: intro-research

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Menu

1. A first look at research

1.1 Research = ask a question and answer

Ask a question

define the boundaries
work out details

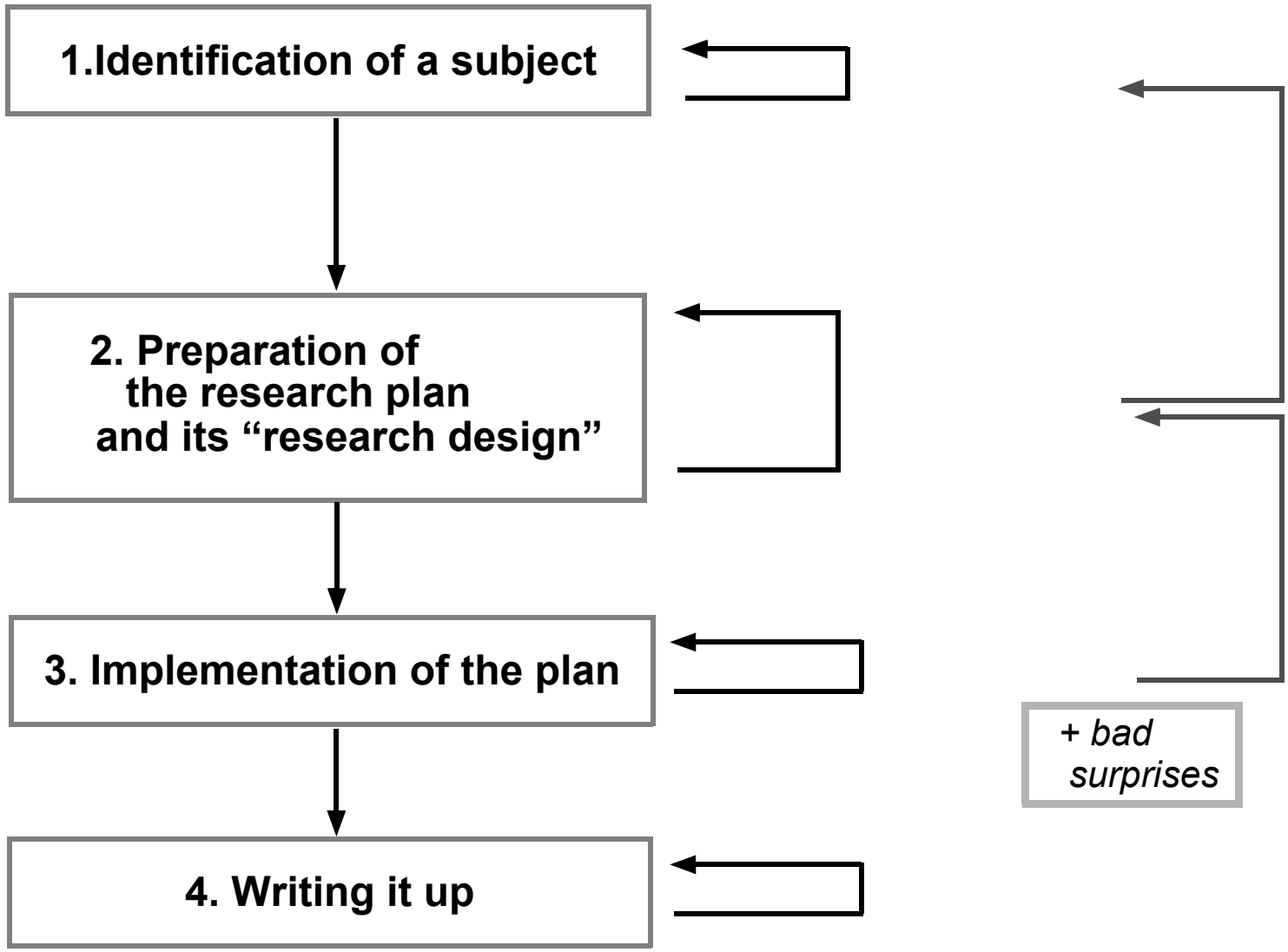
Dig

use clear concepts and definitions
use the appropriate tools
compare with existing knowledge

Answer

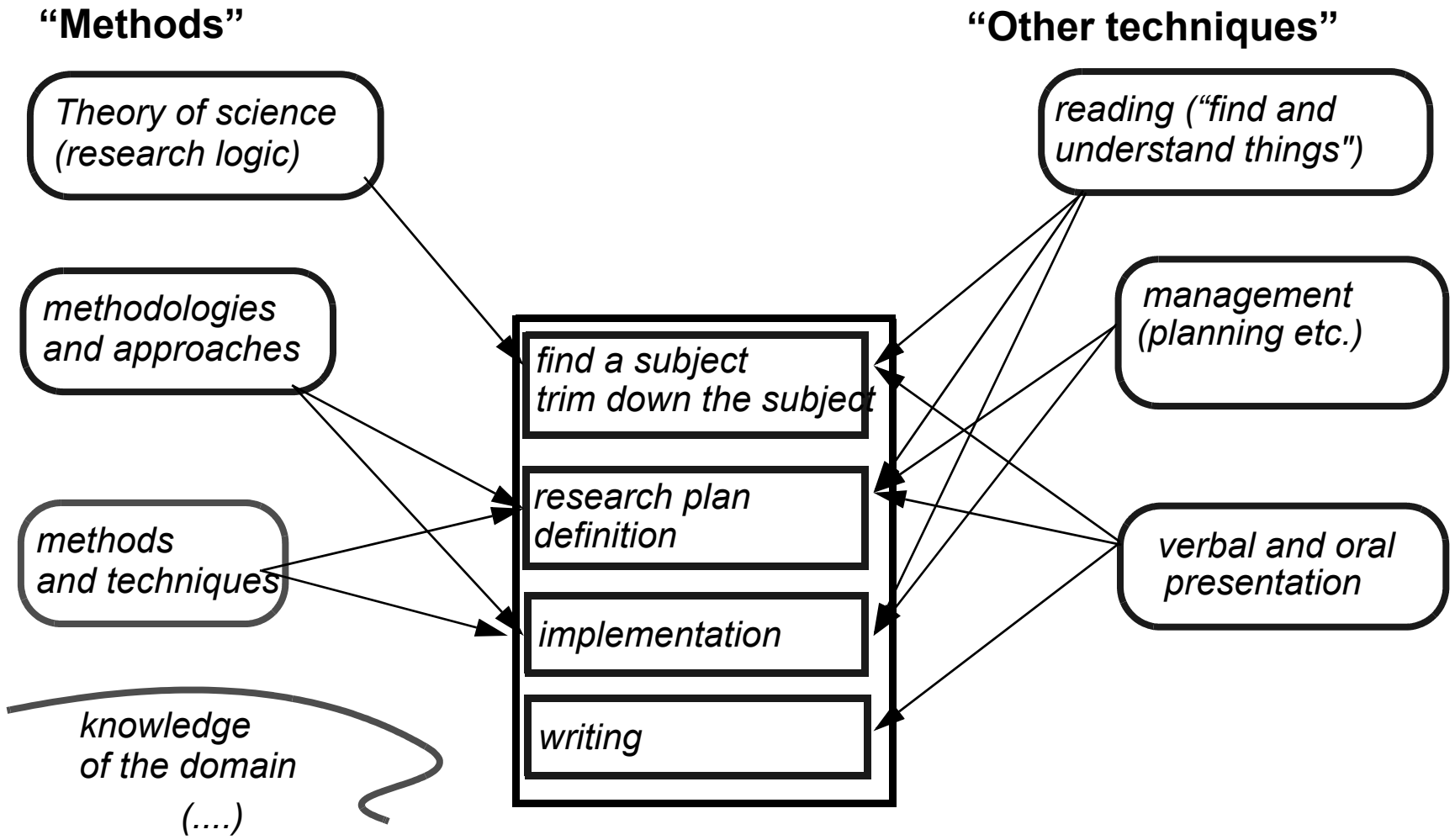
with a clearly structured text (argumentation)

1.2 Major stages of a research project

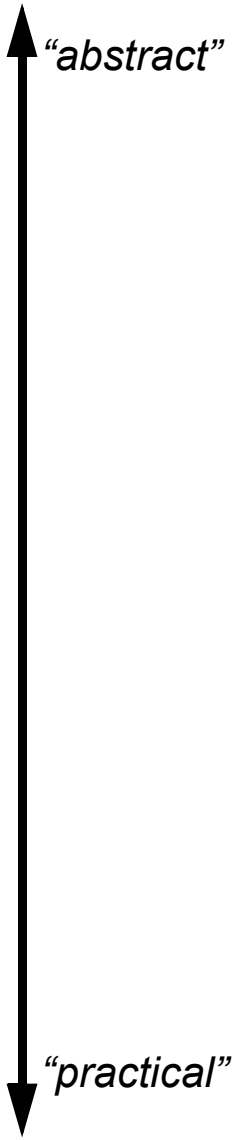


2. Organization of the course

2.1 What do you need to know ?



2.2 Objectives of the course



Academic research

.... some understanding of what it means

Research Methodology

.... some basic principles (e.g. validity)

.... some quantitative and qualitative methods

Research design

.... make a research plan

.... know how to operationalize your research questions

Techniques

.... find ideas, write, plan, etc.

.... some quantitative and qualitative data gathering and analysis techniques

3. The concept of "science"

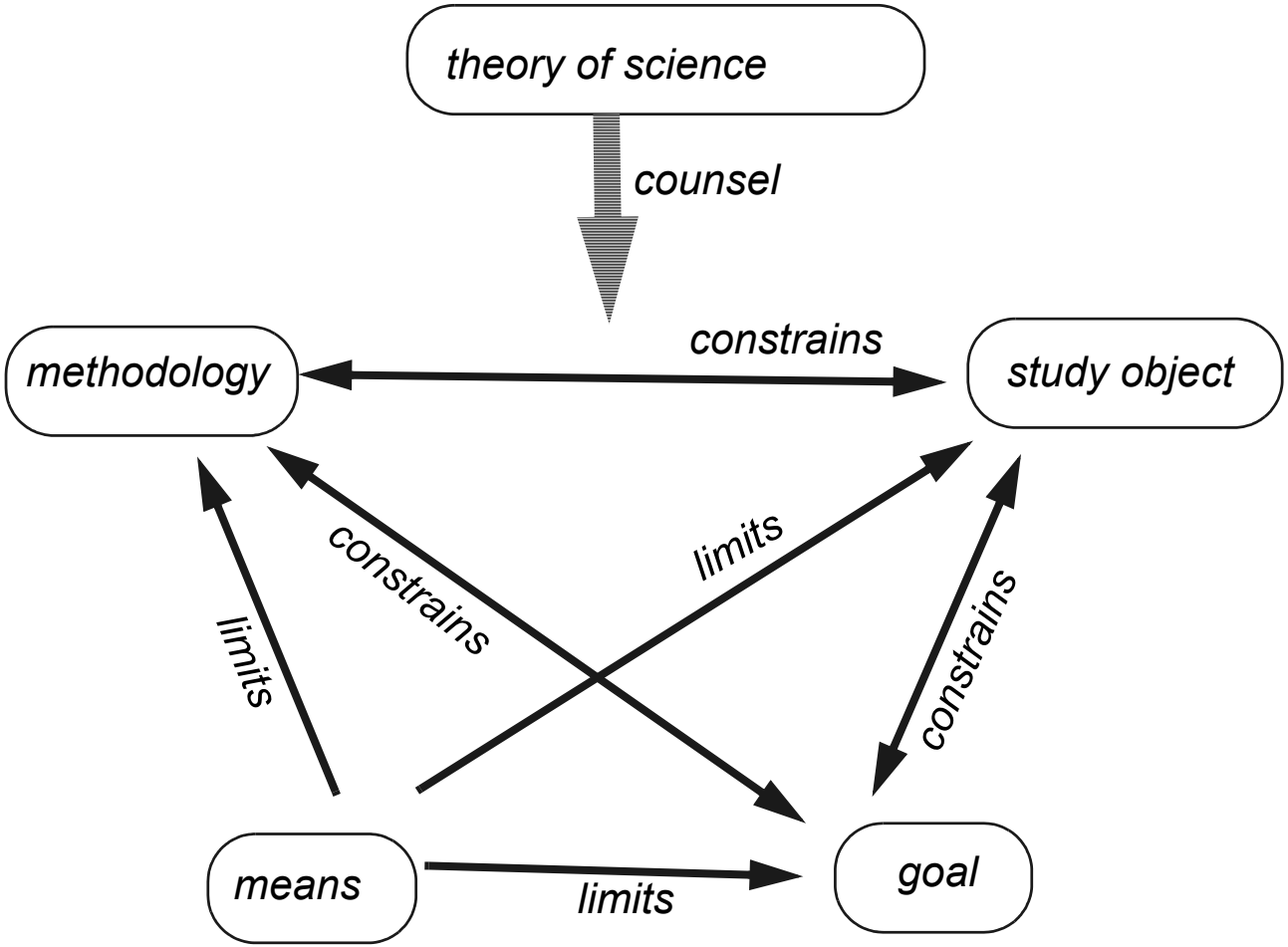
Why bother ??

- to understand how to write a research plan
- to understand your academic partners (e.g. your thesis advisors)
- to find out why they don't like your initial research subject ...

3.1 Which elements define a given piece of research ?

1. ***Theory of science:***
   - what is knowledge ? academic knowledge ?
   - how should you reason ? deduce ? induce ? model ?
2. The ***methodology***:
   - should fit your research subject
   - ..... legitimated by some theory of science.
3. The ***research object***
   - you need to define exactly what you want to study
4. The ***research goal***s
   - what's the purpose of your study?
5. Your ***means***
   - time, money,
   - knowledge,
   - data access

An equilibrium between methods, object, goals and means:



What does this figure tell ?

- In educational technology research, there rarely is a ready solution for your problem !
- There are suggestions (freedom to choose) as well as interdictions (things not to do)
- In other words: You will have to come up with your own research design and its justification !

3.2 What do we mean by academic empirical research (science)?

1. A ***systematic activity***
   - produced knowledge is a ***coherent whole***
   - it (your results) should integrate with a ***system of knowledge*** (build upon literature and compare with literature)
2. centred on ***reality***
   - e.g. nature, la society, people's behavior, people's attitudes
   - in other words: ***don't just speculate, look at things***
3. precise ***tools*** (hypothesis, theories, methods, reliable techniques etc.)
   - be aware of your "confirmation biais", test your conclusions against alternative explanations,
4. ***generalization***
   - contribute to theories by using (and testing) their theoretical statements
   - reuse (and criticize) their instruments (frameworks, analysis grids, etc.)
   - suggest modifications (or even new theories)

in addition:

5. a belief in determinism,
   - phenomenons are the necessary ***consequence*** of conditions (causes).
   - In other words: randomness in explanation is only due to ignorance, complexity, etc.
6. relativism:
   - our knowledge is not ***perfect,***
   - .... in particular in social sciences where man is subject and object, observer and observed and where many variables influence a phenomenon

3.3 What's an interesting piece of research ?

☞ You will have to produce something that is (somewhat) new

- answer ***new questions***
- answer ***old questions without good answers***
- answer ***otherwise*** to questions addressed by the literature
- provide support to ***answers*** found in literature with a new argumentation
- apply a theory to a ***new types of cases*** (e.g. does it apply to Mauritius school system ?)

☞ It produces something that provides "satisfaction"

- to a certain ***community***
  (you don't write your thesis for yourself !).
- to you !

4. The role of method and theory

4.1 Epistemological dimensions of research

☞**Theories of science**

- Sets from a ***philosophical perspective*** the ***conditions of scientific knowledge***
- example: "you can't prove a hypothesis" (only evidence, show that alternatives are wrong,...)

☞**Methodologies (also called approaches)**

- ***general recommendations on how you should design a research plan***.
- draws from a theory of science and suggests a set of legitimate methods.
- example "you should draw hypothesis from theory and then test it with quantitative research"

☞**Methods**

- ***general*** recipes to study a given class of phenomenons
- examples: "survey research methodology", "participatory software design"

☞**Reasoning Methods**

- how to pass from data to theory and from theory to data ?
- .... (influenced by theories of science and doctrine of approaches)

☞**Techniques**

- ***practical tools*** to gather, manipulate, analyze data, manipulate concepts, etc.

4.2 The range of theories

☞"big theories"

- go after complex topics (can't fully be tested)
- .... evolution of children's minds, learning, society, ...

☞Theories with limited scope

- concern more restricted domains
- examples: usability guidelines for software, conditions under which multimedia animations are effective, conditions under which e-learning projects can be sustainably implemented, ...

☞Formal models

- based on formal systems, e.g. mathematics, logics, rule systems, formal learning designs
- sometimes tested with empirical data (not always, e.g. micro-economics is not).

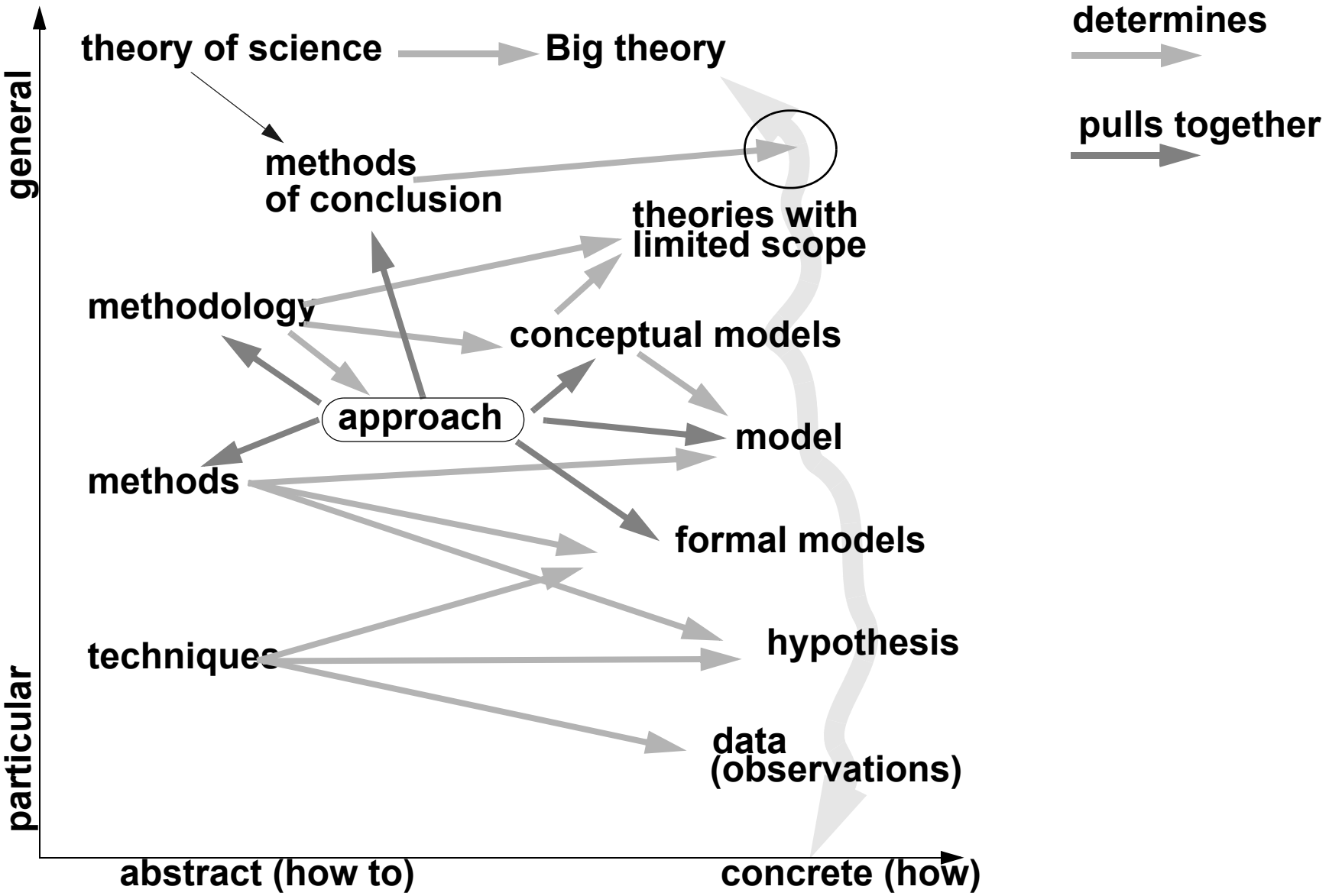
☞Conceptual models

- e.g. "systems analysis", activity theory
- .... conceptual tools that allow you to talk about a phenomenon, to look at them in a certain way

☞Hypothesis

- Are frequently part of a theory or a formal model
- Clear propositions that can be tested
- e.g. "to introduce technology in schools, you need to provide a pedagogical support structure"

4.3 Everything together: components of knowledge



4.4 The paradigm concept

- Origin: Kuhn and his studies on “normal science”

Major components of a paradigm:

1. a general and “asymptotic” ***research goal***
   - ex: “understand how to teach (instructional design)”.
   - At this level you will find general ideas at what you should look at.
2. Intermediate level: ***partial theories***.
   - Par ex: to teach sustainable knowledge, one must engage students in practise and gradually introduce authentic problems that must be solved by themselves
3. Operational level: Empirically ***tested theories***.
   - Par ex: how to teach procedural programming, drive a car, solve a simple geometry problem.
4. Each paradigm favors certain ***methodologies*** and provides you with "toolkits"

Why follow a paradigm ?


your are much ***more productive*** if you can count on confirmed research methodology


different researchers can ***work together***, or at least profit from each other’s results

what happens if you don’t ??


people will not understand you andt herefore ignore you if you don’t use accepted methodology or problems


your results are not comparable

4.5 The approach

There are in fact 2 different definitions

☞ **"approach" +/- = general "methodology"**

- a "***way to do it***"
- includes ***a set of useful and tested methods*** for studying a set of phenomena
  e.g. the you could use the quasi-experimental design to study school reforms
- **an approach is often transdisciplinary:**
  example: the quasi-experimental approach was developed in educational science but has been exported to public policy analysis and many other domains

☞ **"*approach" = "paradigm*".**

- for example: "activity theory approach" to say
  - you believe in a marxist activity-based scheme of looking at social phenomena
  - you may adopt Engeström's related educational theories
  - you favor qualitative methodology
  - you are interested in change

4.6 A word on interdisciplinarity

- combinations of approaches or paradigms

3 variants:

☞ multi-disciplinary:

- juxtaposition on the same object of various research paradigms, each one keeping its own language

☞ Interdisciplinarity:

- confrontation and exchange of methods and/or adoption of a mix from various fields for a new field

☞ Trans-disciplinary:

- usually a high abstraction level, e.g. systems theory

Difficulties

☜ multi-disciplinary research is difficult to coordinate.

- needs wide knowledge and very good communication skills to talk to people using another “languages”

☜ Interdisciplinary research is easier

- ..... because only methods and concepts that fit are taken from other fields,
- however, concerned scientific communities may hate you for that
- takes ***more time*** than disciplinary research (e.g. doing a "complete" educational technology thesis that involves pedagogy, psychology, sociology and ICT development takes more than doing a thesis in just one of these areas).

5. Types of research

5.1 Classification according to theory level

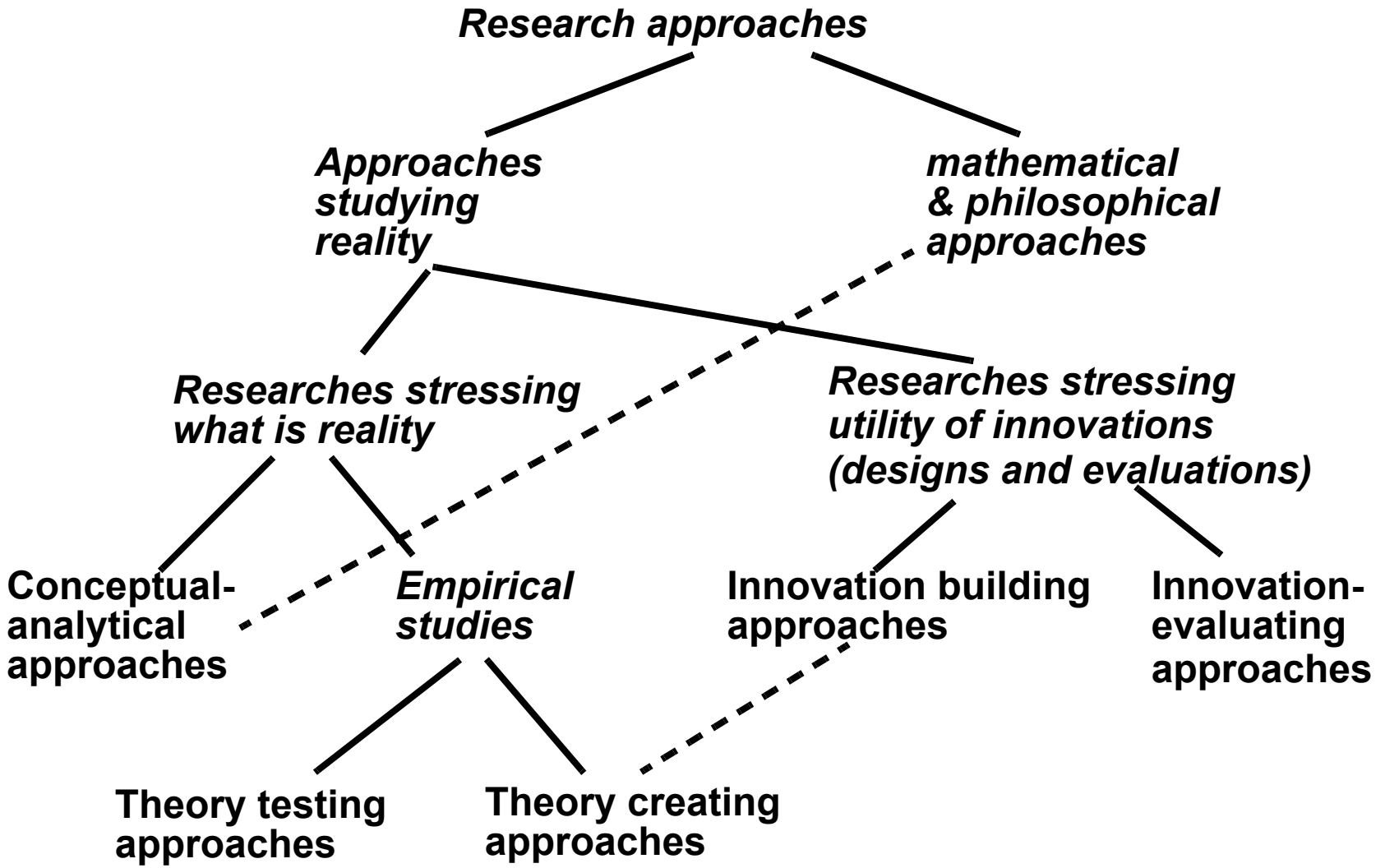
1. Simple ***description:***
   - forget it, it doesn't have much academic value (unless it is led to prepare further research)
2. ***Classifications and categorizations***: put order in concepts or data:
   - The intelligent case study (exploratory research)
   - Typologies (identify characteristics of classes of cases, e.g. uses of technology in schools, types of teachers according to their beliefs in pedagogy, use of ICT, use of new pedagogies, etc.)
   - Ideal-types (theory-based identification of classes of cases)
   - The systems model (shows interactions between elements)
   - ....
3. Research where ***theory*** plays important role:
   - Theory ***attempts generalization*** and demonstrates ***regularities***.
   - Theory tries to ***understand*** or to ***explain*** or to ***predict***.

Research should aspire to level III

5.2 Scientific ends (modified from Marshall & Rossmann 95: 41)

Finalities	Typical questions	Approaches	Methods
exploratory • study of new phenomenons • preparation of another research	What happens in this program ? How does this organization work ?	• case study • field study	• participatory observation • in-depth interviews • information interviews
explanatory • explain the forces that constitute a phenomenon	Which events, behaviors, beliefs result in this phenomenon ?	• comparative case study • historical study • field study • ethnography	• (like above) • questionnaires • document analysis • field observations
descriptive/comprehen. • documentation of a phenomenon • comprehension	What are the events, structures, processes that constitute this phenomenon ?	• field study • case study • ethnography	• (like above) • non-intrusive measures • task observations
predictive • global predictions • predictions of events, behaviors etc.	What's the result of X? How does X influence Y ?	• experiment • quasi-experiment • statistical • simulation	• questionnaires • quantitative content analysis • quantitative obs.
engineering • delivered product • delivered technical rule • test of a technical rule	What's the problem ? How to build something ? Does it work ? What are its effects ?	• designs (with user, usability studies) • most approaches above before and after engineering	• application of design rules (technical rule) • rather qualitative • most methods above

5.3 Typology inspired by Järvinen (2004: 10)



modified par DKS

5.4 A simple typology at the end

Explanatory (theory-testing)	→	**“test/ elaborate hypothesis” “explain by laws/theories” “predict with laws”**
Comprehensive (theory-creation)	→	**“put forward mechanisms “describe & explorer” “propose theories”**
Design	→	**“analyze a problem, present a solution and prove it” “engineering” "create / test" a design rule"**

- you may combine ...

Fundamental empirical research principles

(version 1.0, 1/4/05)

Code: intro-methods

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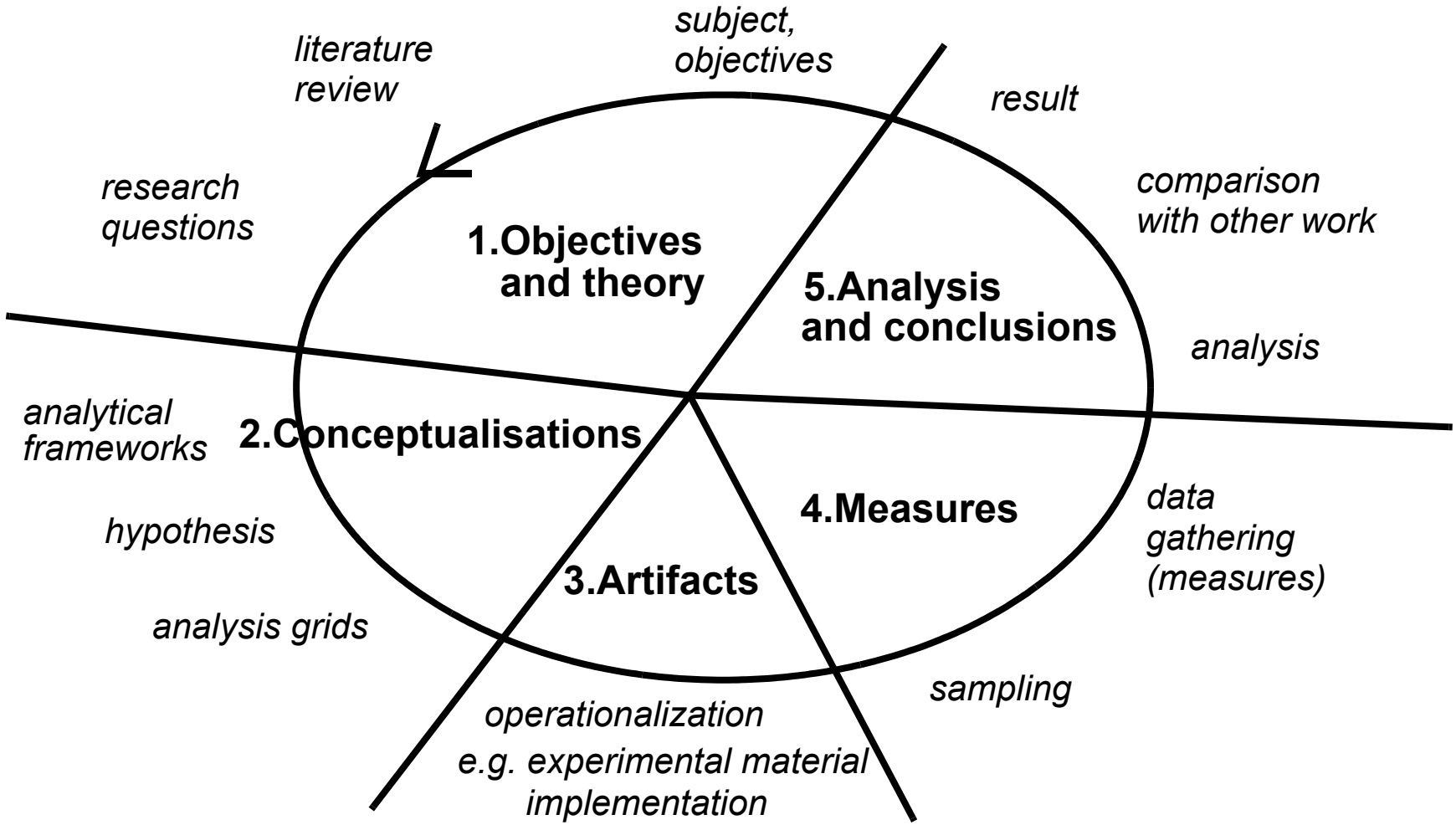
Menu

1. The logic of empirical research

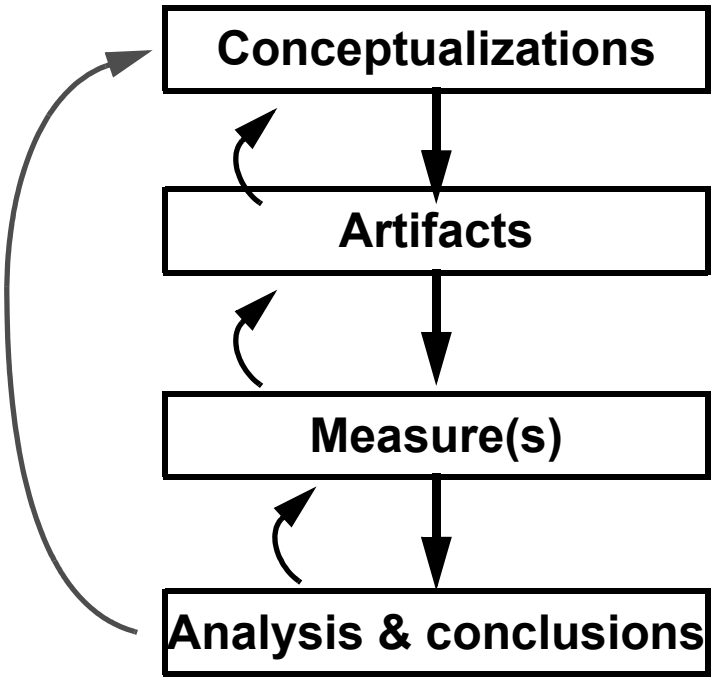
1.1 Elements of a typical research cycle

- Details may considerably change within a given approach



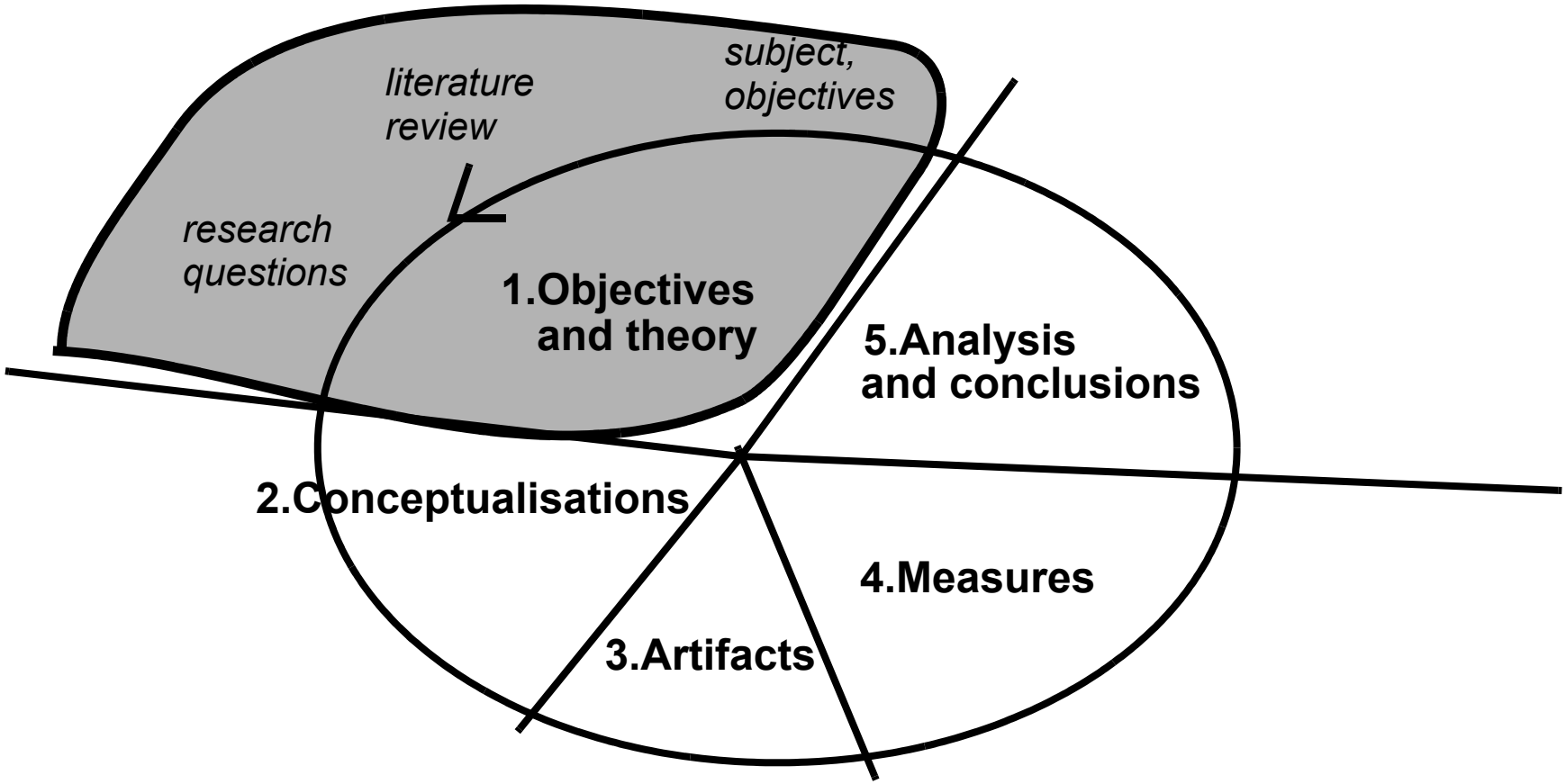
1.2 Key elements of empirical research

For a given research question, you usually do:



- ***Conceptualisations***: make questions explicit, identify major concepts (variables), define terms and their dimensions, find analysis grids, define hypothesis, etc,
- ***Artifacts***: develop research materials (experiments, surveys), implement software, etc.
- ***Measures***: Observe (measure) in the field or through experiments (use your artifacts)
- ***Analyses & conclusion***: Analyze the measures (statistic or qualitative) and link to theoretical statements (e.g. operational research questions and hypothesis)

2. Objectives



Research questions are the result of:

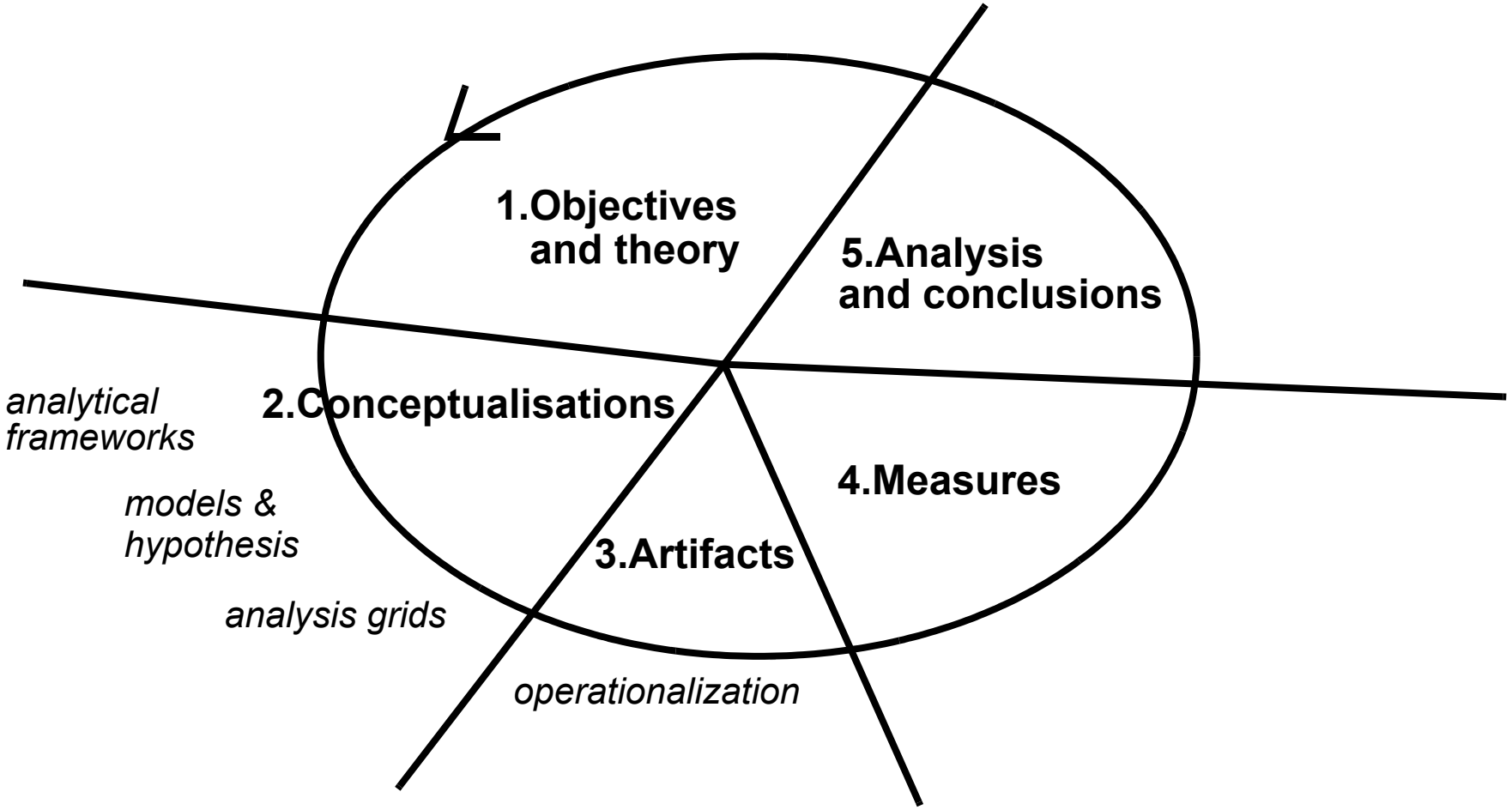
- your initial objectives (which you may have to revise)
- a (first) review of the literature

Everything you plan to do, must be formulated as a research question !

- See slides on "Finding a research subject"

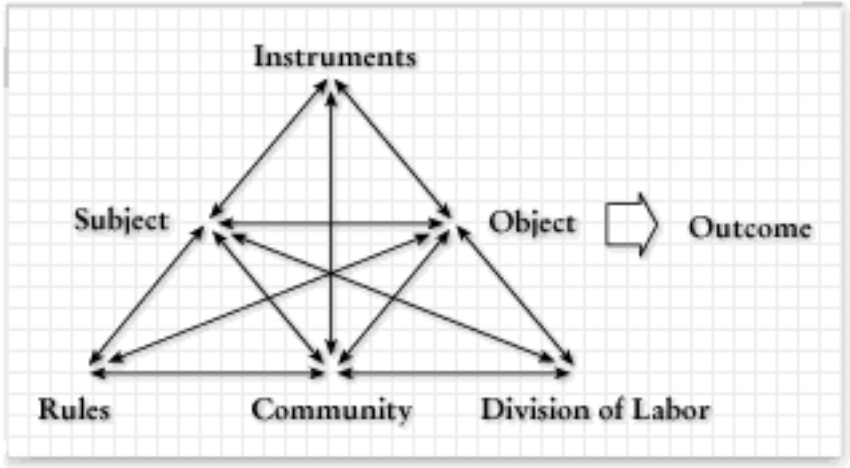
3. Conceptualizations

- elaborate and "massage" concepts so that they can be used to study observable phenomena



3.1 The usefulness of analysis frameworks

E.g. activity theory



Quote: The Activity Triangle Model or activity system representationally ***outlines the various components*** of an activity system into a unified whole. ***Participants in an activity are portrayed as subjects interacting with objects to achieve desired outcomes***. In the meanwhile, human interactions with each other and with objects of the environment are ***mediated through the use of tools, rules and division of labour.*** Mediators represent the nature of relationships that exist within and between participants of an activity in a given community of practices. This approach to modelling various aspects of human activity draws the researcher s attention to factors to consider when developing a learning system. However, activity theory does not include a theory of learning, (Daisy Mwanza & Yrjö Engeström)

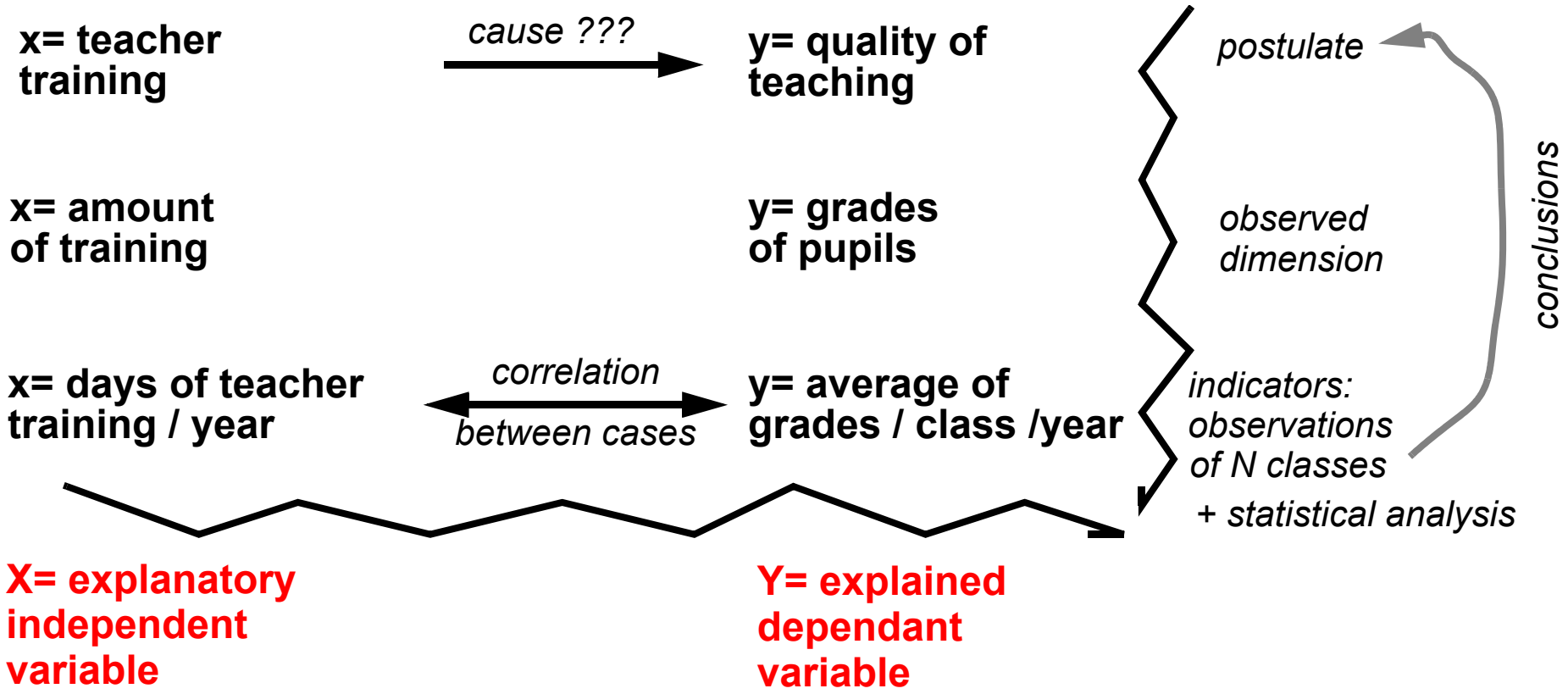
- Translation: Il helps us thinking about a phenomenon to study.
- A framework is not true or false, just ***useful or useless*** for a given intellectual task !

3.2 Models and hypothesis

- These constructions link concepts and ***postulate causalities***
- causalities between concepts (theoretical variables) do not "exist" per se, they only ***can be observed indirectly***
- Typical statements: "More X leads to more Y", "an increase in X leads to a decrease in Y

Exemple 3-1: Causality between teacher training and quality

Hypothesis (often heard): Continuous teacher training (***cause* X**) improves teaching (**Y**)



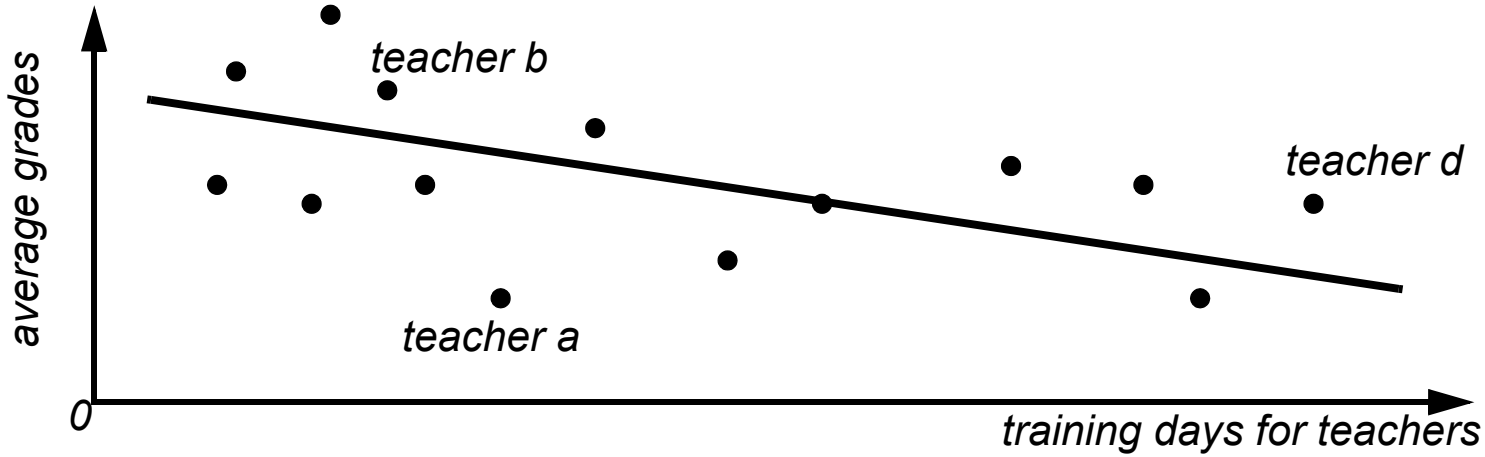
3.3 The importance of difference (variance) for explanations

Without variance, no differences .... no explanatory science

we'd like to know why things exist, why we can observe "more" and "less" ....

Without co-variance, no correlations / causalities ... no explanation

A. Quantitative example:



- We got different grade averages and different training days
  - therefore variance for both variables
- According to these data: increased training days lead to lower averages
  - (consider this hypothetical example false please !)

B. Qualitative example

Imagine that we wish to know why certain private schools introduce technology faster than others. One hypothesis to test could be: "Reforms need external pressure".

	Strategies of a school			
Type of pressure	strategy 1: no reaction	strategy 2: a task force is created	strategy 3: internal training programs are created	strategy 4: resources are reallocated
Letters written by parents	(N=4) ***(p=0.8)***	(N=1) ***(p=0.2)***		
Letters written by supervisory boards		(N=2) ***(p=0.4)***	(N=3) ***(p=0.6)***	
newspaper articles				(N=1) ***(p=100%)***

N = number of observations, p = probability

- Result (imaginary): increased pressure leads to increased action

3.4 How can we measure general concepts ?

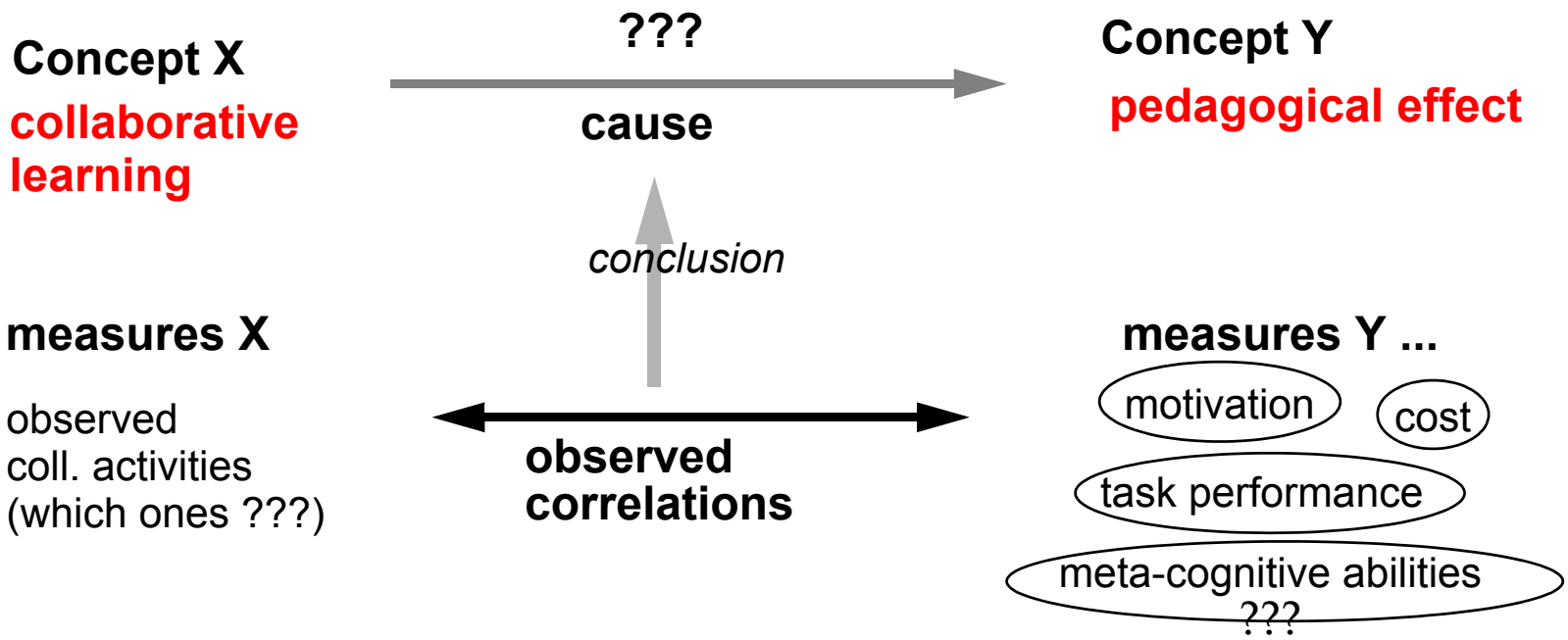
☞ **A scientific proposition contains concepts (theoretical variables)**

- Examples: “the learner”, “performance”, “efficiency”, “interactivity”

☞ **An academic piece links concepts**

- ... empirical research requires that you work with data, find indicators, build indices, ..
- because of observed correlations we can make statements at the theory level

Exemple 3-2: “Collaborative learning improves pedagogical effect”:



- We got a real problem here ! How could we measure "pedagogical effect" or "collaborative learning" ?

A. The bridge/gap between theoretical concept and measure:

- There are 2 issues you must address:

(1) Going from "*abstract" to "concrete*" (theoretical concept - observables)

Examples:

- measure of "student participation" with "number of forum messages posted"
- measure of "pedagogical success" with "grade average of a class in exams"

(2) "*whole - part*" (dimensions):

Examples from educational design, i.e. dimensions you might consider when you plan to measure the socio-constructiveness of some teaching:

- Decomposition of "socio-constructivist design" in (1) active or constructive learning, (2) self-directed learning, (3) contextual learning and (4) collaborative learning, (5) teacher's interpersonal behavior (Dolmans et. al)
- The Five Es socio-constructivist teaching model: Engagement, Exploration, Explanation, Elaboration and Evaluation (Boddy & al)

Example from public policy analysis:

- Decomposition de "economic development" in industrialization, urbanization, transports, communications and education.

Example from HCI:

- Decomposition of usability in "cognitive usability" (what you can achieve with the software) and "simple usability" (can you navigate, find buttons, etc.)

Exemple 3-3: COLLES Constructivist On-Line Learning Environment Survey (Taylor and Maor)

Dimensions (from teacher education over the Internet survey studies survey):

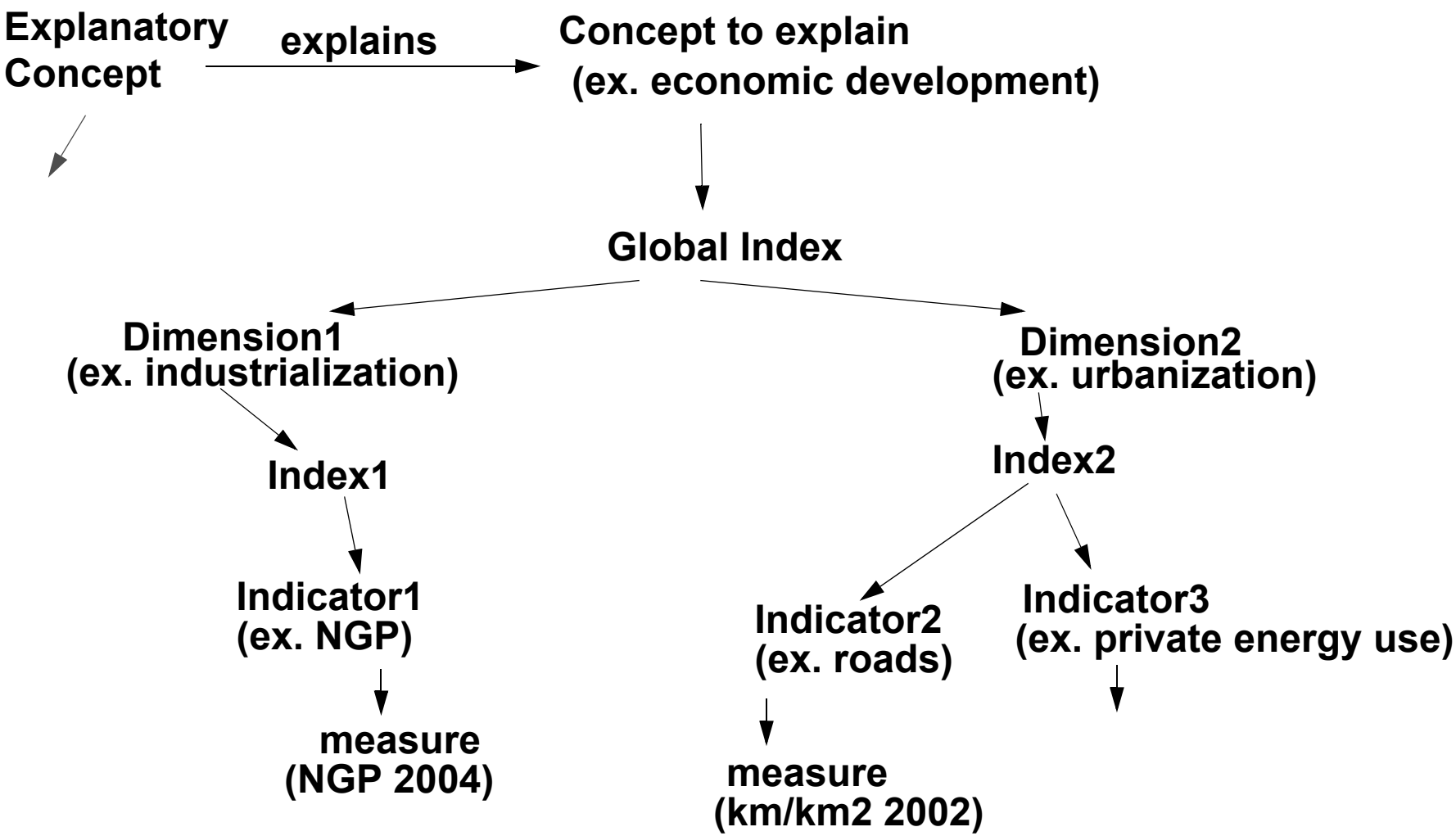
- ***Relevance*** How relevant is on-line learning to students' professional practices?
- ***Reflection*** Does on-line learning stimulate students' critical reflective thinking?
- Interactivity To what extent do students engage on-line in rich educative dialogue?
- Tutor Support How well do tutors enable students to participate in on-line learning?
- Peer Support Is sensitive and encouraging support provided on-line by fellow students?
- Interpretation Do students and tutors make good sense of each other's on-line communications?

Each of these dimensions is then measured with a few survey questions (items), e.g.:

Statements	Almost Never	Seldom	Some-times	Often	Almost Always
Items concerning relevance					
my learning focuses on issues that interest me.	O	O	O	O	O
what I learn is important for my professional practice as a trainer.	O	O	O	O	O
I learn how to improve my professional practice as a trainer.	O	O	O	O	O
what I learn connects well with my prof. practice as a trainer.	O	O	O	O	O
Items concerning reflection					
… I think critically about how I learn.	O	O	O	O	O
… I think critically about my own ideas.	O	O	O	O	O
… I think critically about other students' ideas.	O	O	O	O	O
… I think critically about ideas in the readings.	O	O	O	O	O

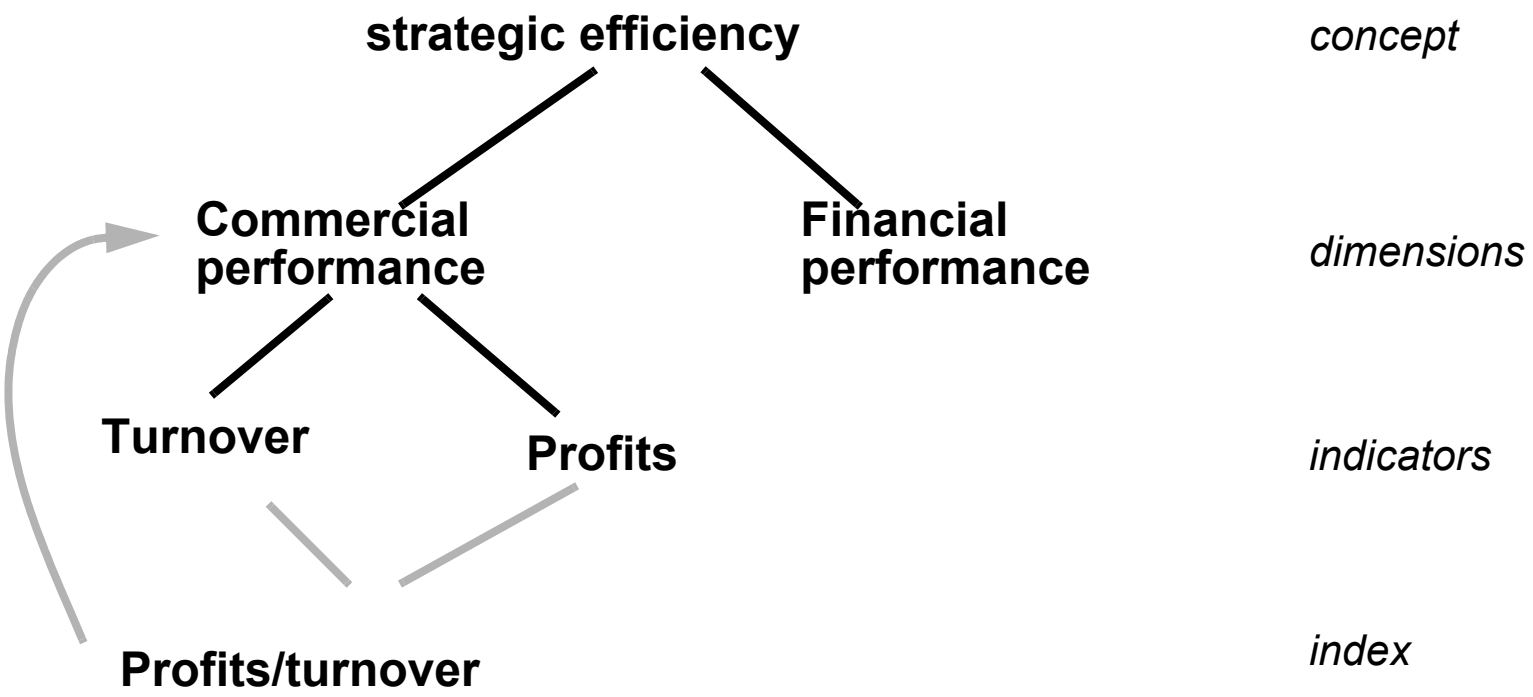
Exemple 3-4: measure of economic development

- usage of official statistics
- (only part of the diagram is shown)



Exemple 3-5: measure of the strategic efficiency of a private distance teaching agency

- example taken from a french methodology text book (Thiétard, 1999)

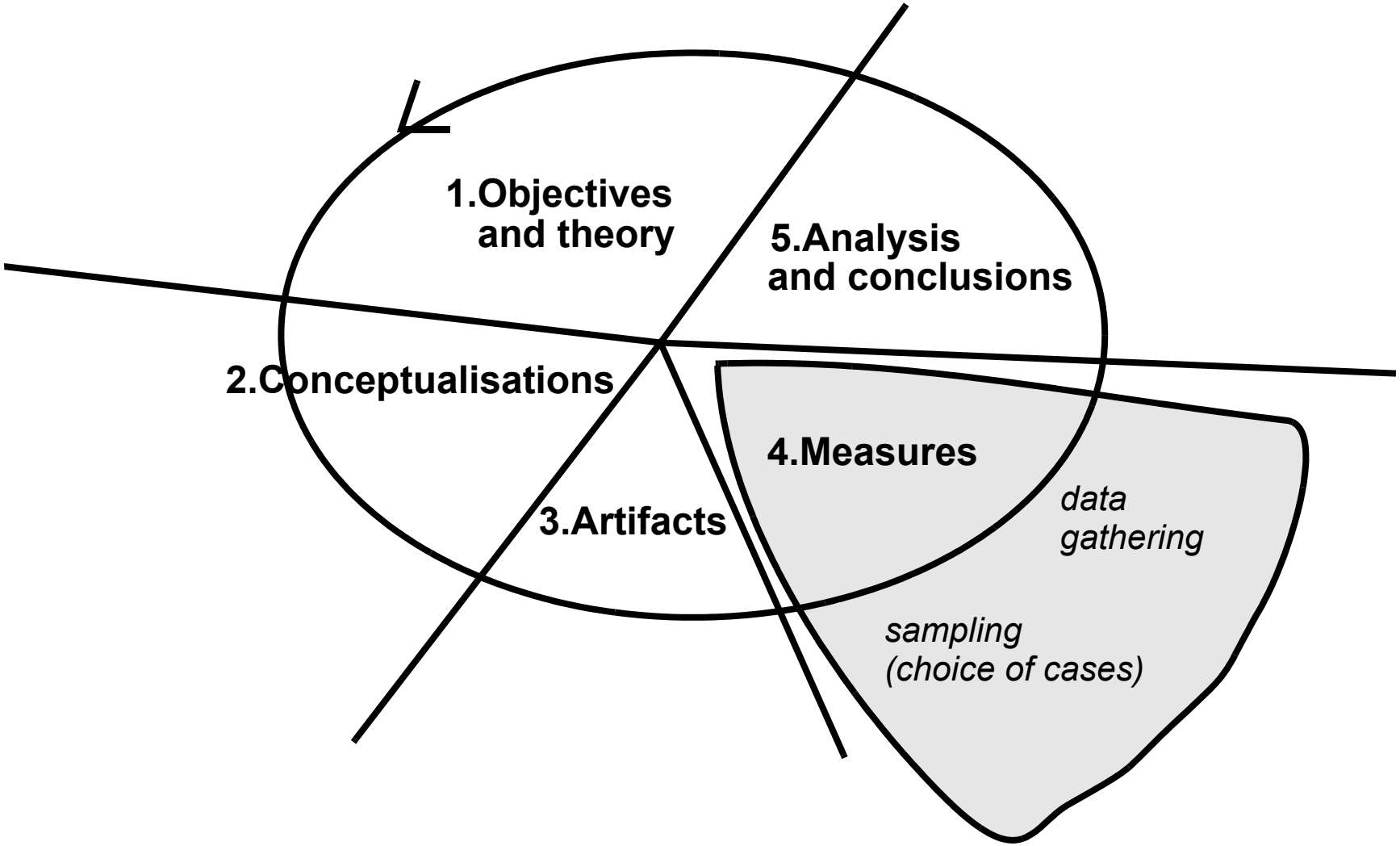


B. Dangers and problems of concept operationalization

1. Gap between data and theory
   - Example: measure communication within a community of practice (e.g. an e-learning group) by the quantity of exchanged forum messages
   - (students may use other channels to communicate !)
2. You forgot a dimension
   - example: measure classroom usage of technology only by looking at the technology the teacher uses e.g. powerpoint, demonstrations with simulation software or math. software
   - (you don't take into account technology enhanced student activities)
3. Concept overloading
   - example: Include "education" in the definition of development
     (it could be done, but at the same you loose an important explanatory variable for development, e.g. consider India's strategy that "overinvested" in education with the goal to influence on development)
   - Therefore: never ever collapse explanatory and explainable variables into one concept !!
4. Bad measures
   - (see later)

4. The measure

- observe properties, attributes, behaviors, etc.
- select the cases you study (sampling)



4.1 Sampling

As a general rule:

- Make sure that "operative" variables have good variance, otherwise you can't make any statements on causality or difference .....
- operative variables = dependant (to explain) and independent (explaining) variables

Overview on sampling strategies

Type of selected cases	Usage
maximal variation	will give better scope to your result (but needs more complex models, you have to control more intervening variables, etc. !!)
homogeneous	provides better focus and conclusions; will be "safer" since it will be easier to identify explaining variables and to test relations
critical	exemplify a theory with a "natural" example
according to theory, i.e. your research questions	will give you better guarantees that you will be able to answer your questions ....
extremes and deviant cases	test the boundaries of your explanations, seek new adventures
intense	complete a quantitative study with an in-depth study

- sampling strategies depend a lot on your research design !

4.2 Measurement techniques

- There are not only numbers, but also text, photos and videos !
- Not treated here, see the modules «ix Quantitative data acquisition methods (e.g. surveys and tests)» and «x Qualitative data acquisition methods (e.g. Interviews and observations)» !

Principal forms of data collection

	Articulation		
Situation	**non-verbal and verbal**	**verbal**	
		oral	**written**
informal	participatory observation	information interview	text analysis, log files analysis, etc.
formal and unstructured	systematic observation	open interviews, semi-structured interviews, thinking aloud protocols, etc.	open questionnaire, journals, vignettes,
formal and structured	experiment simulation	standardized interview,	standardized questionnaire, log files of structured user interactions,

4.3 Reliability of measure

☞ **reliability = degree of measurement consistency for the same object**

1. by different observers
2. by the same observer at different moments
3. by the same observer with (moderately) different tools

example: measure of boiling water

- A thermometer always shows 92 C. => it is reliable (but not construction valid)
- The other gives between 99 and 101 C.: => not too reliable (but valid)

Sub-types de reliability (Kirk & Miller):

1. circumstantial reliability: even if you always get the same result, it does not means that answers are reliable (e.g. people may lie)
2. diachronic reliability: the same kinds of measures still work after time
3. synchronic reliability: we obtain similar results by using different techniques, e.g. survey questions and item matching and in depth interviews

In short: can we reproduce and replicate, can we trust data?

The “3 Cs” of an indicator

Are your data *complete* ?

•Sometimes you lack data ....

•Try to find other indicators

Are your data *correct* ?

•The reliability of indicators can be bad.

•Example: Software ratings may not mean the same

•according to cultures (sub-cultures, organizations, countries) people are more or less outspoken.

Are your data *comparable* ?

•The meaning of certain data are not comparable.

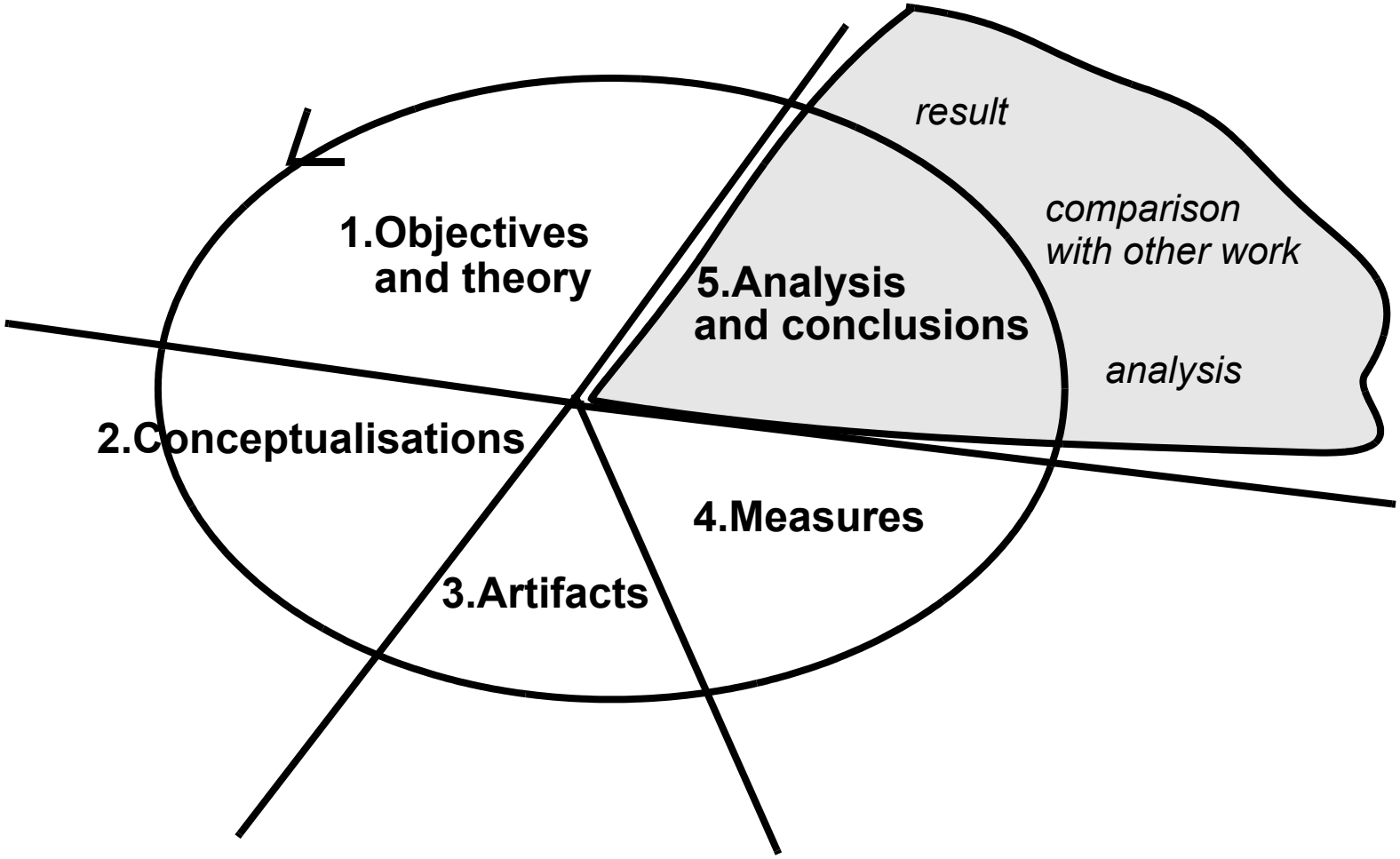
•examples:

(a) School budgets don’t mean the same thing in different countries (different living costs)

(b) Percentage of student activities in the classroom don’t measure "socio-constructive" sensitivity of a teacher (since there a huge cultural differences between various school systems)

5. Interpretation: validity (truth) and causality

- Can you really trust your conclusions
- Did you misinterpret statistical evidence for causality ?



5.1 The role of validity

- Validity (as well reliability) determine the formal quality of your research
- More specifically, validity of your work (e.g. your theory or model) is determined by the validity of its components.

In other words:

- can you justify your interpretations ??
- are you sure that you are not a victim of your confirmation bias ?
- can you really talk about causality (or should you be more careful) ?

Note: Validity is not the only quality factor

	Judgements
Theories	usefulness (understanding, explanation, prediction)
Models (“frameworks”)	usefulness & construction (relation between theory and data, plus coherence)
Hypotheses and models	validity & logic construction (models)
Methodology ("approach")	usefulness (to theory and conduct of empirical research)
methods	good relation with theory, hypothesis, methodology etc.
Data	good relation with hypothesis et models, plus reliability

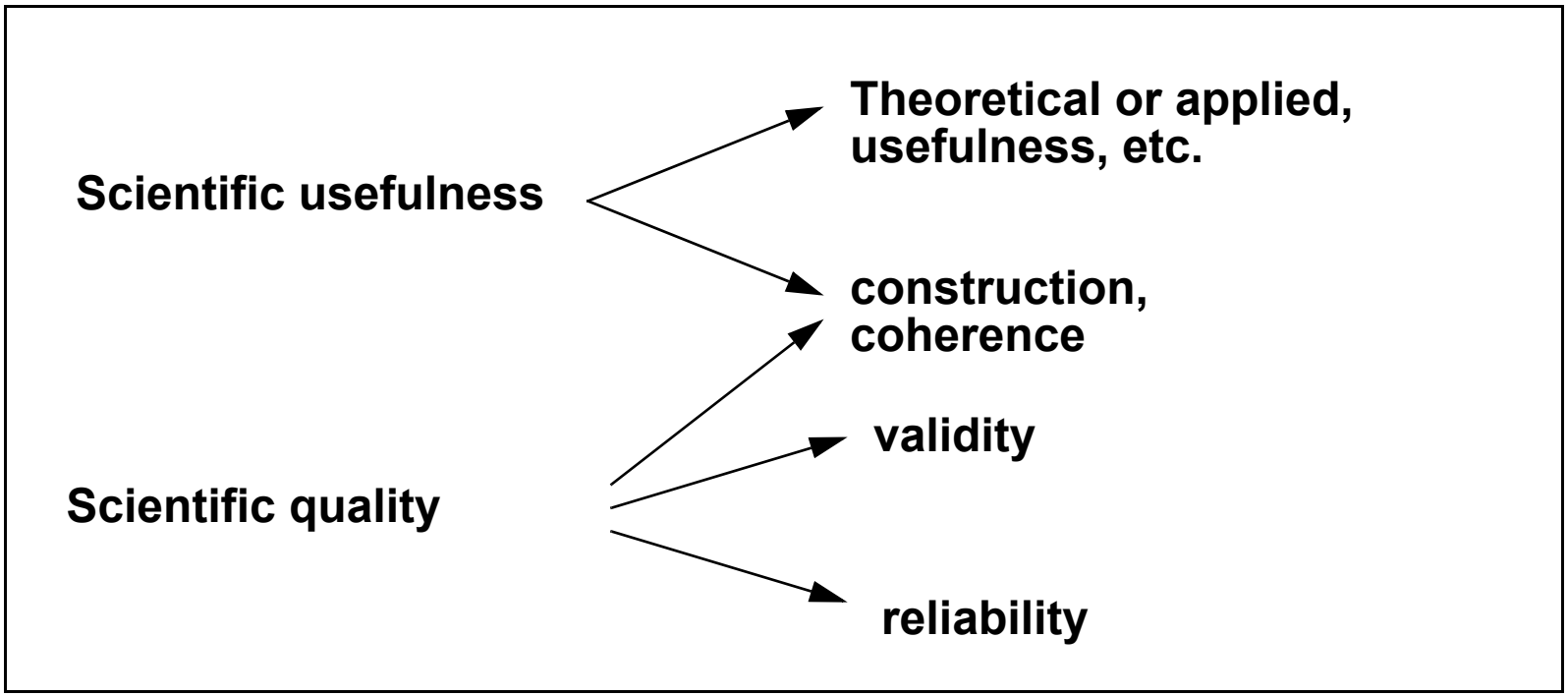

A good piece of work satisfies first of all an objective, but it also must be valid

The same message with another picture:

☞ **The most important usefulness criteria is: "does it increase our knowledge"**

☞ **The most important formal criteria are validity and reliability**

☞ **Somewhere in between: "Is your work coherent and well constructed" ?**



5.2 Some reflections on causality

☞ A correlation between 2 variables (measures) does not prove causality

Co-occurrence between 2 events does not prove that one leads to the other

- The best protection against such errors is theoretical and practical reasoning !

example:

- "We introduced ICT in our school and student satisfaction is much higher"
- (It's maybe not ICT, but just a reorganization effect that had impact on various other variables such as teacher-student relationship, teacher investment, etc.)

☞ **If you observe correlations in your data and you are not sure, talk about association and not cause !**

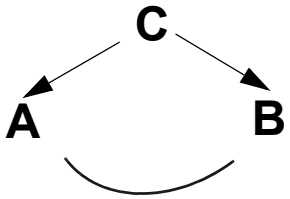
☞ **Even if can provide sound theoretical evidence for your conclusion, you have the duty to look a rival explanations !**

- There are methods to test rival explanations (see modules on data-analysis)

Some examples of bad inference

- Simple hidden causalities

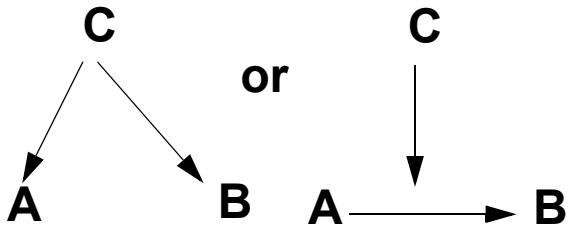
Situation 1: Badly interpreted correlation (no real link between A and B)



Example from european folklore:
"Là où ont voit des cigognes, il y a plus de naissances"
naissances (A) et cigognes (B) sont un effet (négatif) de l'urbanisation (C)

Situation 2: Double effect

A and B are explained by C and/or the relation between A and B is function of C



example:
"more parent meetings increase spending for ICT"
School's organizational culture (C) influences participation (A) and spending (B)

Situation 3: Causality chain

example: "Young teachers hate ICT"
Young teachers (A) use less ICT (C) because they have less resources (time) left to spend on it (B)

- Think !

6. Conclusion

6.1 Some advice

At every stage of research you have to think and refer to theory:

- Good analytical frameworks (e.g. instructional design theory or activity theory) will provide structure to your investigation and will allow you to focus on essential things.
- You can't answer your research question without a serious operationalization effort.
  - Identify major dimensions of concepts involved, use good analysis grids !

Watch out for validity problems

- You can't prove a hypothesis (you only can test, reinforce, corroborate, etc.).
  - Therefore, also look at anti-hypotheses !
- Good informal knowledge of a domain will also help
  - Don't hesitate to talk about your conclusions with a domain expert
- Purely inductive reasoning approaches are difficult and dangerous.
  - ... unless you master an adapted (costly) methodology, e.g. "grounded theory"

You have a "confirmation bias" !

- humans tend to look for facts that confirm their reasoning and ignore contradictory elements
- It's your duty to test rival hypothesis (or at least to think about them) !

Attempt some (but not too much) generalization

- show the others what they can learn from your piece of work , confront your work to other's !

6.2 Choice and complementarity of methods

A. Triangulation of methods

☞ **Different viewpoints (and measures) can consolidate or even refine results**

- E.g. imagine that you (a) led a quantitative study about teacher's motivation to use ICT in school or (b) that you administered an evaluation survey form to measure user satisfaction of a piece of software.
- You then can run a cluster analysis through your data and identify major types of users
  - (e.g. 6 types of teachers or 4 types of users).
- Then you can do in-depth interviews with 2 representatives for each type and "dig" in their attitudes, subjective models, abilities, behaviors, etc. and confront these results with your quantitative study.

B. Theory creation v.s theory testing

☞ **qualitative methods are better suited to create new theories**
•(exploration / comprehension)

☞ **quantitative methods are better suited to test / refine theories**
• (explication / prediction)

... but:

- validity, causality, reliability issues ought to be addressed in any piece of research
- it is possible to use several methodological approaches in one piece of work

Finding a research subject in educational technology

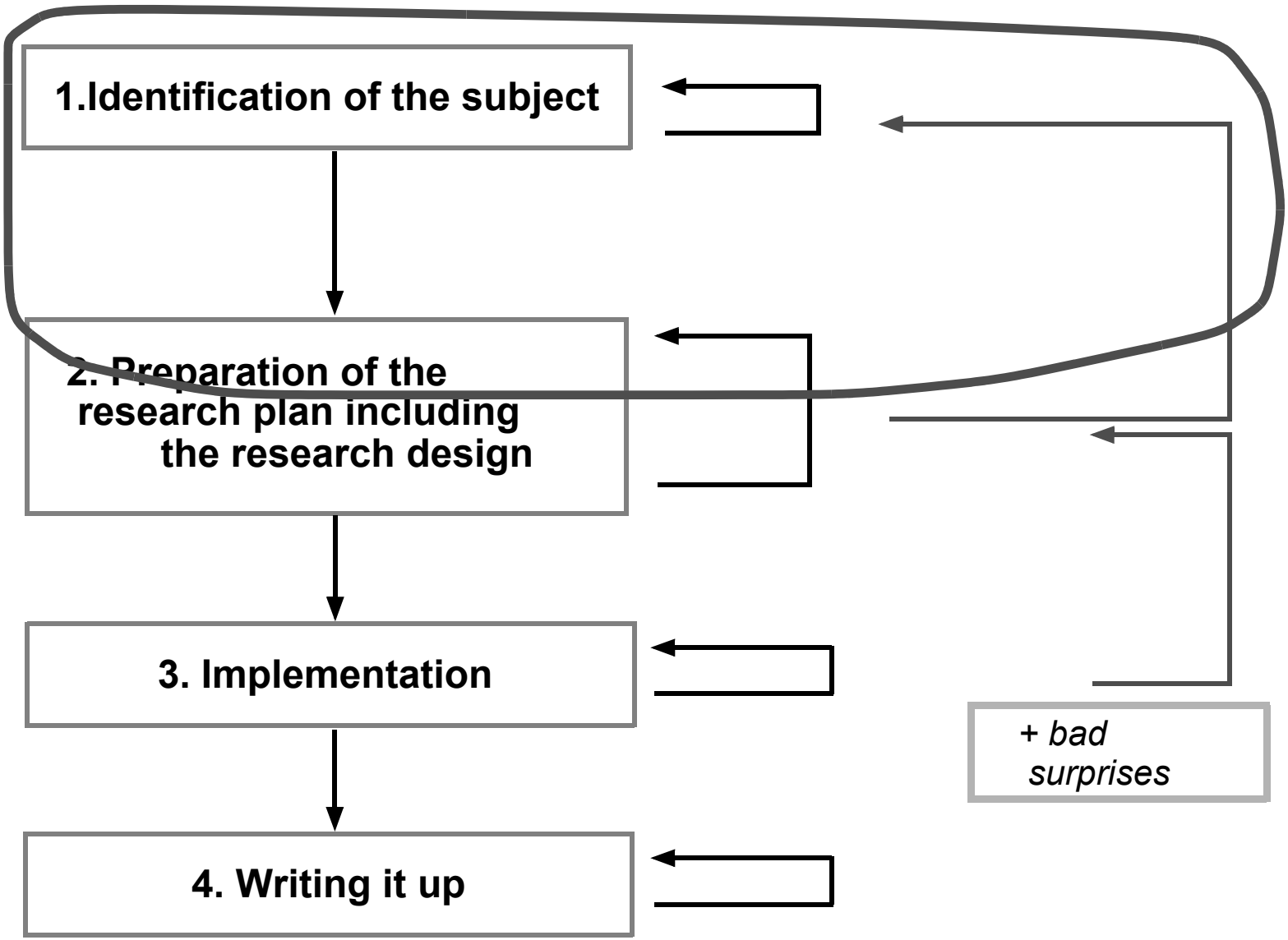
(version 1.0, 1/4/05)

Code: thesis-subject

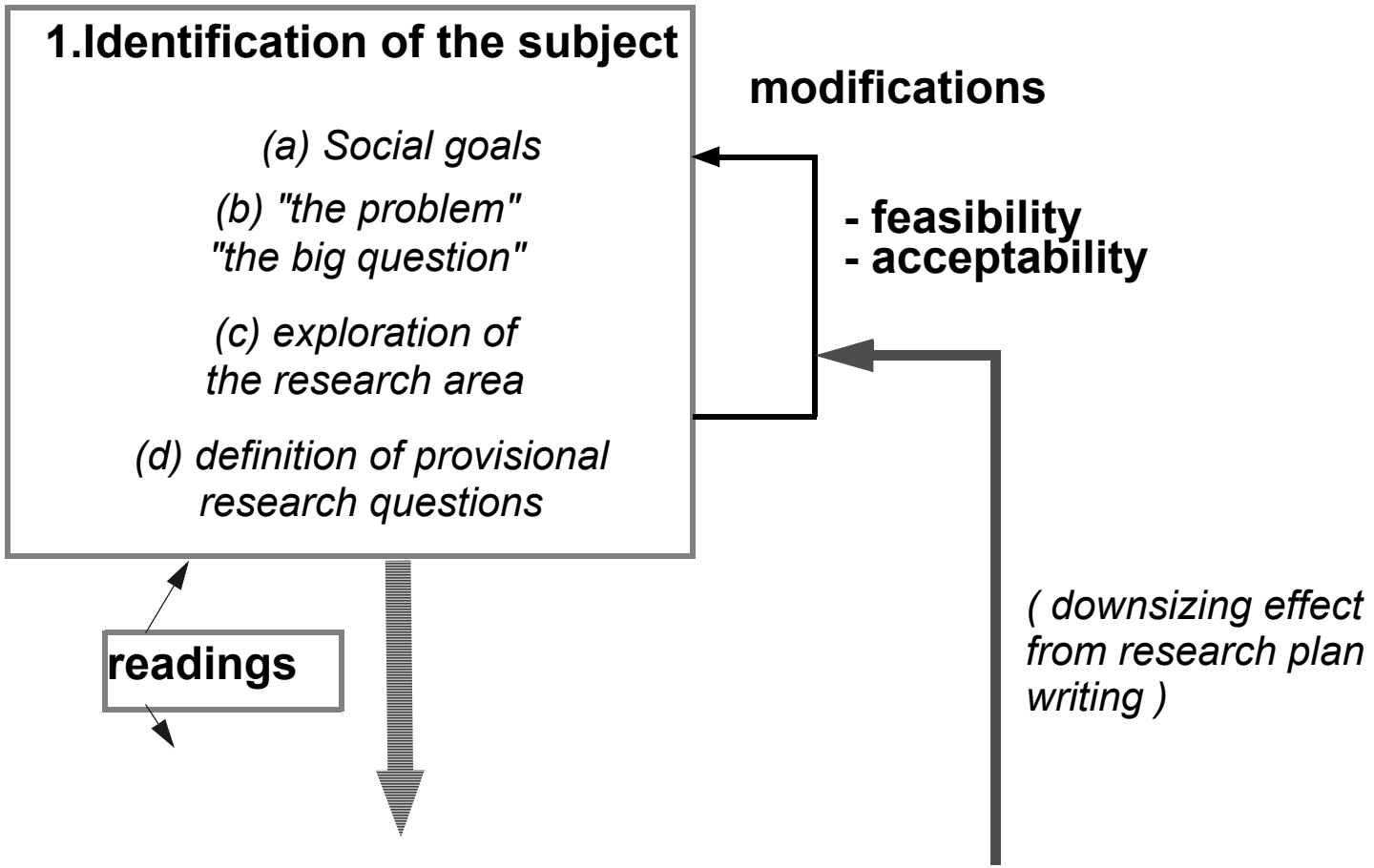
Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Choice of a research subject



1.1 Identification of the subject: important elements



- You need to loop through this several times when you start writing your research plan !

1.2 The identification process

The most important phases

1. Identify a few topics / subjects and make a "short list"
2. Make explicit each potential subject
   - see: 3. “Identification of the central problem” [6]
3. Discuss with your professors
4. Explore the subjects (new short list)
   - see: 5. “Readings and ideas” [12]
5. Make a draft of the research plan and negotiate
   - see: 4. “Anticipation of the research plan” [10]
6. Make it official
   - (consult your local procedure)
7. .....

2. Identification of social goals

Learn something, institutional constraints, fun, ...

1. What should your job be in 3-4 years ?
   - A thesis is part of your "profile", a "visit card"
   - A thesis will teach you a lot, what do you wish to learn ?
2. And your employer ?
   - Is he interested in your master thesis
   - can you marry academic work with the goals of your organization ?
3. What would you consider to be real "fun" ?
   - are you intrinsically motivated ?

3. Identification of the central problem

- A research subject is not just a topic !!
- It must be of some academic interest
  for example: explain a phenomenon, identify processes, provide scientific arguments for an expertise, prove cognitive ergonomics of some software, demonstrate pedagogic effectiveness, invent new design rules, ...

3.1 The "big question"

- does not necessarily match the title of your project (which just can announce a topic)

La “grande question”

- is a summary of your research question
- .... may also imply practical goals

Exemple 3-1: E-learning

Bad: “E-learning” in vocational teacher training

Good (a): ***Efficiency*** of e-learning in ...

Good (b): ***Perception*** of e-learning ....

Maybe: ***Analysis of e-learning*** in ...

(all these variants need further precision)

3.2 Objectives and research questions

- Even if you did manage to phrase a good "big question", your intentions will be too vague
- Therefore you must take your big question apart
  - in the form of research questions and/or hypothesis
- You ***absolutely must make all your objectives explicit***
  (else you are looking for conflicts and other problems).
- You then must formulate ***research questions*** that cover your objectives
  - Formulate working hypotheses if you can and if it's appropriate.
  - You also may formulate scientific hypothesis (based on theoretical argumentation)
  - It is much easier to deal with hypothesis than with more open research questions ....
- Finding the right research questions / hypothesis is an ***iterative*** process.
  - Usually you only get them right after having written a draft of the literature review !!
  - Therefore, don't start field research, development etc. before you have done some theory !

Exemple 3-2: Etude pilote sur la mise en oeuvre et les perceptions des TIC

(Luis Gonzalez, DESS thesis 2004)

Main goal: "Understand the factors that favor teacher's use of ICT"

- The author first defines 8 factors and then also postulates a few relationships among them
  - The 8 factors were found through literature review.
- Below we quote from the thesis (and not the research plan):

<< Sachant qu'une faible proportion d'enseignants utilise le matériel informatique dans leur pratique, je me suis demandé s'il était possible d'identifier des facteurs favorisant l'intégration des TIC. >>

<< Mon hypothèse principale postule l'existence d'une corrélation entre les facteurs suivants et la mise en œuvre des TIC par les enseignants :

- Le type support offert par le cadre institutionnel
- Leurs compétences pédagogiques
- Leurs compétences techniques
- La formation reçue, que se soit la formation de base ou la formation continue
- Leur sentiment d'auto-efficacité
- Leur perception des technologies
- Leur perception de l'usage pédagogique des TIC
- Leur rationalisation et digitalisation pédagogique

>>

Exemple 3-3: Engineering project: a system to support inquiry-based learning (IBL)

Quote: "L'objectif de ce module est de donner une structure basique adaptable, aux enseignants qui désirent offrir une activité d'apprentissage par investigation à leurs élèves. Ils peuvent ainsi aisément créer des supports informatisés pour des activités pédagogiques de ce type."

The goals of this research have been defined implicitly by deriving the specification of the software module from a known inquiry framework:

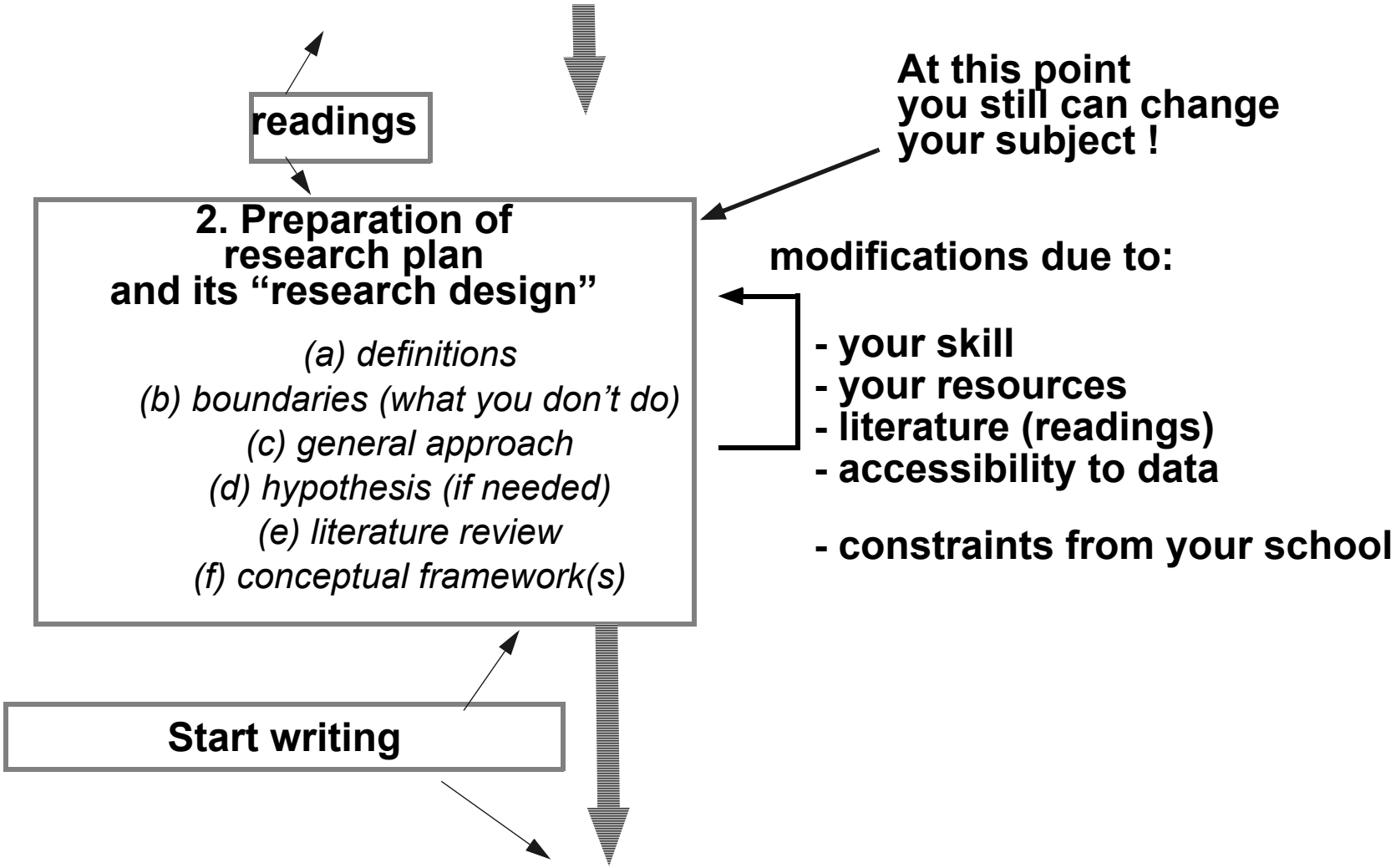
- L'enseignant peut ainsi créer un type de fiche qui correspond à l'activité qu'il a en tête, [....]
- Cette fiche donne une structure qui permettra aux apprenants de répondre à des questions [...] (étape 1 : Questionner).
- L'enseignant soumet l'activité aux apprenants qui peuvent créer une instance de la fiche type afin de faire l'exercice. [...]. Dès lors, ils recherchent les informations susceptibles de les aider à remplir les différents éléments de la fiche (étape 2 :Questionner), [...]
- Une fois les informations trouvées, l'apprenant rempli son instance de fiche, [...] (étape 3 : Créer),
- puis, au moyen de la visualisation des instances des autres apprenants et de la possibilité des commenter, il peut débattre avec les différentes personnes ayant fait la même fiche que lui (étape 4 : Discuter). [....] Enfin, il soumet son instance de fiche au professeur et/ou à l'expert associé à l'activité.
- La 5e étape du modèle (Réfléchir) peut être incluse dans l'activité de différentes manières, [...]

This master thesis clearly lacked precise research questions

- the big questions was: how should we design a system for IBL support (and can I do it ?)
- the driving operational questions were a specification based on a popular IBL model
- but it was accepted that this development would lay the basis for further research, since such a tool did not exist before
- (only preliminary usability testing was required from the thesis advisor)

4. Anticipation of the research plan

Here is an idea



The research plan = what + why:

What ?	A good question ! (problématique)	• “So what” ? "What knowledge do we gain"
	A (or more) good conceptual frame-work(s) that...	• links your research to a larger identified issue, • structures your phenomenon • links your project to a body of existing knowledge • ... is preferably available as a nice drawing
How?	**Consider that your research plan should be ...**	• systematic: show that you will study your "big question" and related research questions (and nothing else!) • academic: identify your main approache(s) and major techniques you will use. • somewhat flexible (make sure that you identify priorities also) • In some designs it is required that show details regarding how you plan to answer your questions.
	Be realistic ! Prove that you have ...	• the time to do it ? • access to data ? • the ability to do it (or to learn how to do it) ?
A whole !	**Integration !**	• A coherent whole ! • All your intentions are made explicit. • Your research questions cover your essential planned work.

5. Readings and ideas

5.1 Who/what can help you finding a good subject

1. Examples (other thesis in the same area)
2. Academic articles
3. Interviews with academic experts
4. Interviews with domain experts
5. Your librarian, your library, on-line journals
6. http://scholar.google.com

Remarks

- Your research topic will be vague in the beginning
- Be sure to talk to other persons than just your advisor
- Engage discussion with a written ***list of precise questions***
  - and make sure that all questions have been covered at the end of your meeting
  - don’t ask by mail, ask for an appointment (unless the teacher tells you otherwise)
- Don’t just think, start producing at some point

5.2 Initial readings

1. start with 2-3 ***articles/standard works*** and that contain a survey of your topic or a related area.
   - ask experts, use the library, use scholar.google.com, use on-line journals
2. if you can't find anything:
   - hunt for articles that cover subjects with similar structural properties (e.g. concerning the approach, the "way to look at things", etc.)
   - start to occupy "islands" (and enlarge with "circles")
3. look for further publications
   - follow-up leads from you 2-3 initial articles
   - go through specialized indexes
   - systematically browse through specialized journals
4. Go through the ***Internet pages of well know researchers in your field***
   - do not trust randomly found things (e.g. indirect quotes) on the Internet
   - hunt down the home pages (a lot of researchers publish at least a few papers on their site)
5. etc.

Don't read too much ! Stop when:

1. the same information comes back,
2. you found a good central framework, the analysis grids for your concepts, experimental designs that provide you with a good example, etc. (details depend on your approach),
3. you can relate your research questions to published work.

5.3 Exploitation of literature and draft of the theory part

- Don't write "summary memos", it takes to much time (IMHO)

Here is an advice:

1. Read texts "diagonally", and just mark the most relevant concepts, theories, models, hypothesis, etc.
2. Make a matrix of the most important concept

	Concepts				
Articles	**A**	**B**	**C**	**D**	**....**
1		x	x		
2	x		x	x	
...					x

   - you may add some small comments
3. Sort concepts
   - mark the most important ones
   - look at relations
   - throw away the ones you won't need (the theory part must support the empirical part, nothing else)
4. Write a draft
   - Be synthetic and be critical (!)
   - Do not align one mini-summary after each other (i.e. order by concepts and not authors !)
   - End up with a conclusion that argues in favor of a central framework, that identifies major dimensions (elements) and corresponding analysis grids
   - Look again at your research questions (revise them or add/remove things from your draft)

5.4 Idea generation

A. brainstorming

☞ **is done in several stages:**

1. Write ***rapidly*** keywords (what you want investigate, know, etc.) on paper
2. Take this list and do it again for each point
3. Sort/clean and go to the next steps

B. Organize your ideas

☞ **make drawings, that contain major elements and relationships**

- you may use mind mapping software, but don't not overdo it !
- ... mind mapping may generate too much complexity

C. The outline

☞ **Outlines are useful for your research plan, difficult chapters like the theory part, to:**

- organize your ideas,
- produce a detailed plan of work to do (e.g. work packages),
- order your ideas in a linear way (your thesis will be linear).

Have something to write on you (always)!

- good ideas sometimes pop out of nothing at odd times, and you should not forget them.

6. Summary of some exploration activities

Discussions

- Talk to field experts, academic experts (in particular potential advisors)
- Also contact your "victims"

Political feasibility

- Make sure that you will find "subjects", that organizations will cooperate, etc.

Theoretical feasibility

- Have got a good enough overview ?
- E.g. theoretical frameworks, analysis grids, propositions (hypothesis)

Methodological feasibility

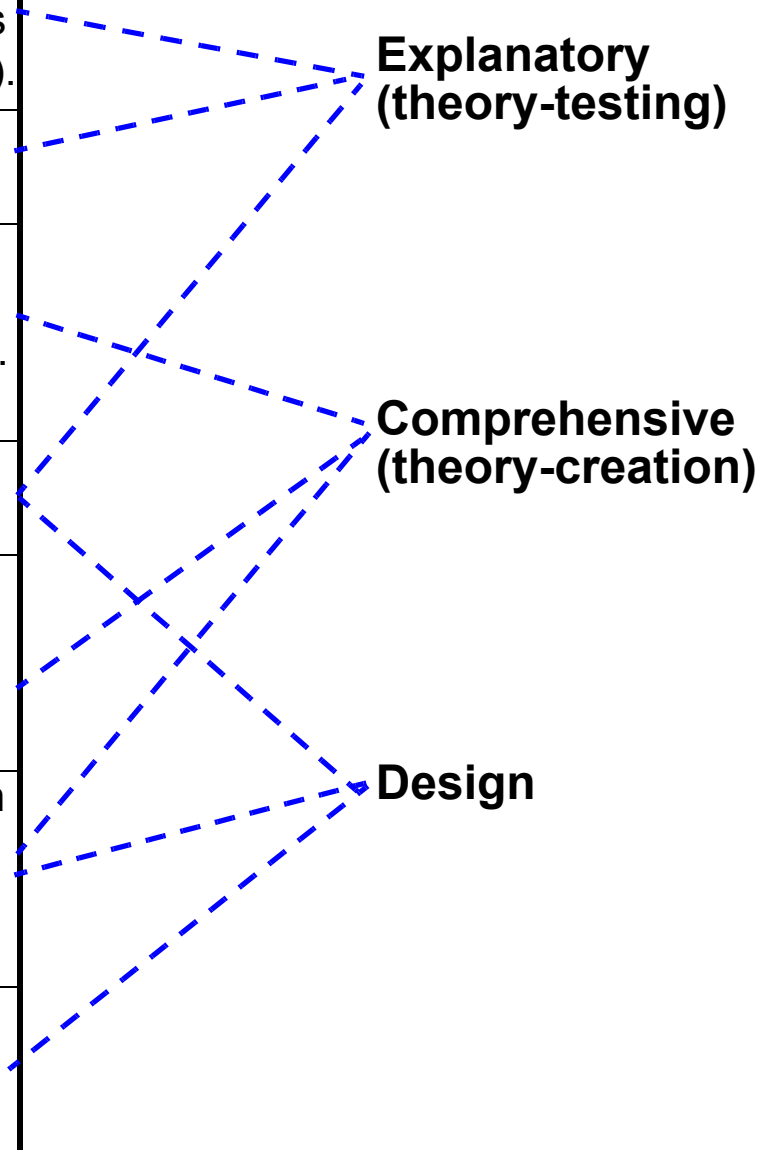
- Did you make a list of the concepts found in your research questions ?
- Do you have initial definitions for them ?
- Do you believe that you can measure each empirical concept ?
- Do you have an idea how to analyze relationships (to answer your research questions) ?

Budgetary feasibility

- Time is your enemy
- keep your subject as small as possible (but make sure that you address an academic question ..)

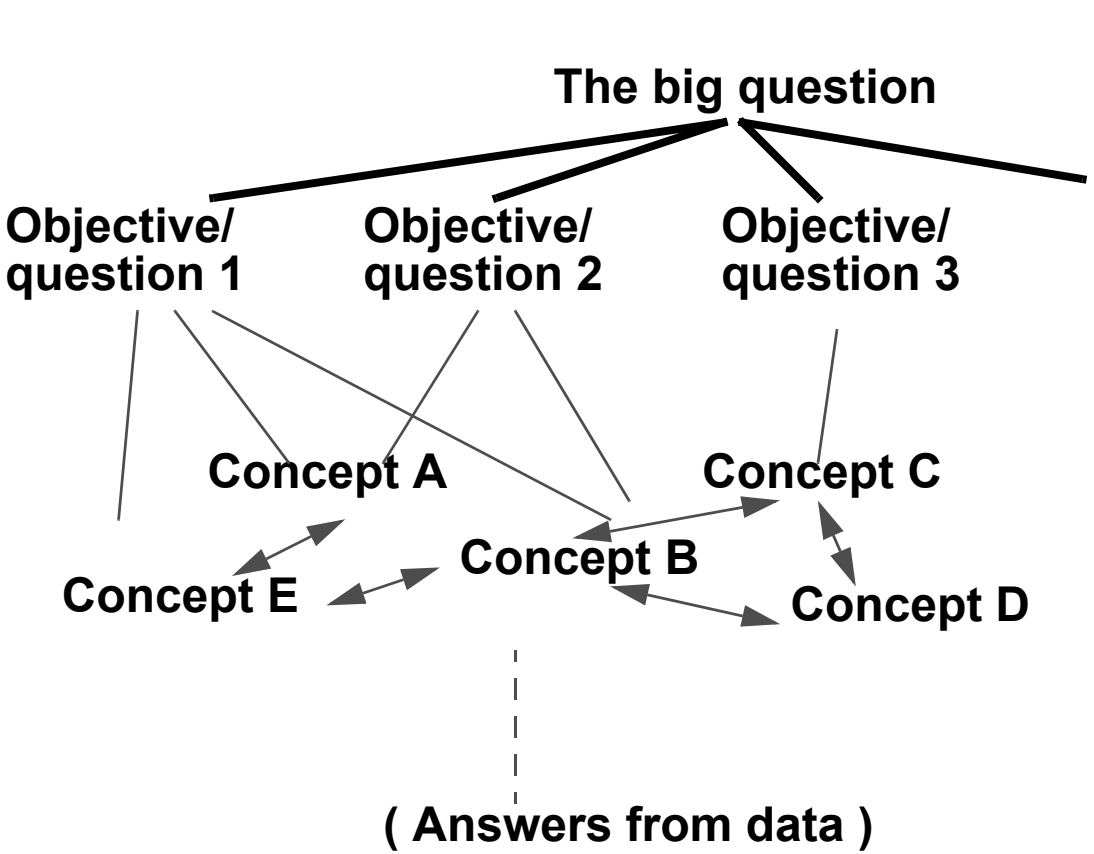
6.1 Try to identify a general thrust for your research

Some possibilities for a master thesis:
• ***Experimental designs*** that study ***how humans behave under certain conditions*** (e.g. "Under what conditions does a multimedia animation have a positive effect on learning ?").
• ***Quasi-experimental*** studies (e.g. ***test*** if one instructional design is better then an other).
• ***Sociological studies*** (e.g. the introduction of ICT to school systems and/or organizations, study of certain population's ***attitudes and behaviors*** towards ICT or an ICT initiative, e.g. teachers).
• Economic studies (e.g. ***Return on investment*** at the organizational or the national level)
• ***Ethnographic*** or clinical studies of human subjects, i.e. ***in-context behavior*** (e.g. usability studies of software, work place analysis to study informal learning, problem-solving behavior related to the use of ICT etc.)
• Development of ***innovative instructional designs*** (either in real world settings or exploratory studies). All kinds of settings: Formal/informal, distance/blended/classroom, workplace e-learning, just-on-the-spot learning, ...
• ***Technical development*** of a system or exploration of new technologies (and that explore/introduce ***new ideas (pre-theories)*** profitable to education and learning)



6.2 Think hard about the concepts you use

The theoretical face



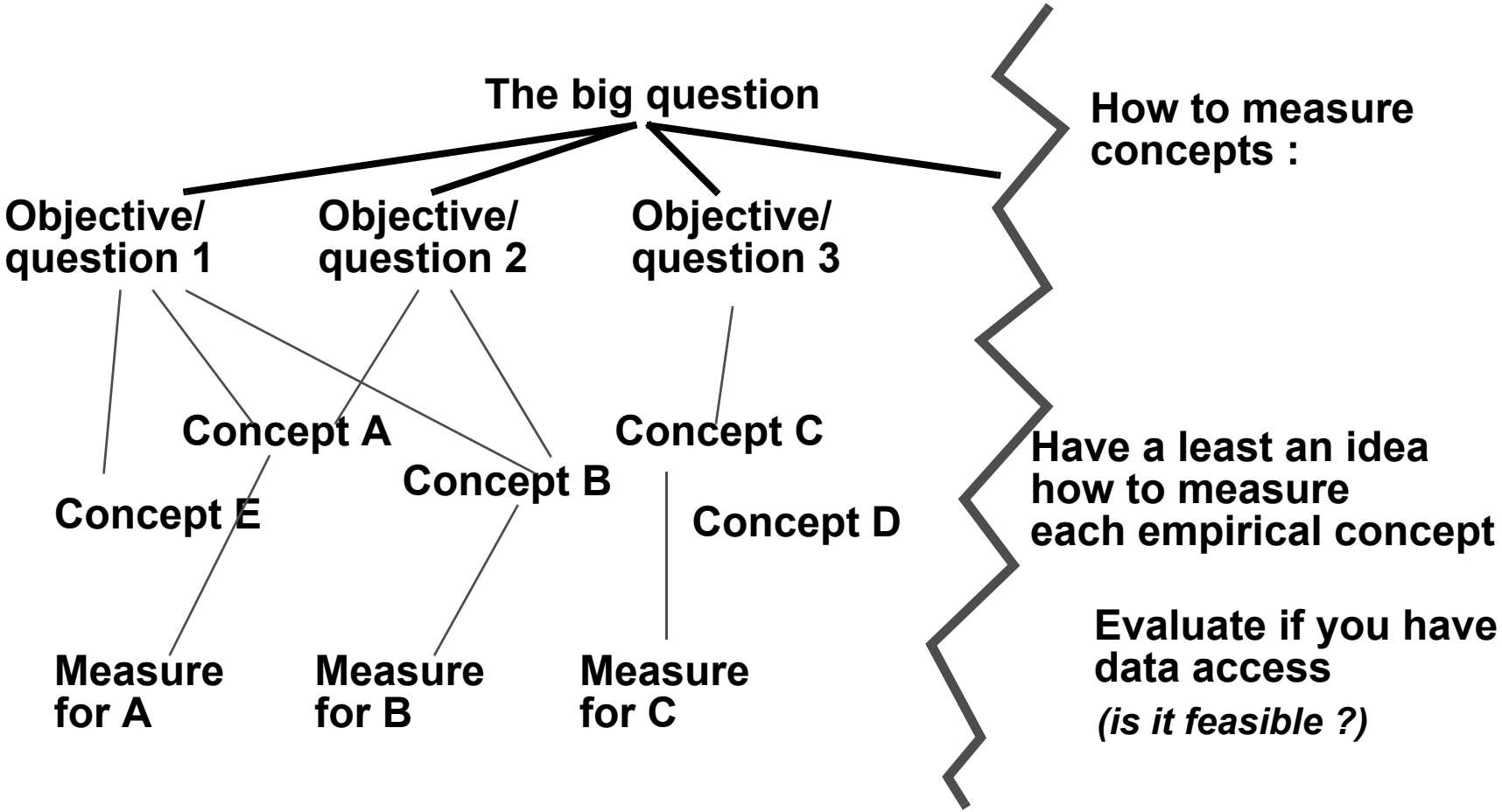
Objectives & preliminary research questions
(don't forget anything don't hide anything !)

Concepts
(be precise)

Hunt (keep some for later):

Theoretical anchors
Approaches
Hypothesis
"Frameworks"
Analysis grids
Analysis methods

The empirical face



- See modules on research design if you don't understand this (and come back later)

The research plan and conceptual frameworks

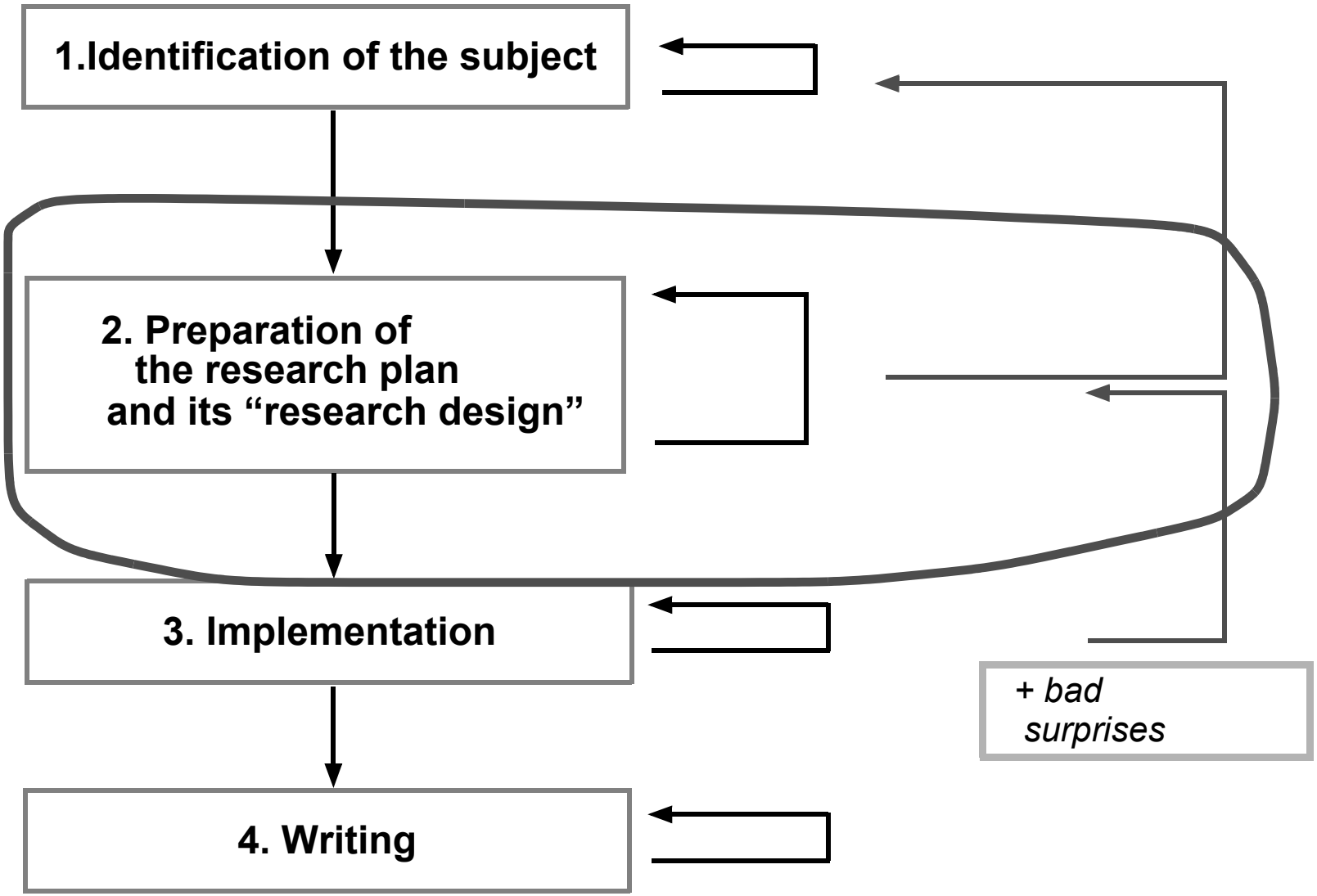
(version 1.0, 1/4/05)

Code: res-design-intro

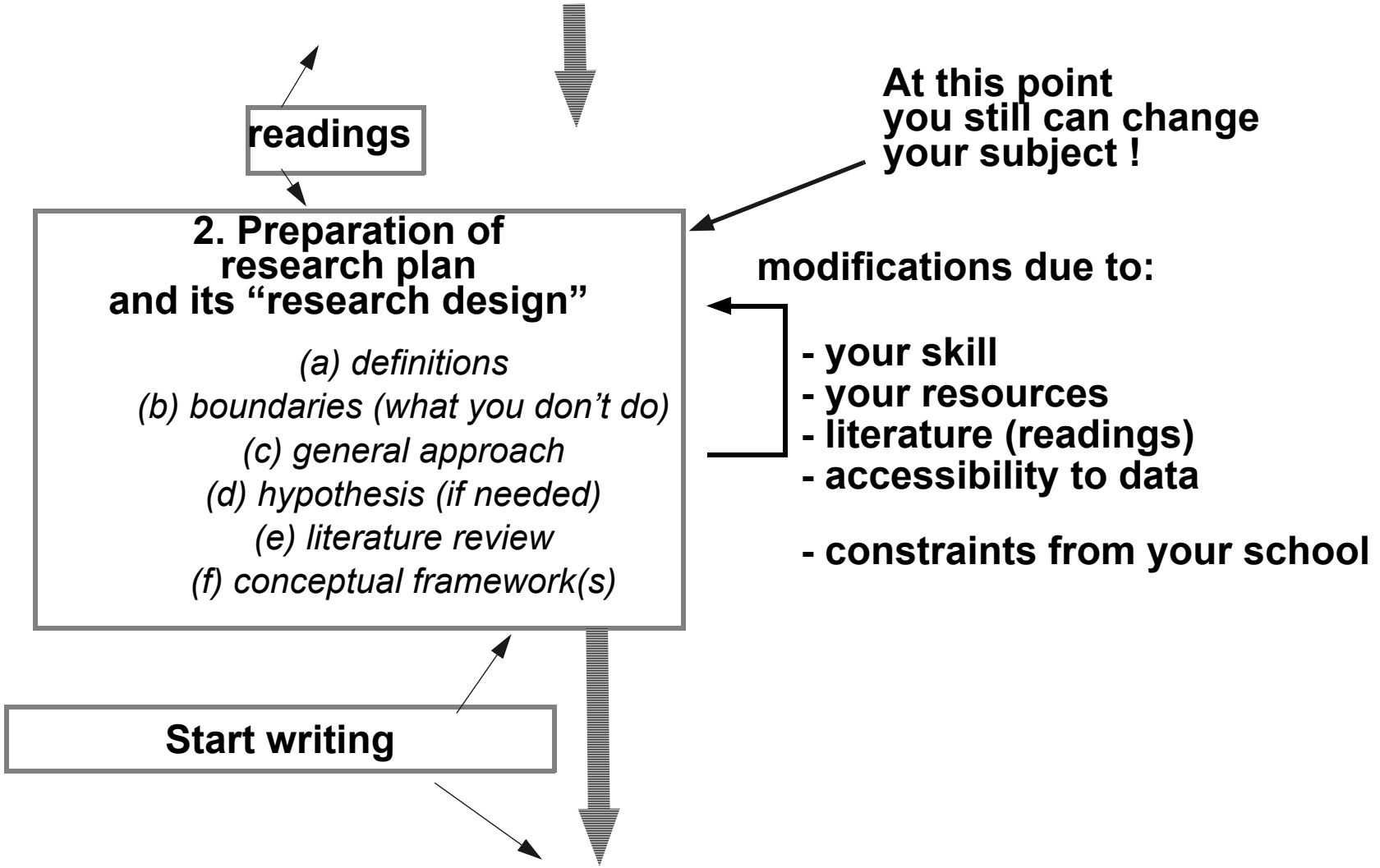
Daniel K. Schneider, TECFA, University of Geneva

Menu

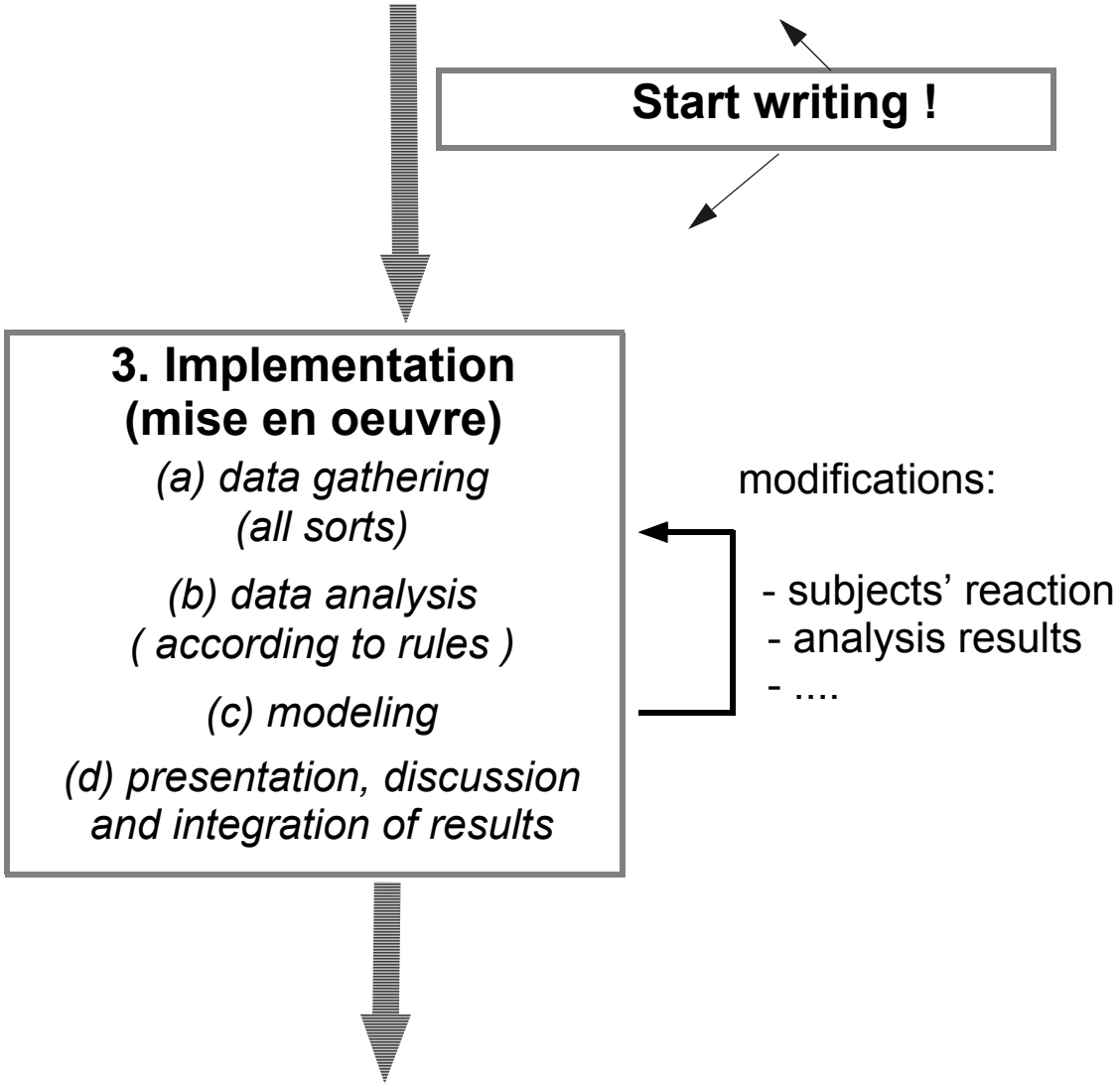
1. Place of the research plan



1.1 Important elements of the research plan



1.2 Anticipation of main research activity (implementation)



2. Elements of a typical research plan

- Note: You may have to adapt this list to fit formal requirements from your institution or methodology constraints ...

2.1 Element: Your research subject

- the big question (general subject in one sentence)
- explicitation of the big question
  - at least a few sentences that demonstrate its practical and theoretical interests.
- motivations and various ends
- delimitations (what you are not going to do)

2.2 Element: Objectives of your research

- Say clearly what you wish to achieve
- Will determine «Element: Research questions and/or hypothesis» [p. 6]
- Valorization (if appropriate): how can you transfer results in a "real context" ?

2.3 Element: theory

- Start with a short and synthetic text describing and discussing the "state of the art" in your subject area.
  - Be sure to mention the major publications. Read the ones you quote from !
- You may point out inconsistencies and gaps (adds additional interest to your project !)
- Identify theories and conceptual models that you will use.
  - Maybe add your modifications and present both at the end
- Make sure that you define all concepts
  - A lot of concepts are controversial, e.g. pedagogical effectiveness, efficiency, ...

2.4 Element: Research questions and/or hypothesis

Make explicit your research subject, main goal and objectives

Choose from (or combine):

- Open research questions (but make an effort to be as precise as possible).
- Research questions formulated as working hypothesis.
- Real hypothesis that are based on theory.
- In theory-oriented research, formulate hypothesis that postulate causalities
  - Bad: "I postulate that my e-learning design will work"
  - Good: "Conditions for successful implementation of an e-learning design in the context XXX of are ....."
  - Bad: "ICT doesn't work in schools"
  - Good: "Critical variables A, B, C for successful implementation of e-learning are ...".
    Then, make explicit A, B, C as causal rules.

2.5 Element: Approach & methodology

- “Description of your overall approach (for example "experimental design", "survey study", "usability study", "instructional design")
- Description of data gathering and analysis techniques (for example, semi-directive interviews, content analysis ...)

  Note: Make sure to explain your methodological designs for all levels of analysis !

  - at the organizational level (if you are interested in this question),
  - at the individual level (e.g. students, teachers)

Basic principle:

- show convincingly ***how you are going to answer each research question !***
- Obey guidelines dictated by the general approach
  - in particular: be careful with experimental designs (rules are strict !)
- (more details below)

A. Approach

- Briefly describe the overall approach you are using
- Discuss analysis grids that will measure important concepts
- You also can discuss conceptual frameworks (if not done before)
- For experimental studies: clearly describe the experimental conditions

B. Measures and material

- Data gathering techniques: (interviews, observations, surveys, ...)
- Sampling strategies (or justification of singular case selection)
- For qualitative in-depth studies
  - sampling of interviews, events, etc.
- For experimental studies
  - there is a strict way of doing things ! You have to describe in detail experimental conditions, materials used, sampling conditions etc.

C. Analyses

- Shortly describe analysis techniques (both qualitative and quantitative)
- If necessary: point out which methods need development (e.g. analysis of student-student interaction in a CSCW environment)

2.6 Element: Information sources

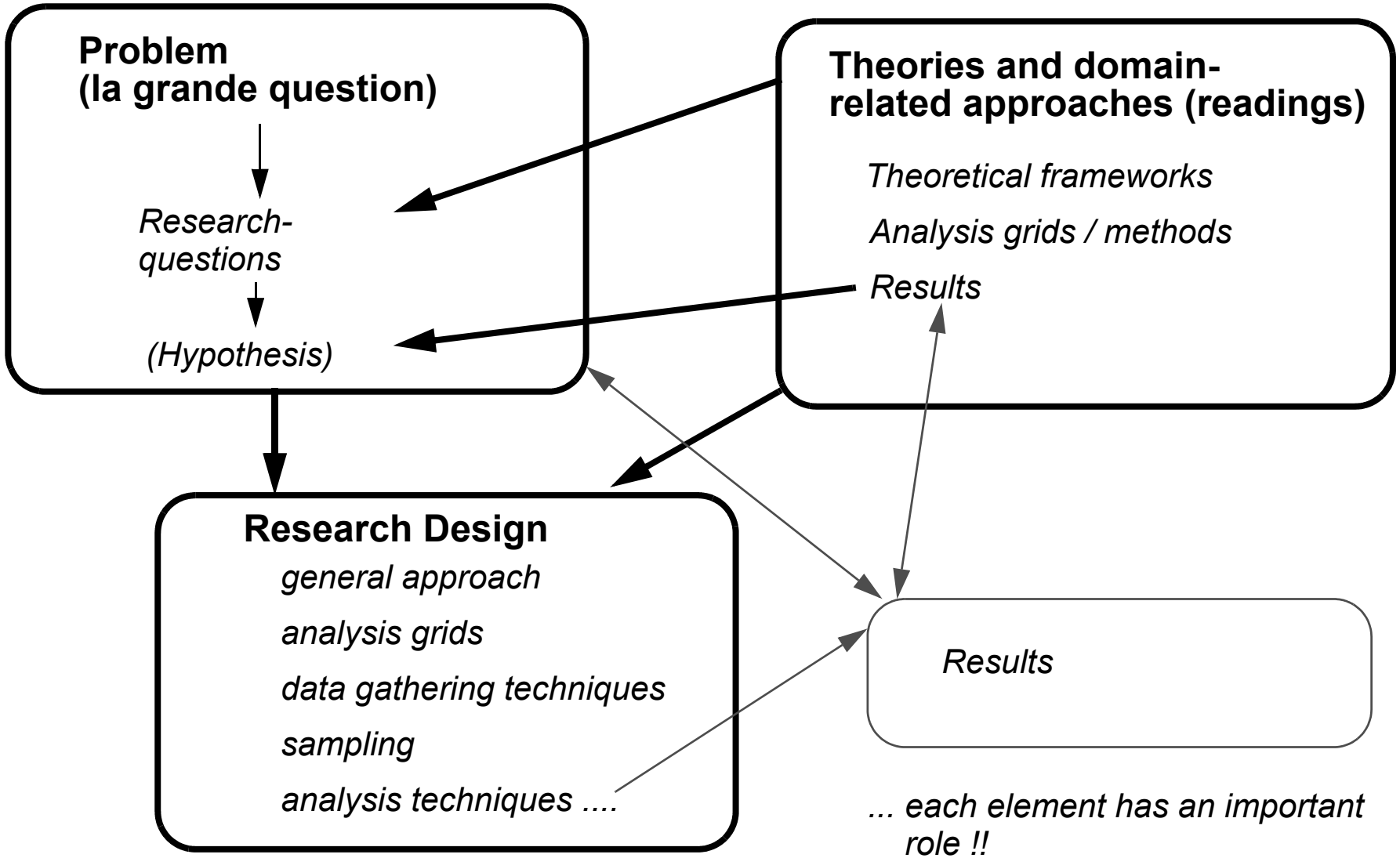
- Bibliography (use a real standard, like APA !)
- Documents to analyze
- Information interviews, etc., ...

2.7 Element: Work Agenda

(see module «xiv Planning techniques»)

3. The research plan is a whole

3.1 Major elements must be linked together



3.2 Recall: Research plan = what + why:

What ?	A good question ! (problématique)	• "So what" ? "What knowledge do we gain"
	A (or more) good conceptual frame-work(s) that...	• links your research to a larger identified issue, • structures your phenomenon • links your project to a body of existing knowledge • ... is preferably available as a nice drawing
How?	**Consider that your research plan should be ...**	• systematic: show that you will study your "big question" and related research questions (and nothing else!) • academic: identify your main approache(s) and major techniques you will use. • somewhat flexible (make sure that you identify priorities also) • In some designs it is required that show details regarding how you plan to answer your questions.
	Be realistic ! Prove that you have ...	• the time to do it ? • access to data ? • the ability to do it (or to learn how to do it) ?
A whole !	**Integration !**	• A coherent whole ! • All your intentions are made explicit. • Your research questions cover your essential planned work.

3.3 Before you believe that your are done

Check again:

1. Theoretical feasibility
   - You can't do it all by yourself, check the literature (if not already done so, find "ground breaking" articles)
   - In particular: theoretical frameworks, analysis grids, theoretical statements.
   - organize an interview with a least an academic and a domain expert
2. Inventory of approaches and methods
   - there are some constraints, you can't study everything in any way (but you do have choice !)
   - finding a good design always is an iterative process (so don't worry if your first version looks bad)
3. Identify your main approach :
   - look at similar research
   - if you want to prove things and make causality claims, you need comparison !
   - use qualitative approaches to explore and to understand, quantitative to confirm, generalize, prove, ...
4. Methodological feasibility
   - Dress a list of all the ***concepts*** that appear in your research questions (and hypothesis if you have)
   - Take each concept apart for its dimensions,
   - Operationalize each empirical dimension (make it is measurable)
5. Does your theory part really relate to your empirical / practical part ?
6. Make sure that you can produce needed data and then analyze them
   - do you know how to gather data (make observations, design questionnaires, make interviews, ...
   - can you handle these data ?

4. Importance of conceptual frameworks, typologies and grids

Analytical frameworks

- Provide an overview of the phenomenon (elements and relations)
- Help to bridge the gap between theory and empirical research
- Direct analysis (e.g. what causalities to look at, what's of interest, etc.)

Lists of dimensions

- Help to focus on all aspects of a concept

Analysis grids

- Help to organize data gathering and collection
- Will bridge the gap between general concepts at theory level, e.g. in your research questions) and measurable indicators

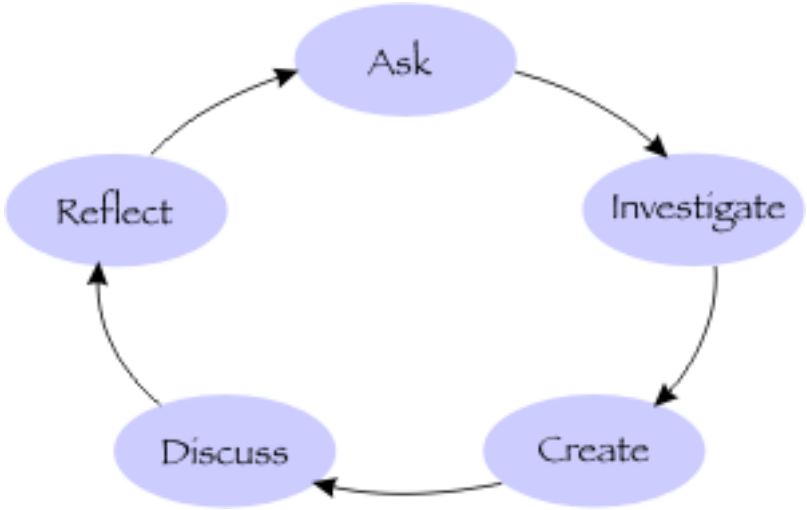
  (examples on the next slides)

4.1 Example frameworks

Exemple 4-1: The inquiry circle in inquiry-based learning doctrine

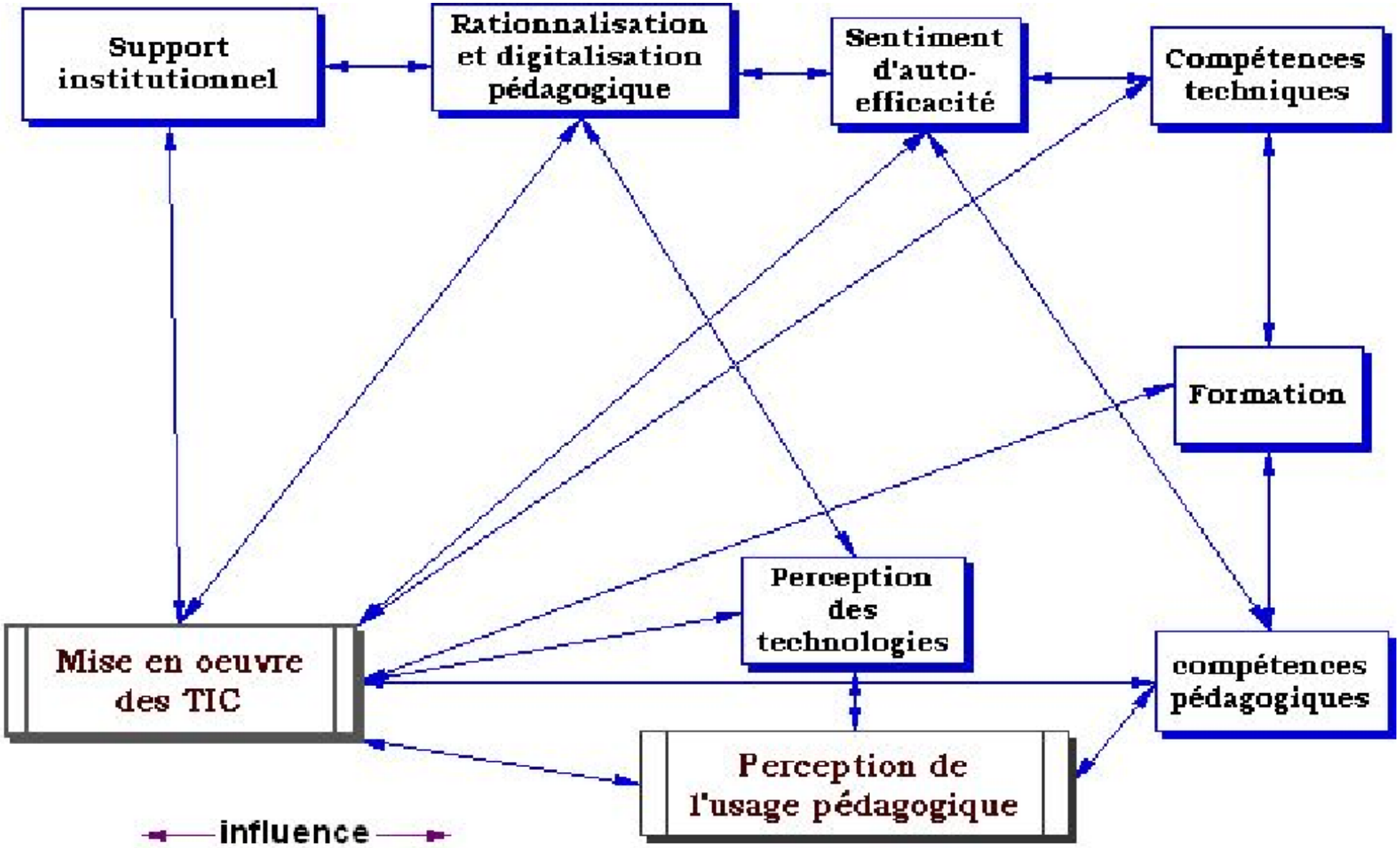
url: **http://www.inquiry.uiuc.edu/**

- See also: DESS mémoire de Stéphane Lattion (2004)



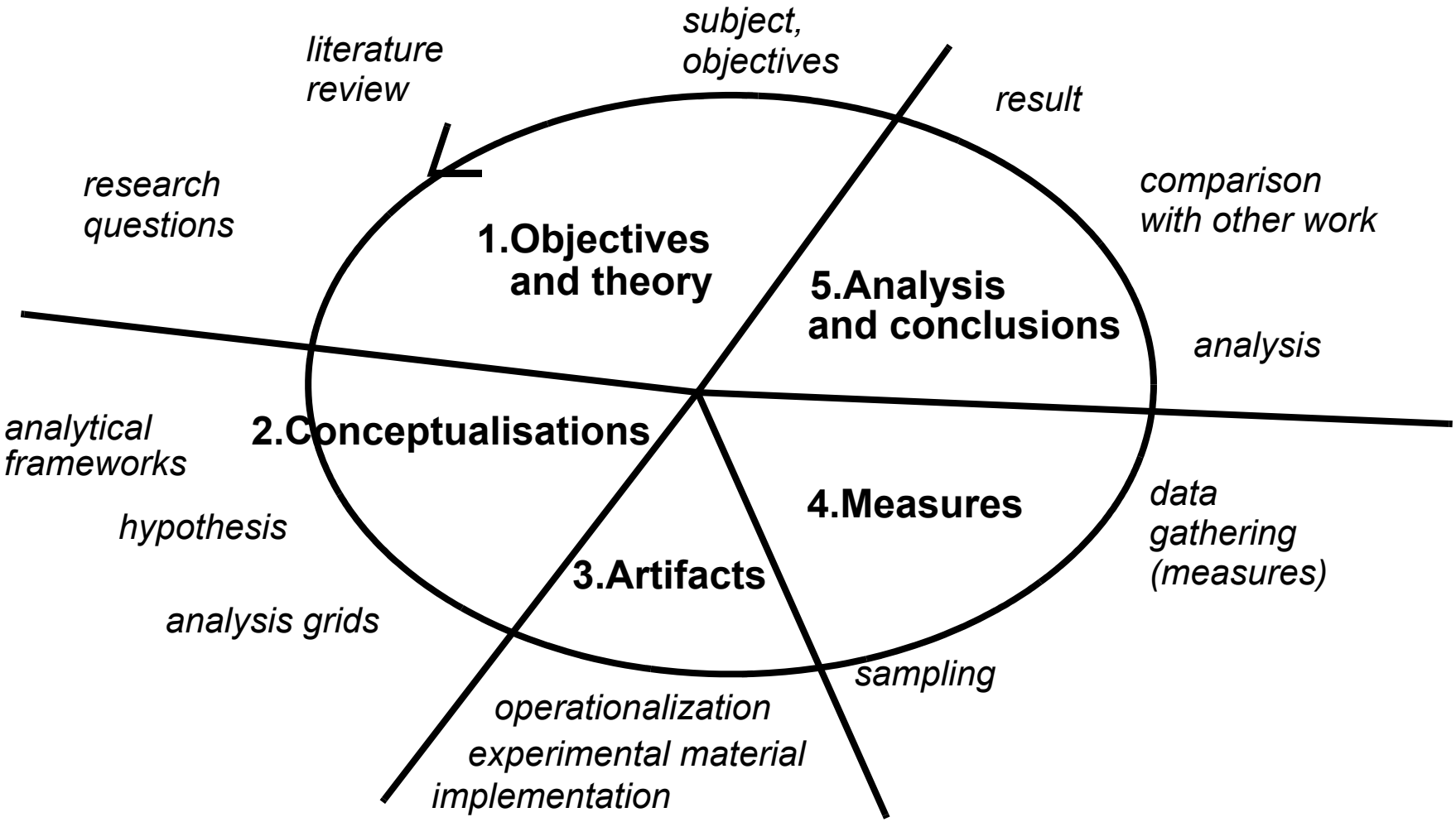
- clearly identifies 5 elements of inquiry
- claims/shows that inquiry is circular

Exemple 4-2: Gonzalez 8-factor model for ICT usage in schools



Exemple 4-3: A linear model of research

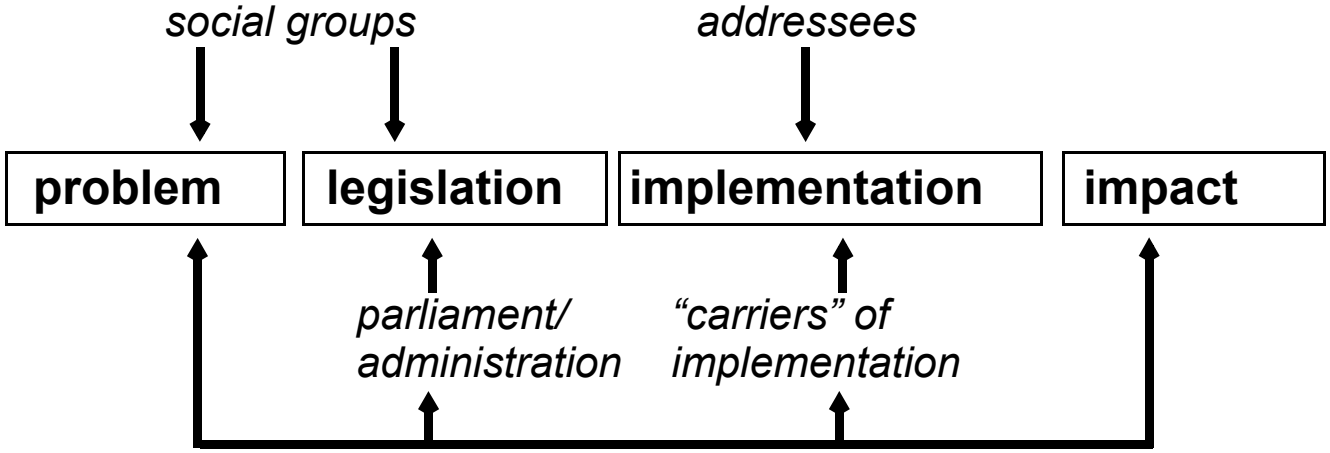
- Note: Even this course has a analytical organizing framework :)



Exemple 4-4: Implementation research model

Provides a certain "image" of the policy-making process:

- Actors intervene during the whole process (and not just in their "natural" stage"
- Problem perception, goals and other elements can be changed over time !
  - i.e. sometimes the implementors may redefine the set goals !



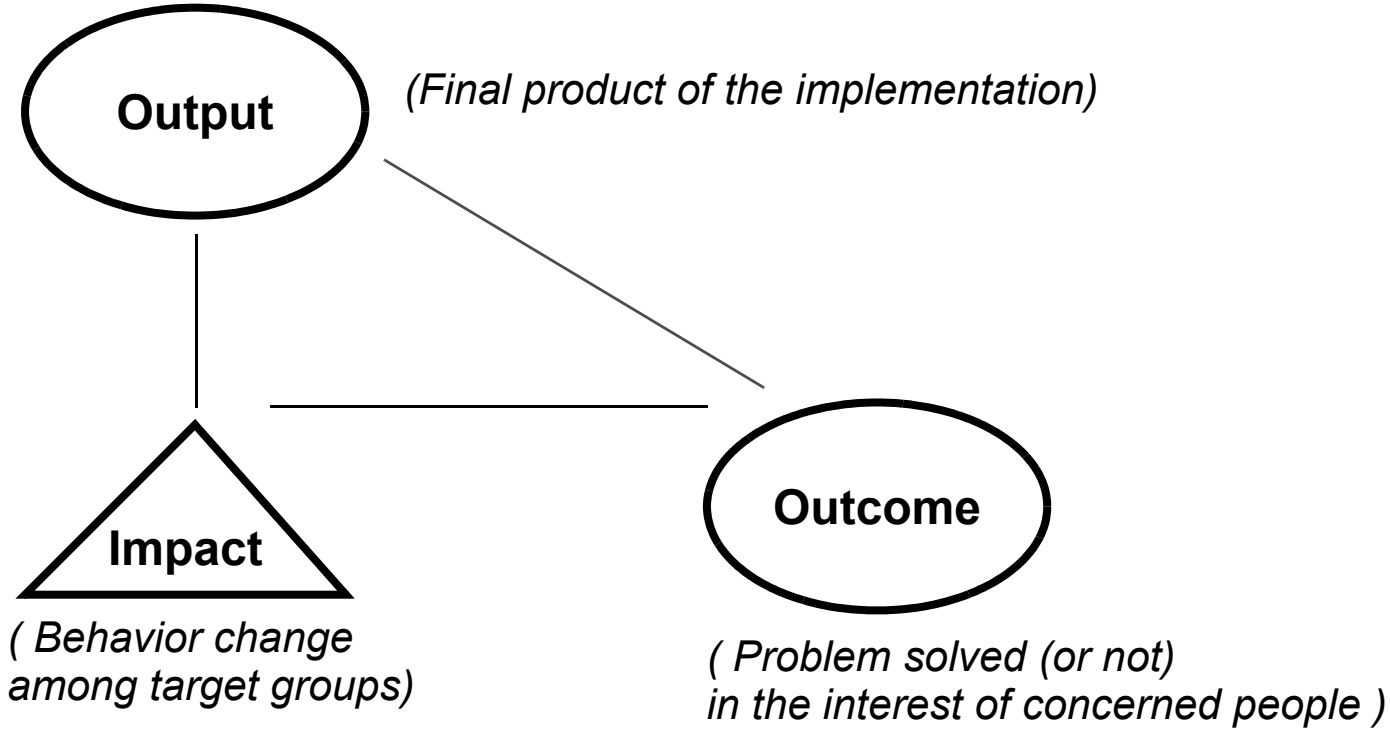
Possible relevance for educational technologies:

The fact that a government agency has been created to sponsor ICT-based pedagogical reform, does not entail that it will happen as they plan. Implementation "carriers" (e.g. schools) and addressees (e.g. teachers) may redefine goals and will have to establish operational practise.

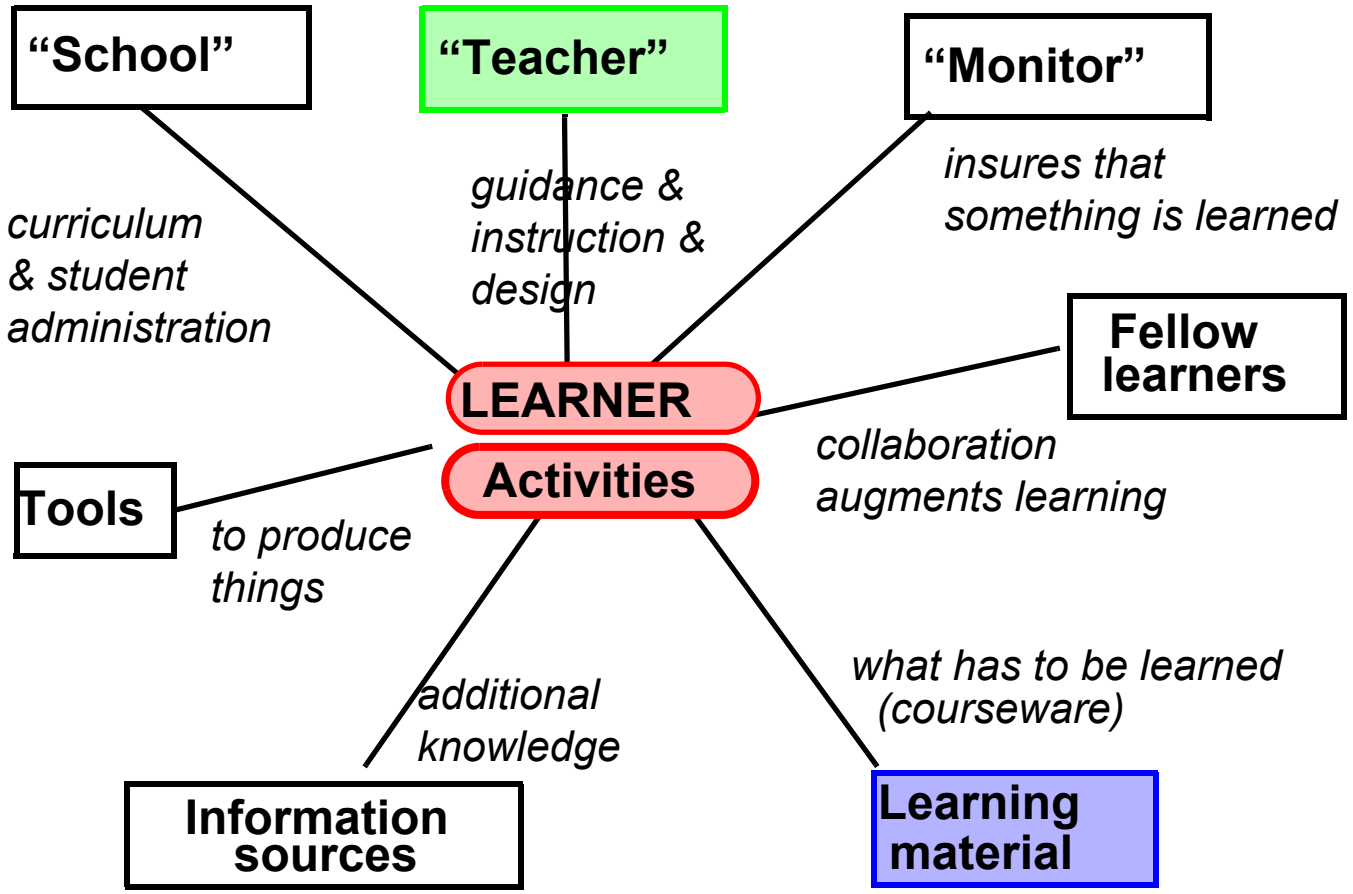
Exemple 4-5: Policy outcomes

Définition des prestations au sens de produits finaux de mise en oeuvre d'une politique publique [Knoepfel, P. (1996) TQM et fédéralisme, Cahier de l'IDHEAP, 159, p 10]

- E.g. useful to provide a perspective on the analysis of educational reform policies
- There are three major kinds of "results" you can study according to the author



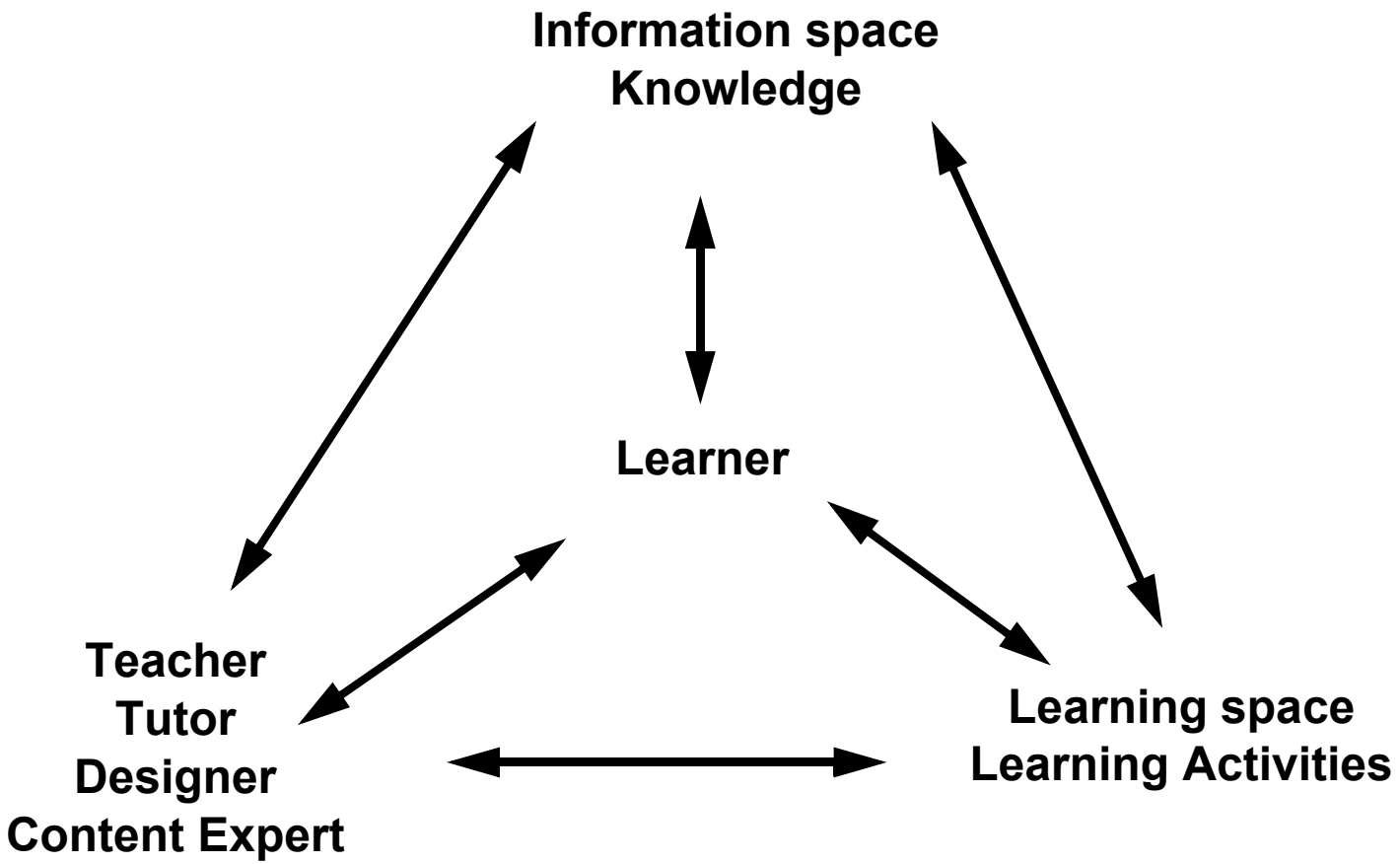
Exemple 4-6: Functions of a learning environment: Where do we focus ?



modified from Sandberg

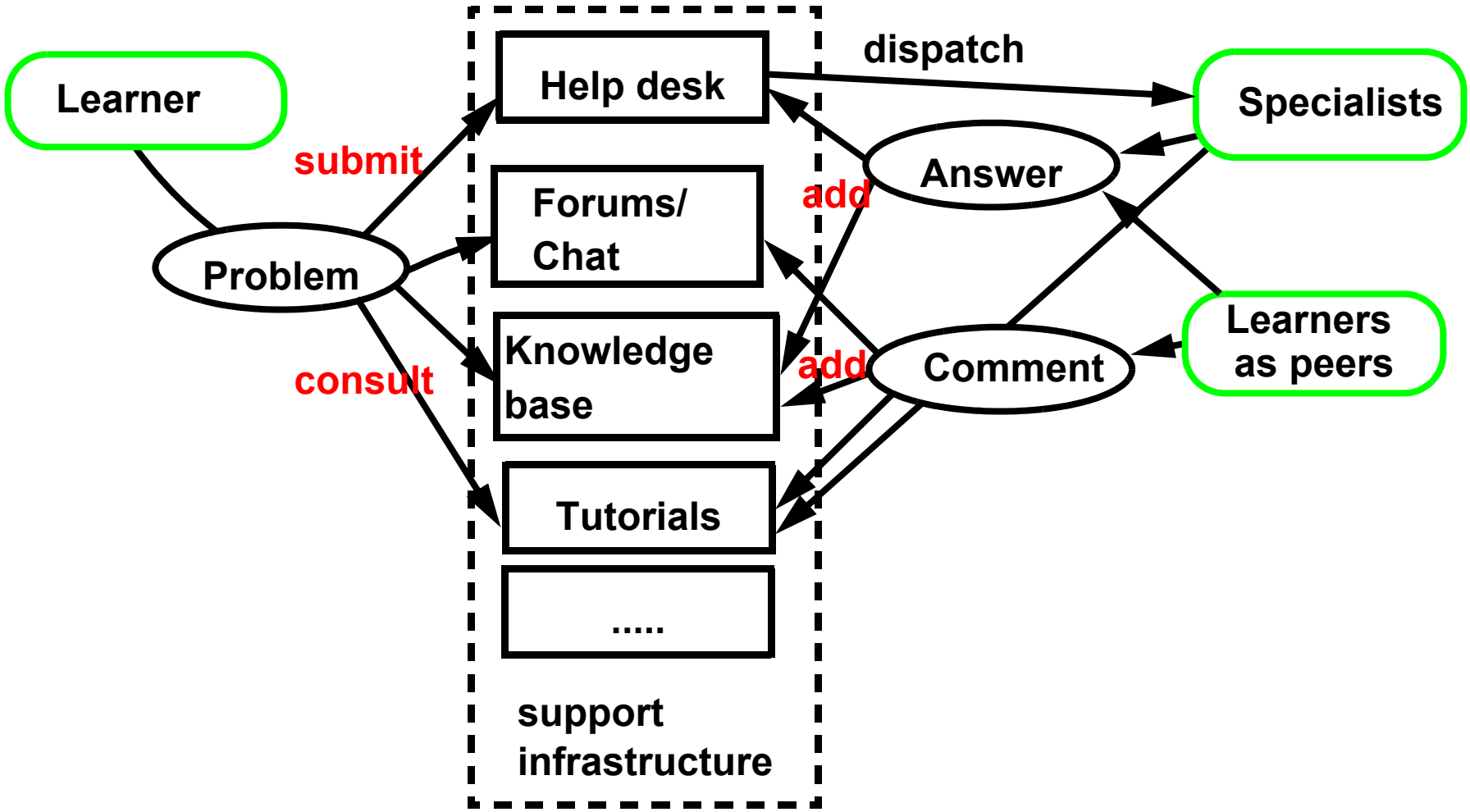
- This model makes you think about functions that a learning environment should provide and therefore about structure that will instantiate function
- It also allows to think about priorities in your design
  - E.g. teacher role is central in activity-based designs
  - E.g. Learning material is important in e-learning designs for mass-education

Exemple 4-7: A simple picture defining key elements of an ICT design



- This is not a great model, but it makes you think about the distinction between pedagogical activities, informations (learning material), people involved.....
- Roles and relations here can't be filled in without some reference to pedagogical method (so it's not such a good model)

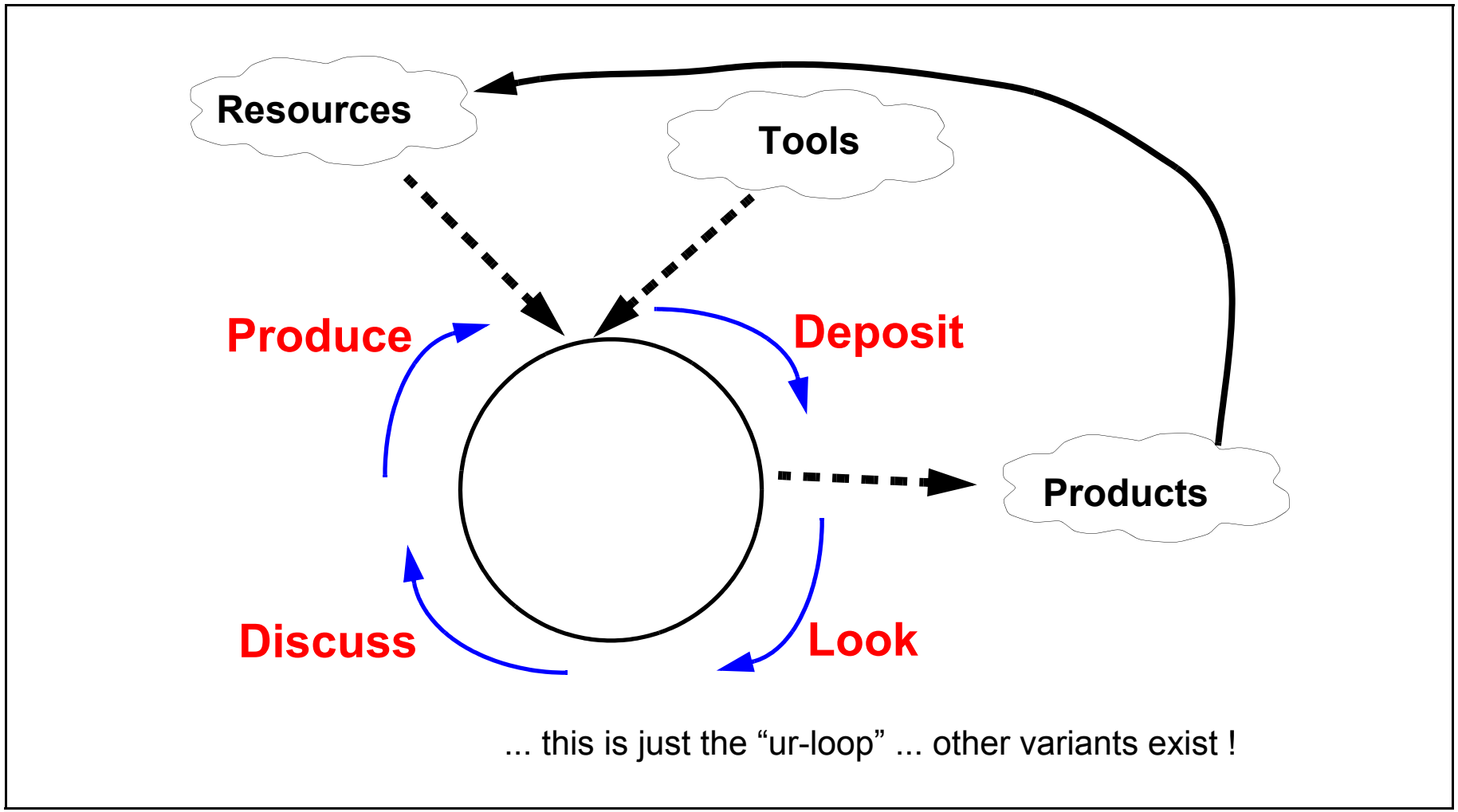
Exemple 4-8: A "help desk model" for "on-the-spot" life-long learning



- This model allows you to think at the same time about system components and actor's roles
- Technical infrastructure used: either C3MS portals, groupware, specialized help desk, knowledge management software.

Exemple 4-9: My favorite picture for introducing activity-based teaching

- Scenarios are sequences of activity phases within which group members do tasks and play specific roles
- This ***orchestration*** implies organizing workflow loops



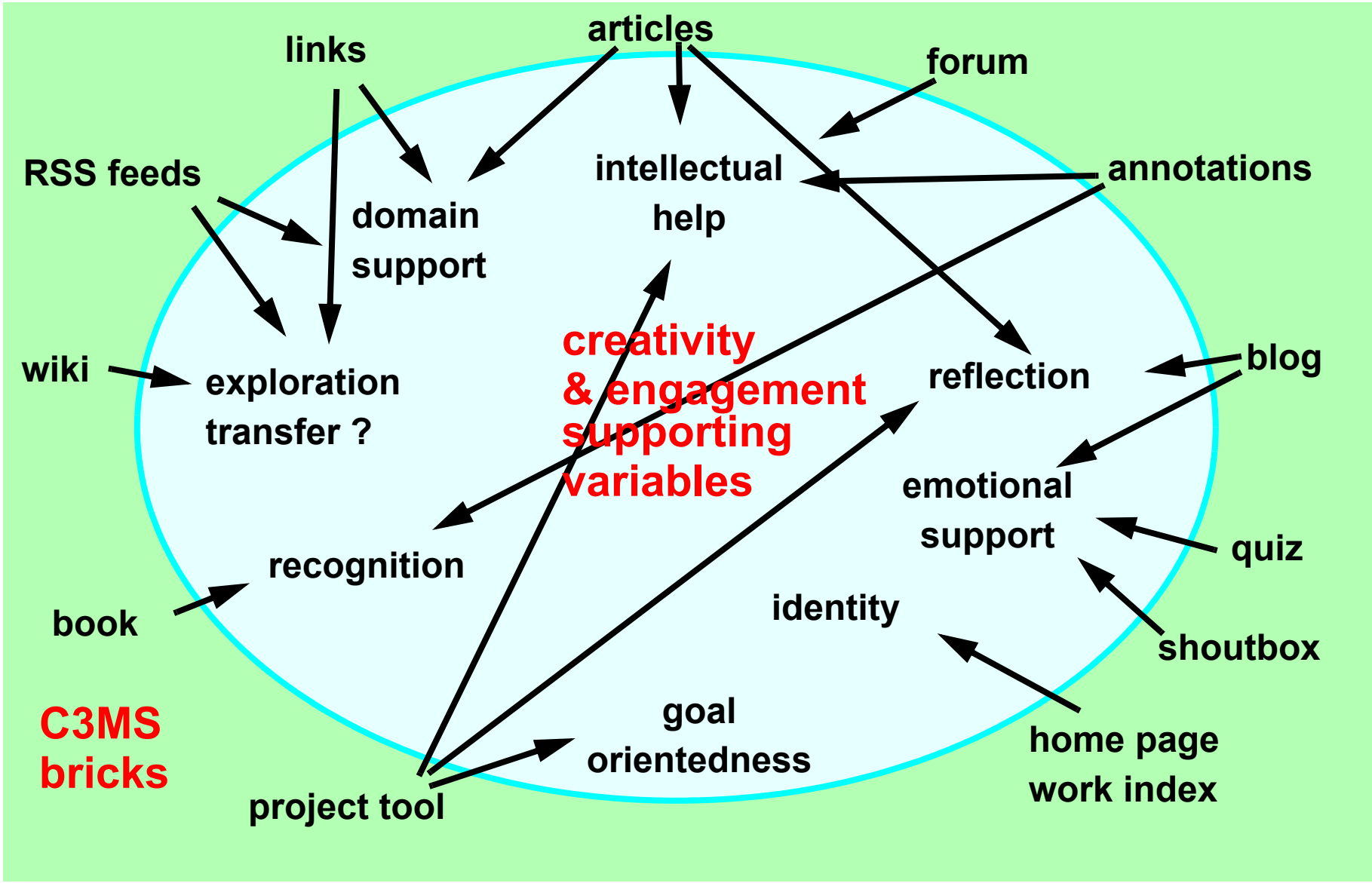
- This framework clearly shows that students have to engage in activities, that activities lead to products that can be discussed and reused.

Exemple 4-10: Definition of a C3MS (community) portal (Schneider)

Function	C3MS modules (tools of the portal)
Content management	News engine (including a organization by topics and an annotation mechanism) - Content Management Systems (CMS) Collaborative hypertexts (Wikis) - Image albums (photos, drawings, etc.) - Glossary tool or similar - Individual weblogs (diaries)
Knowledge exchange	News syndication (headlines from other portals) File sharing (all CMS tools above)
Exchange of arguments	Forums and/or new engine Chats, ...
Project support	Project management modules, Calendars, ...
Knowledge management	FAQ manager - Links Manager (“Yahoo-like”) Search by keywords for all contents “top 10” box, rating systems for comments “What’s new” (forum messages, downloads, etc.), ...
Community management	Presence, profile and identification of members Shoutbox (mini-chat integrated into the portal page) Reputation system Activity tracing for members Event calendar News engine, ...

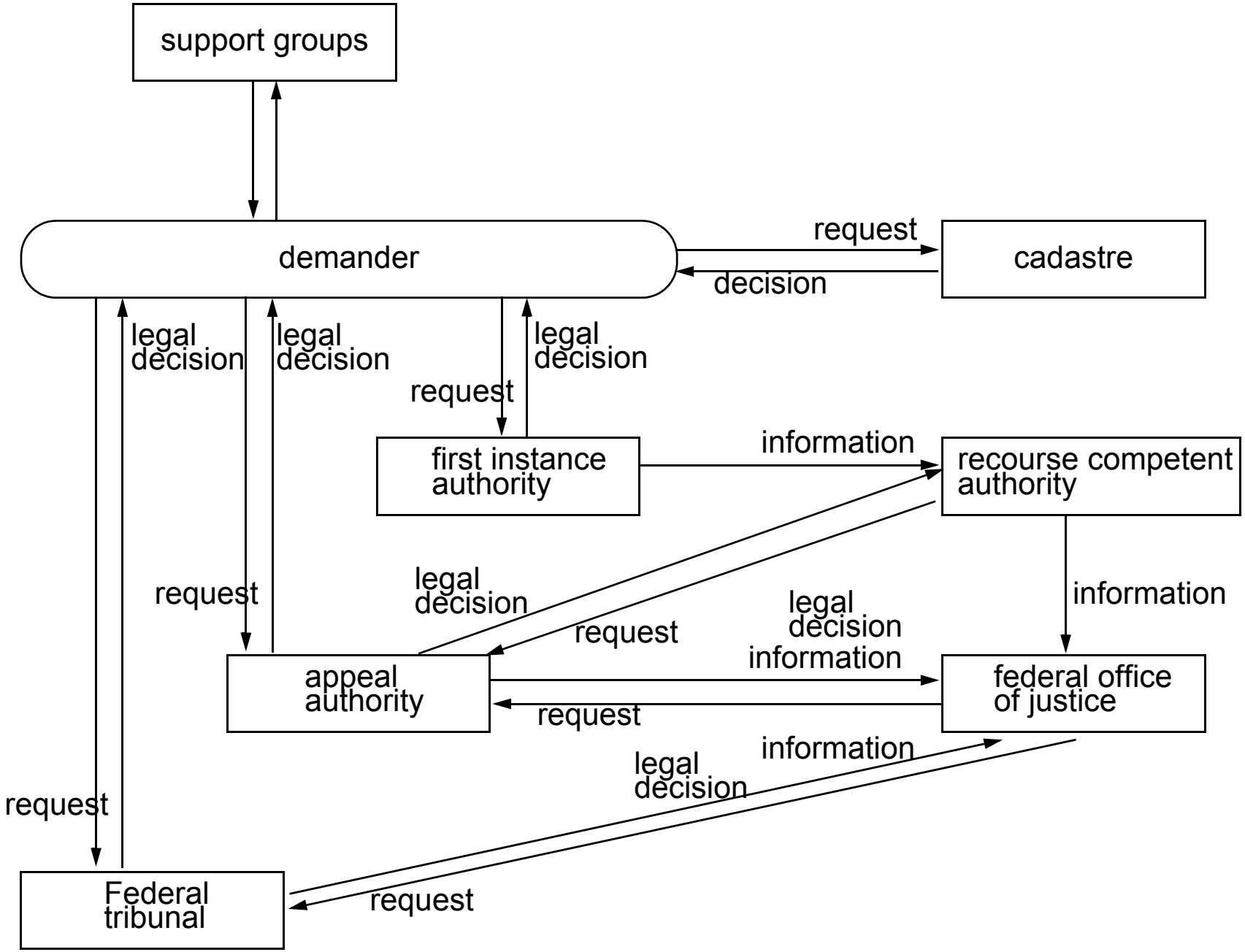
- This table makes association between a list of functions and structure (software modules)

Exemple 4-11: C3MS modules support for creativity and engagement variables



- Also links structure (software elements) to functions (creativity and engagement enhancing variables)

Exemple 4-12: Visualization of formal procedures



4.2 Lists of dimensions and typologies

Exemple 4-13: Types of Learning (Kearsley's http://tip.psychology.org/)

1. Attitudes:
   - Disposition or tendency to respond positively or negatively ....
2. Factual Information (memorization):
   - Processing of factual information and remembering .....
3. Concepts (discrimination):
   - ... how to discriminate and categorize things. Concept mastery is not related to simple recall and must be constructed.
4. Reasoning (inference, deduction):
   - thinking activities that involve making or testing inferences
5. Procedure learning:
   - .... being able to solve a certain task by applying a procedure.
6. Problem solving:
   - identification of subgoals, use of methods to satisfy subgoals.
7. Learning strategies:
   - can hardly be taught and only be learned through appropriate experience and to some extent only !

Exemple 4-14: Major pedagogical approaches (strategies)

(**Baumgartner & Kalz**, modifications by Schneider

Transfer	Tutor	Coach
Factual knowledge, "know-that"	Procedural knowledge, "know-how"	Social practise, "knowing in action"
Transfer of propositional knowledge	Presentation of predetermined problems	Action in (complex and social) situations
to know, to remember	to do, to practise	to cope, to master
Production of correct answers	Selection of correct methods and its use	Realization of adequate action strategies
Verbal knowledge, Memorization	Skill, Ability	Social Responsibility
to teach, to explain	to observe, to help, to demonstrate	to cooperate, to support
Teaching I	**Teaching II**	**Teaching III**

- E.g. helps to decide what sort of teaching and learning you want to study or favor with an ICT-based environment

Exemple 4-15: Khan's (2000) list of pedagogical methods and strategies

Presentation	**Exhibits**
Demonstration	**Drill and Practice**
Tutorials	**Games**
Story Telling	**Simulations**
Role-playing	**Discussion**
Interaction	**Modeling**
Facilitation	**Collaboration**
Debate	**Field Trips**
Apprenticeship	**Case Studies**
Generative Development	**Motivation**

Makes you worry a bit:

- Which pedagogical strategies work better **for what types** of learning ?

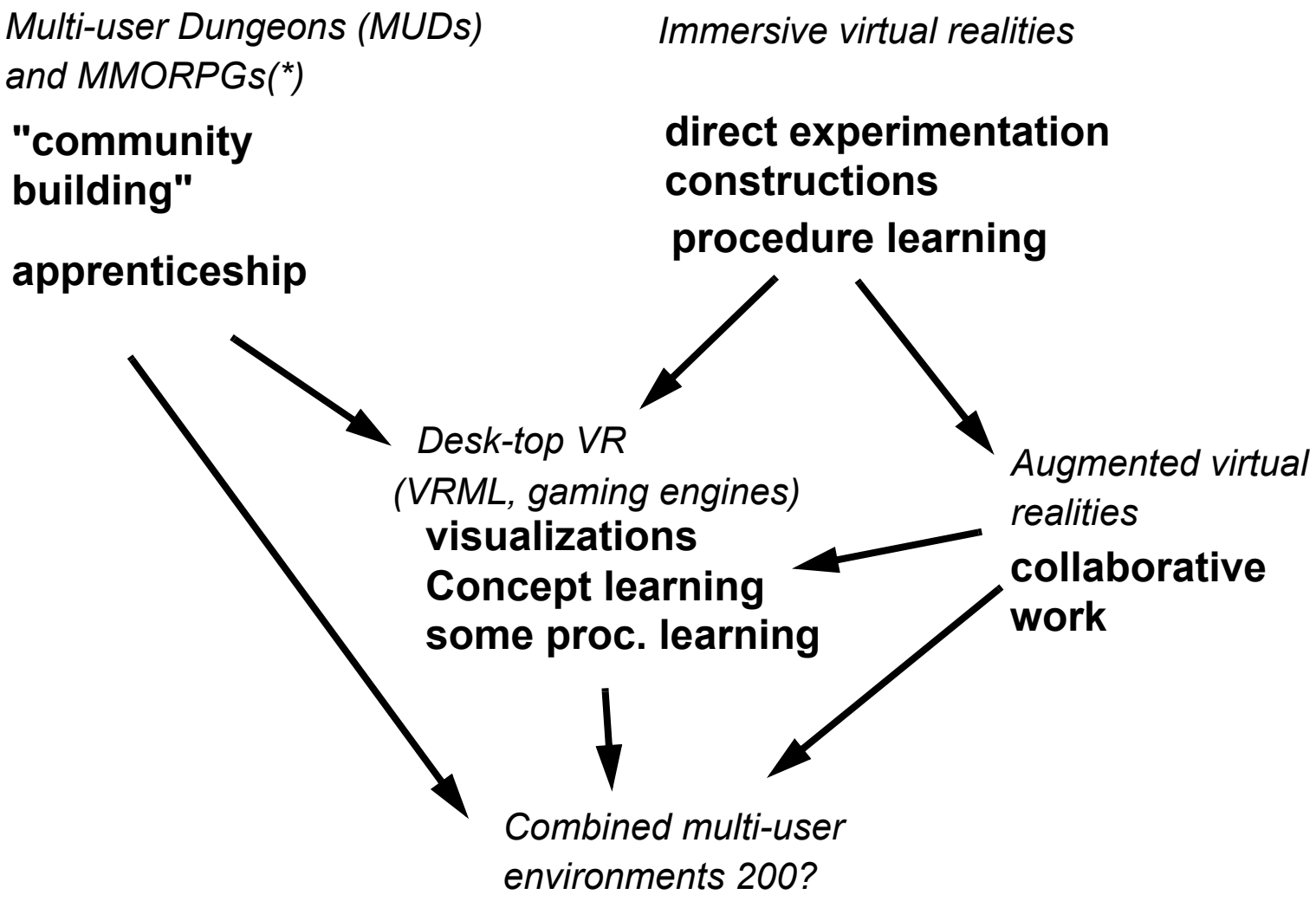
Exemple 4-16: Intrinsically motivating elements of gaming ...

(Frété 2002, Master thesis TECFA)

Element	
fantasy	• imagination and freedom (make believe + voluntary activity)
challenge & curiosity	• a level of difficulty that triggers curiosity • presence of goals • uncertainty (surprise)
feedback	• immediate • clear
self-esteem	• adapted tasks • encouragement to learn & augment scores
control	• levels to play, user selection of goals, strategies & tactics

- What could we learn from gaming ?
- Why do kids spend many hours playing games without getting bored or tired ?

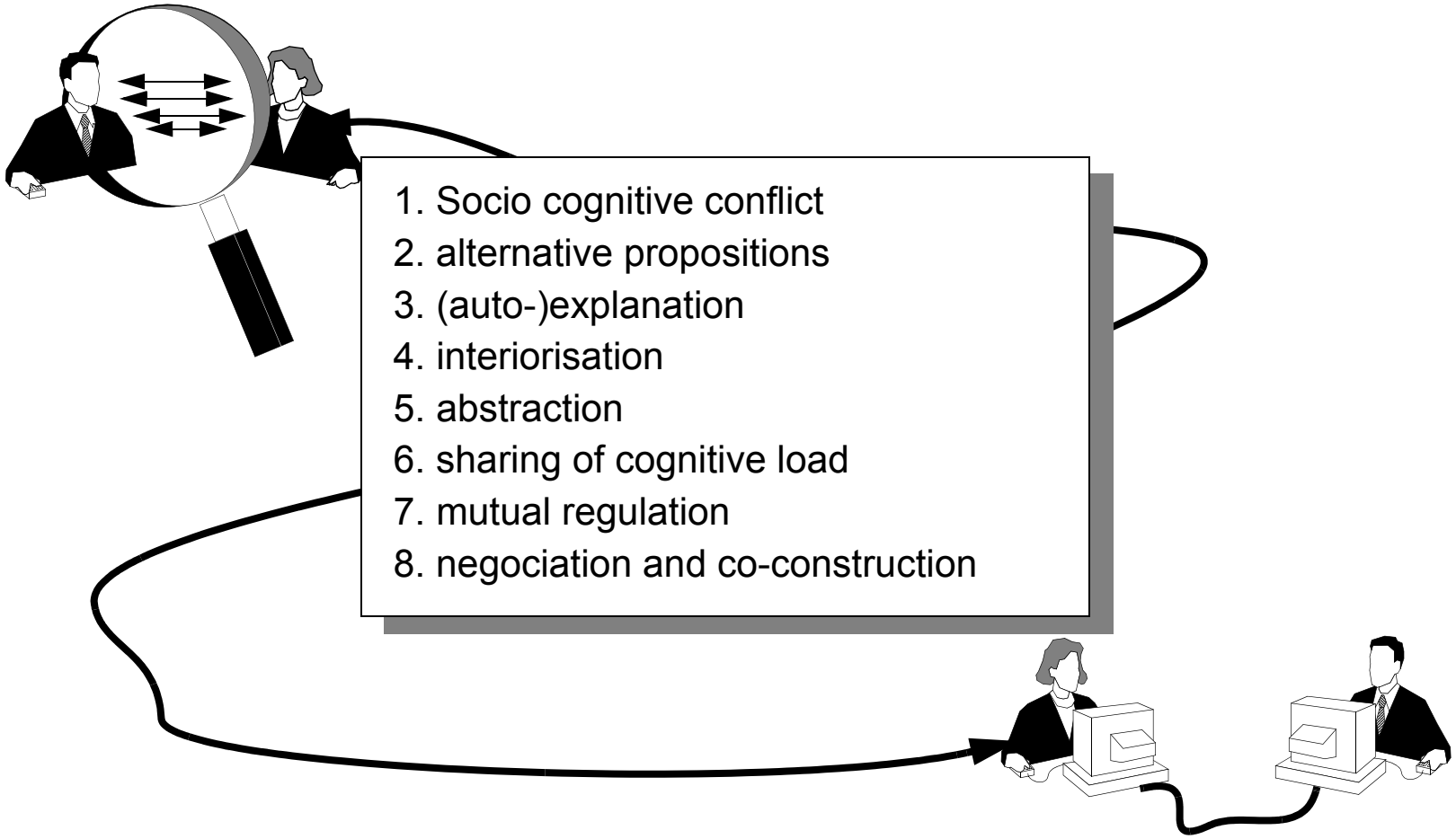
Exemple 4-17: Typology and typical functions of virtual environments



(*)Massively multiplayer online role-playing games

- What do ***you*** mean by a virtual environment ?
- Is is safe to use "virtual environment" when you talk about an e-learning platform ?

Exemple 4-18: Pierre Dillenbourg on CSCL (Computer supported collaborative learning)



- Collaborative learning can be very powerful because its properties engage students in various meta-cognitive activities.
- Note: needs scenario-building (story-boarding)

4.3 Example analysis grids

- more grids (scales) are shown in quantitative design and analysis modules

Exemple 4-19: Ergonomics criteria de Bastien

url: **http://www.lergonome.org/pages/detail_articles.php?indice=22**

1. Guidage 1.1 Incitation* 1.2 Groupement/Distinction entre items 1.2.1 Groupement/Distinction par la localisation* 1.2.2 Groupement/Distinction par le format* 1.3 Feed-back immédiat* 1.4 Lisibilité* 2. Charge de travail 2.1 Brièveté 2.1.1 Concision* 2.1.2 Actions minimales* 2.2 Densité informationnelle* 3. Contrôle explicite 3.1 Actions explicites* 3.2 Contrôle utilisateur*	4. Adaptabilité 4.1 Flexibilité* 4.2 Prise en compte de l'expérience de l'utilisateur* 5. Gestion des erreurs 5.1 Protection contre les erreurs* 5.2 Qualité des messages d'erreur* 5.3 Correction des erreurs* 6. Homogénéité/Cohérence* 7. Signifiance des codes et dénominations* 8. Compatibilité*

Exemple 4-20: Profil des compétences d'un manager (dimensions)

Emery, Y. (1997) Le centre d'évaluation pour managers publics, Cahier de l'IDHEAP 166, p9.

A. compétences personnelles:

1. introspection et apprentissage permanent
2. résistance aux tensions, énergie et ténacité

B. compétences intellectuelles:

3. pensée systémique, capacité d'analyse et de synthèse

C. compétences relationnelles:

4. leadership et de gestion de groupe
5. capacité d'écoute et de communication

D. compétences managériales:

6. attention à l'environnement et proactivité
7. entrepreneurship et esprit de décision
8. planification et controlling

Sur 4 pages l'auteur indique ensuite les sous-dimensions et ensuite comment les mesurer par des dispositifs expérimentaux variés....

Exemple 4-21: COLLES Grid - socio-constructivist features of on-line teaching

(Taylor and Maor) - Teacher education over the Internet

1. Relevance

- How relevant is on-line learning to students' professional practices?

2. Reflection

- Does on-line learning stimulate students' critical reflective thinking?

3. Interactivity

- To what extent do students engage on-line in rich educative dialogue?

4. Tutor Support

- How well do tutors enable students to participate in on-line learning?

5. Peer Support

- Is sensitive and encouraging support provided on-line by fellow students?

6. Interpretation

- Do students and tutors make good sense of each other's on-line communications?

Remarks:

- This grid clearly identifies 6 dimensions of socio-constructivism (there are many other grids)
- We will see in the data gathering and analysis modules how to make it operational

Theory driven research designs

(version 0.9, 1/4/05, some examples in french)

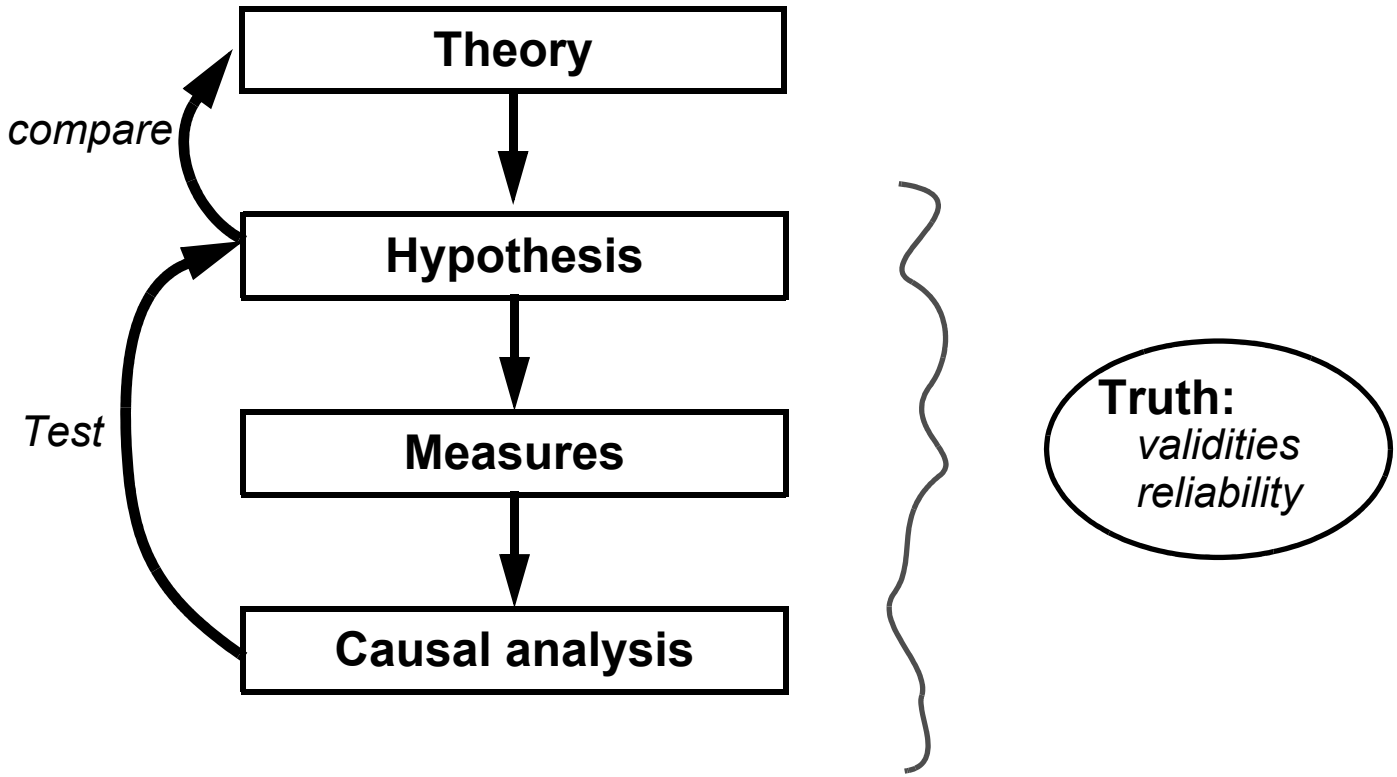
Code: res-design-quant

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Theory driven research

Most important elements of an empirical theory-driven design:



- ***Conceptualisations***: Each research question is formulated as one or more hypothesis. Hypothesis are grounded in theory.
- ***Measures***: are usually quantitative (e.g. experimental data, survey data, organizational or public "statistics", etc.) and make use of artifacts like surveys or experimental materials
- ***Analyses & conclusion***: Hypothesis are tested with statistical methods

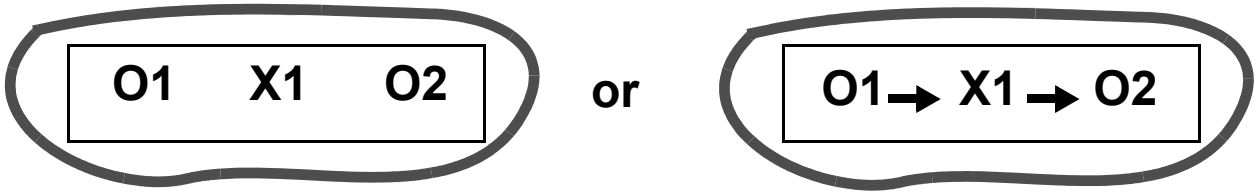
2. Experimental designs

2.1 The scientific ideal

☞ **Control physical interactions between variables**

Experimentation principle in science:

1. The study object is completely isolated from any environmental influence and observed (O_1)
2. A stimulus is applied to the object (X)
3. The object's reactions are observed (O_2).



- O1 = observation of the non-manipulated object's state"
- X = treatment (stimulus, intervention)
- O2 = observation of the manipulated object's state".

☞ **Effect of the treatment (X): the difference between O_1 and O_2**

2.2 The simple experiment in human sciences

☞ **It is not possible to totally isolate a subject from its environment**

Simple experimentation using a control group :

R	**X O**	**experimental group**
R	**O**	**control group**

X=stimulus,
(independent explanatory variable)
O=mesure
(dependant variable, to explain)

Principle:

1. Two groups of subjects are chosen randomly (R) within a mother population:
   - this ought to eliminate systematic influence of unknown variables on one group
2. Ideally, subjects should not be aware of the research goals
3. The independent variable (X) is manipulated by the researcher (experimental condition)

Analysis of results: effects are compared:

	effect (O)	**non-effect (O)**		
treatment: (group X)	bigger	smaller	100 %	vertical comparison
non-treatment: (group non-$\overline{X}$)	smaller	bigger	100 %	

- What is the probability that treatment X lead to effect O ?

(b) Simple experiment with different treatments:

R	X1	O1	**experimental group 1**
R	X2	O2	**experimental group 2**
R	X3	O3	**experimental group 3**
R	X..	O..	

- a slightly different alternative
- Example: First students are assigned randomly to different lab sessions using a different pedagogy (X) and we would like to know if there are different effects at the end (O).

Problems with simple experimentation:

- Selection: Subjects may not be the same in the different groups
  - Since samples are typically very small (15-20 / group) this may have an effect
- Reactivity of subjects: Individuals ask themselves questions about the experiment (compensatory effects) or may otherwise change between observations
- Difficulty to control certain variables in a “real” context
  - Example: A new ICT-supported pedagogy may work better, because it stimulates the teacher, students may increase their attention and work input, groups may be smaller and individuals get more attention.
  - In principle one could test these variables with experimental conditions, but for each new variable, one has to add at least 2 more experimental groups, ...

2.3 The simple experiment with pretests:

R	**O1**	**X**	**O2**	**experimental group**
R	**O3**		**O4**	**control group**

- To control the potential difference between groups: compare O_2-O_1 (difference) with O_4-O_3
- Disadvantage: effects of the first measure on the experiment
  Example: (a) If X is supposed to increase pedagogical effect, the O_1 and O_3 tests could have an effect (students learn by doing the test), so you can't measure the "pure" effect of X.

The Solomon design:

R	**O1**	**X**	**O2**
R	**O3**		**O4**
R		**X**	**O5**
R			**O6**

- combines the simple experiment design with the pretest design:
- and we can test for example: O2>O1, O2>O4, O5>O6, O5>O3

Note: comparing 2 different situations is NOT an experiment ! The treatment variable X must be simple and uni-dimensional (else you don't know the precise cause of an effect)

- There a more complicated designs to measure interaction effects of 2 or more treatments

A. The non-experiment: what you should not do

The experiment without control group nor pretest:

X	O	experimental group

Exemple 2-1: A bad discourse on ICT competence of pupils

"Since we introduced ICT in the curriculum, most of the school's pupils are good at finding things on the Internet"

There is a lack of real comparison !!

- We don't compare: what happens in other schools that offer no ICT training ? (Maybe this is a general trend since more households have computers and Internet access.)
- We don't even know what happened before !

Most of the students are good ! ...

	x= ICT in school	x= no ICT in school
bad at web search	10 students	???
good at web search	20 students	???

- horizontal comparison of % ???

Things have changed ! ...

	before	after
bad at web search	???	10 students
good at web search	???	20 students

- horizontal comparison of % ???

Experiments without randomization nor pretest

X O	**experimental group**
O	**control group**

There is no control over the conditions and the evolution of the control group

- Example: Computer animations used in school A are the reason of better grade averages (than in school B)
- School A simply may attract pupils from different socio-economic conditions and that usually show better results.

The experiment without control group

O X O	**experimental group**

We don't know if X is the real cause

- Example: "Since I bought my daughter a lot of video games, she is much better at word processing "
- You don't know if this evolution is "natural" (kids always get better at word processing after using it a few times) or if she learnt it somewhere else.

2.4 Examples

Exemple 2-2: Under which conditions does animation favor learning ?

Master (DESS) thesis by Cyril Rebetez, TECFA 2005

Note: Funded by a real research project, i.e. the student did ***more than usually expected*** !

Research question

"Notre recherche a pour objectif de mettre en évidence l'influence, de la ***continuité du flux***, de la ***collaboration***, de la ***permanence des états antérieurs,*** ainsi que de vérifier la portée de ***variables individuelles*** telles que l'empan visuel et les capacités de rotation mentale." (p.33)

- This objective is then further developed through 1 1/2 pages in the thesis. Causalities are discussed in verbal form (p. 34-40) and then "general" hypothesis are presented on 2 pages.

Explanatory (independent) variables, i.e. conditions

1. Animation, ***static vs. dynamic condition***: allows to visualize transition between states. Static presentation forces a student to imagine movement of elements.
2. Permanence, ***present or absent condition***: If older states of the animation are shown, students have better recall and therefore can more easily build up their model.
3. Collaboration, ***present or absent condition***: Working together should allow students to create more sophisticated representations.

Operational hypothesis (presented in the methodology chapter):

Quotations from the thesis:

- Animation
  - Les scores d'inférence ainsi que les scores de rétention seront plus élevés en condition dynamique qu'en condition statique.
  - La charge cognitive perçue sera plus élevée en condition dynamique qu'en condition statique. Les temps de discussion ainsi que les niveaux de certitude n'ont pas de raison d'être différents entre les conditions.
- Permanence
  - Les participants en condition avec permanence auront de meilleurs résultats aux questionnaires que les participants en condition sans permanence. Les résultats d'inférence sont tout particulièrement visés par cet effet.
  - La charge cognitive perçue ne devrait pas être différente entre ces deux conditions. Les temps de discussion ainsi que les niveaux de certitude devraient être plus élevés avec que sans permanence.
  - L'influence de la permanence sera d'autant plus grande si les participants sont en condition de présentation dynamique.
- Collaboration
  - La collaboration aura un effet positif sur l'apprentissage, autant en ce qui concerne la rétention que l'inférence. Toutefois, l'inférence devrait être tout particulièrement avantagée en cas de " grounding ". Les participants en duo auront donc de meilleurs scores que les participants en solo.
  - La charge cognitive perçue devrait suivre le niveau de résultat et être plus bas en condition duo qu'en solo.
  - Les temps de discussion devraient être naturellement plus grand en condition duo. Les niveaux de certitude devraient également s'élever en condition duo face à la condition solo.

Method (short summary !)

- Population = 160 students
  - All have been tested to check if the were novices (show lack of domain knowledge used in the material)
- Material
  - Pedagogical material is 2 different multimedia contents (geology and astronomy), each one in 2 versions. For the dynamic condition there are 12 animations, for the static conditions 12 static pictures
  - Contents of pedagogical material: "Transit of Venus" made with VRML, "Ocean and mountain building" made with Flash
  - These media were integrated in Authorware (to take measures and to ensure a consistent interface)
- Procedure (roughly, step by step)
  - Pretest (5 questions)
  - Introduction (briefing)
  - For solo condition: paper folding and Corsi visio-spatial tests
  - Material
  - Cognitive load test (nasa-tlx)
  - Post-test (17 questions)
- Measured dependant variables:
  - Nombre de réponses correctes aux questionnaires de rétention.
  - Nombre de réponses correctes aux questionnaires d'inférence.
  - Niveau de certitude des réponses aux questionnaires.
  - Scores sur cinq échelles de charge cognitive perçue (tirées du nasa-tlx).
  - Score au paper-folding test.
  - Score d'empan au test de Corsi.
  - Temps (sec) et nombre d'utilisation des vignettes en condition de permanence.
  - Temps de réflexion entre les présentations (sec).

3. Quasi-experimental designs

- are inspired by experimental design (pre- and post tests, and control groups)
- are led in non-experimental situations (e.g. real contexts)
- are used when the treatment is too "heavy", i.e. does not just involve a well defined variable
- address all sorts of threats to internal validity (see next slides)

In quasi-experimental situations, you really lack control

- you don’t know all possible stimuli (causes not due to experimental conditions)
- you can’t randomize (distribute evenly other intervening unknown stimuli over the groups)
- you may lack enough subjects

Usage examples in social sciences:

- evaluation research
- organizational innovation studies
- questionnaire design (think about control variables to test alternative hypothesis)

3.1 Interrupted time series design

O1	O2	O3	O4	X	O5	O6	O7	O8

Advantages:

- you may control (natural) trends

Problems:

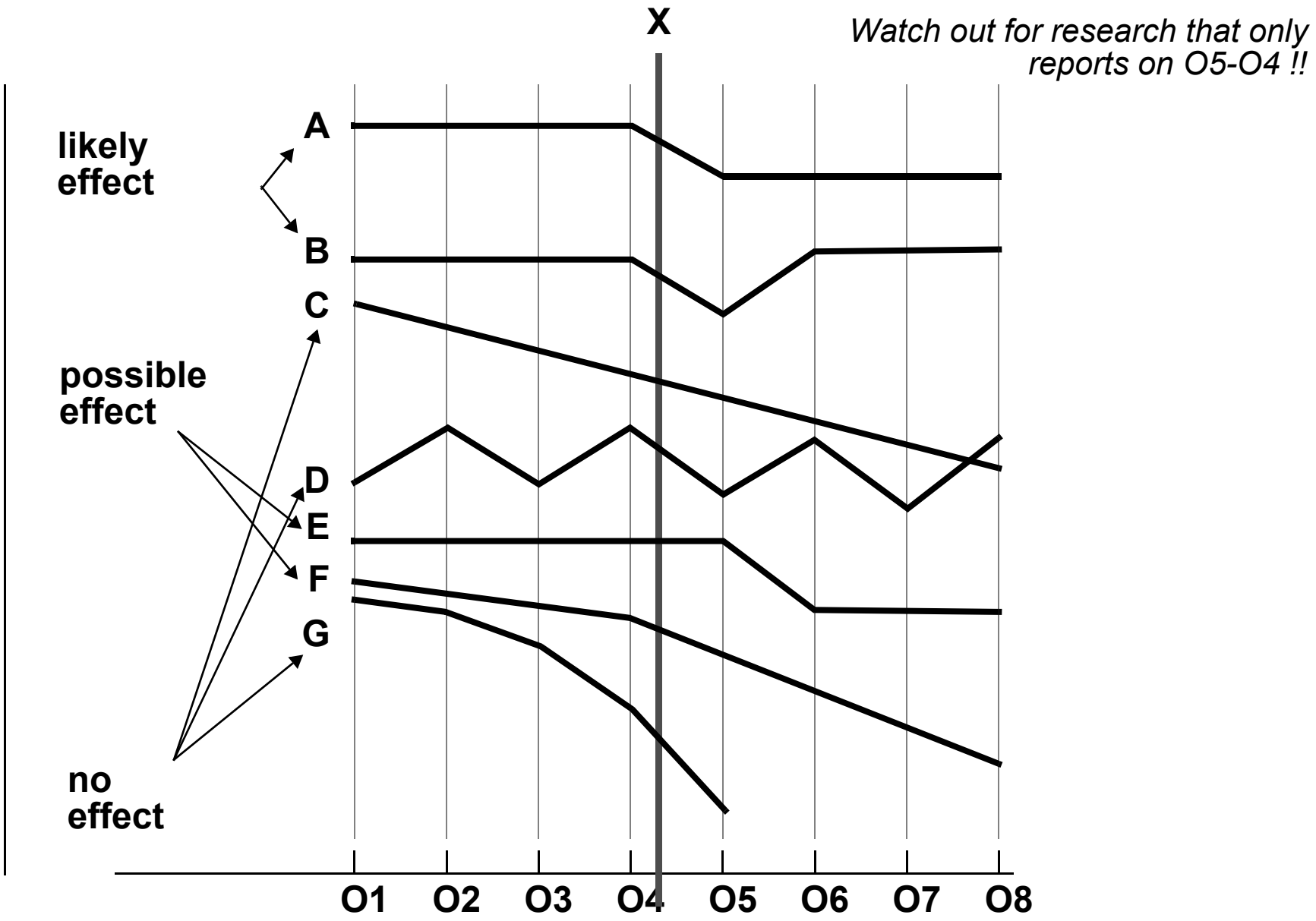
- Control of external simultaneous events (X_2 happens at the same time as X_1)
- Example: ICT-based pedagogies are introduced together with other pedagogical innovations. So which one does have an effect on overall performance ?

Practical difficulties

- Sometimes it is not possible to obtain data for past years
- Sometimes you don't have the time wait long enough (your research ends too early)
  - Example: ICT-based pedagogies often claim to improve meta-cognitive skills. Do you have tests for year-1, year-2, year-3 ? Can you wait for year+3 ?

Examples of time series (see next slide also):

- O1, O2, etc. are observation data (e.g. yearly), X is the treatment (intervention)



A. a statistical effect is likely

- Example "Student's drop-out rates are lower since we added forums to the e-learning content server "
- but attention: you don't know if there was an ***other intervention*** at the same time.

B. Likely "Straw fire" effect:

- Teaching has improved after we introduced X. But then, things ***went back to normal***
- So there is an effect, but after a while the cause "wears out"
  - e.g. the typical motivation boost from ICT introduction in the curriculum may not last

C. Natural trend (unlikely effect),

- You can control this error by looking beyond O4 and O5 !

D. "Confusion between cycle effects and intervention"

- Example: government introduced measures to fight unemployment, but you don't know if they only "surf" on a natural business cycle. Control this by looking at the whole time series.

E. Delay effect:

- Example: high investments in education (take decades to take effect)

F. Trend acceleration effect,

- difficult to discriminate with G

G. Natural exponential evolution: same as (C).

3.2 Threats to internal validity

☞ What other variables could influence our experiments ?

(Campbell and Stanley, 1963)

Type	Definition:
history	An other event than X happens between measures example: ICT introduction happened at the same time as introduction of project-based teaching.
maturation	The object changed “naturally” between measures example: Did this course change your awareness of methodology or was it simply the fact that you started working on your master thesis.
testing	The measure had an effect on the object example: Your pre-intervention interviews had an effect on people (e.g. teachers changed behavior before you invited them to training sessions)
instrumentation	Method use to measure has changed example: Reading skills are defined differently. E.g. newer tests favor text understanding.
statistical regression	Differences would have evened out naturally example: School introduces new disciplinary measures after kids beat up a teacher. Maybe next year such events wouldn’t have happened without any intervention.
(auto) selection	Subjects auto-select for treatment example: You introduce ICT-based new pedagogies and results are really good (Maybe only good teachers did participate in these experiments).

Type	Definition:
mortality	Subjects are not the same- example: A school introduces special measures to motivate "difficult kids". After 2-3 years drop-out rates improve. Maybe the school is situated in a area that show rapid socio-demographic change (different people).
interaction with selection	Combinatory effects example: the control group shows a different maturation
directional ambiguity	example: Do workers show better output in "flat-hierarchy" / participatory / ICT-supported organization or do such organizations attract more active and efficient people ?
Diffusion or treatment imitation	example: An academic unit promotes modern blended learning and attracts good students from a wide geographic area. A control unit also may profit from this effect.
Compensatory egalization	example: Subjects who don't receive treatment, react negatively.

3.3 Non-equivalent control group design

O_1	X	O_2	**experimental group**
O_3		O_4	**control group**

Advantages: Good at detecting other causes

- If O_2-O_1 is similar to O_4-O_3, we can reject the hypothesis that O_2-O_1 is due to X.

Inconvenients and possible problems:

- Bad control of natural tendencies
- Finding equivalent groups and control interaction effects between groups may not be easy.

Exemple 3-1: Experimentation and imitation effects

	Course A introduces TEET	Course B doesn't
Effect 1:costs	augment	stable
E 2: student satisfaction	augments	augments
E 3: deadlines respected	better	stable

compare results horizontally

Questions:

- E2: Why does student satisfaction improve at the same time for B ?

3.4 Validity in quasi-experimental design

Types of validity according to Stanley et al.

Internal validity* concerns *your research design

• You have to show that postulated causes are "real" (as discussed before), that alternative explanations are wrong.

•This is the most important validity type

***External validity* .... can you make generalizations ?**

• not easy ! because you may not be aware of "helpful" variables, e.g. the "good teacher" you worked with or the fact that things were much easier in your private school ....

•How can you provide evidence that your successful ICT experiment will be successful in other similar situations, or situations not that similar ?

***Statistical validity* .... are your statistical relations significant ?**

• not too difficult for simple analysis

•just make sure that you use the right statistics and believe them

•(see module on data analysis)

C*onstruction validity ...* are your operationalizations sound ?

- Did you get your dimensions right ?
- Do your indicators really measure what you want to know ?

Use comparative time series if you can

O	O	O	O	X	O	O	O	O
O	O	O	O		O	O	O	O

1. Compare between groups (situations)
2. Make series of pre- and post observations (tests)

☞ **Difficulties:**

1. Find comparable groups
2. Find groups with more than just one or a few cases (!)
3. Find data (in time in particular)
4. Watch out for simultaneous interventions at point X.

Exemple 3-2: Michele Notari's master thesis

Title: Scripting Strategies In Computer Supported Collaborative Learning Environments

- This thesis concerns the design and effects of ICT-supported activity-based pedagogics in a normal classroom setting
- Target: Biology at high-school level (various subjects)

Three research questions formulated as 'working hypotheses':

- The use of a ***Swiki*** as collaborative editing tool ***causes no technical*** and comprehensive problems (after a short introduction) for high school students without experience in collaborative editing but with some knowledge of the use of a common text-editing software and the research of information in the Web.
- ***Scripting which induces students to compare and comment on the work of the whole learning community*** (using a collaborative editing tool) ***leads to better learning performance*** (as assessed by pre- and post-testing) ***than a script leading students to work without such a tool and with little advice or / and opportunity to make comments and compare*** their work with the learning community.
- The ***quality*** of the product of the working groups is ***better*** (longer and more detailed) when students are induced to compare and comment on their work (with a collaborative editing tool) during the learning unit.

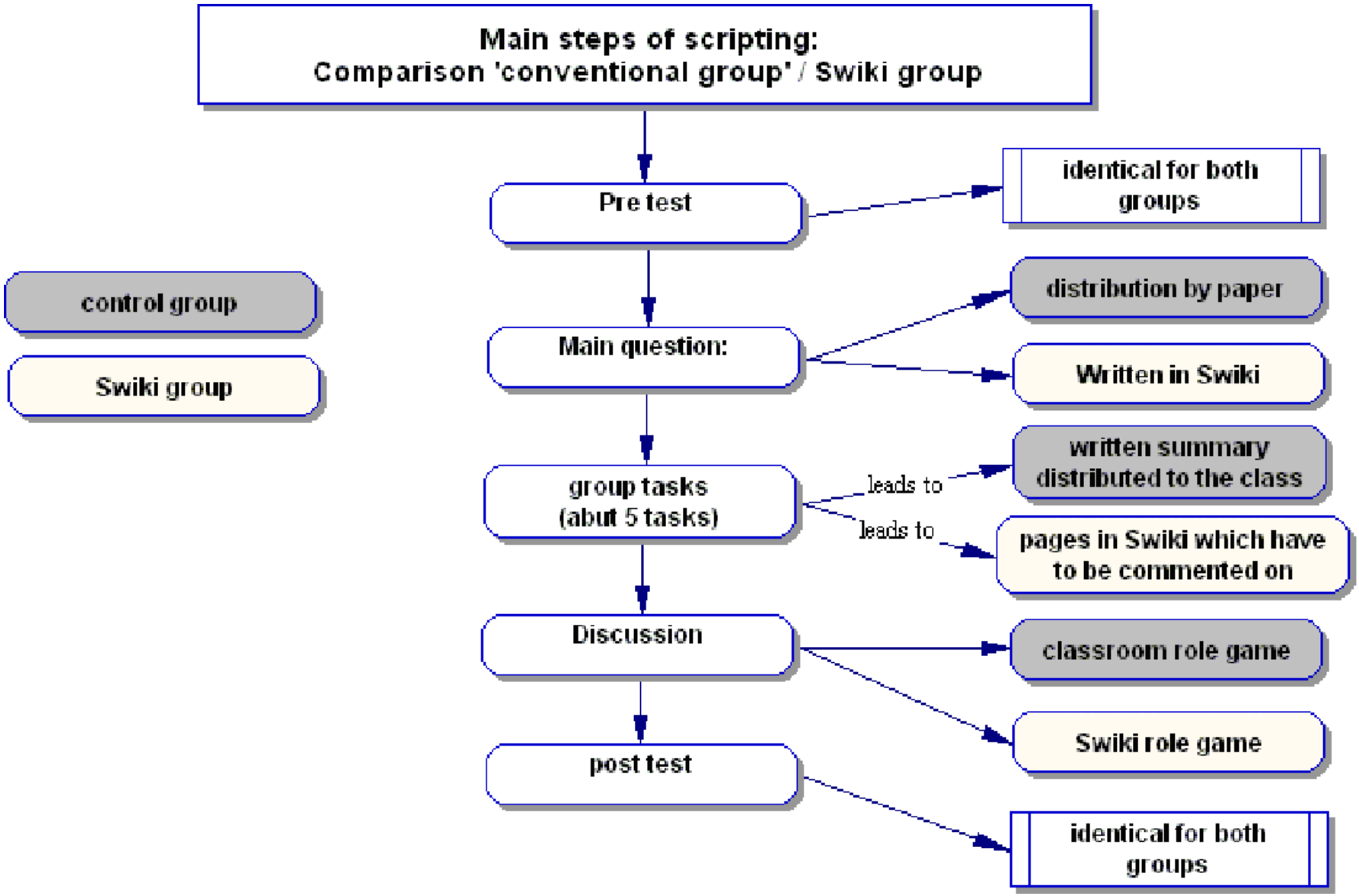
Method (Summary, quotations from thesis)

- The whole research took place in a normal curricular class environment. The classes were not aware of a special learning situation and a deeper evaluation of the output they produced.
- We tried to embed the scenarios in an absolutely everyday teaching situation and supposed students to have the same motivational state as in other lessons.
- To collect data we used questionnaires, observed students while working, and for one set up we asked students to write three tests.
- Of course the students asked about the purposes of the tests. We tried to motivate them to perform as well as they could without telling them the real reason of the tests.

Notes:

- This master theses concerns several quasi-experiments, all in real-world settings.
- On the next slide we just reproduce the settings for one of these.
- Several explaining variables intervene in the example on next page (the procedure as whole was evaluated, and not variables as defined by experimentalism).

A sample "experiment" from Notari's thesis:



4. Statistical designs

Statistical designs are related to experimental designs:

☞ Statistical designs formulate laws

- there is no interest in individual cases (unless something goes wrong)
- You can test quite a lot of laws (hypothesis) with statistical data (your computer will calculate)

☞ Designs are based on prior theoretical reasoning, because:

- measures are not all that reliable,
  - what people tell may not be what they do,
  - what you ask may not measure what you want to observe ...
- there is a statistical over-determination,
  - you can find correlations between a lot of things !
- you can not get an "inductive picture" by asking a few dozen closed questions.

☞ Design à la Popper:

1. You start by formulating hypothesis
   (models that contain measurable variables and relations)
2. You test relations with statistical tools

- Most popular variant in educational technology: Survey research

4.1 Introduction to survey research

A typical research plan looks like this:

1. Literature review leading to general research questions and/or analysis frameworks
2. You may use qualitative methodology to investigate new areas of study
3. Definition of hypothesis
4. Operationalization of hypothesis, e.g. definition of scales and related questionnaire items
5. Definition of the mother population
6. Sampling strategies
7. Identification of analysis methods

Implementation (mise en oeuvre)

1. Questionnaire building (preferably with input from published scales)
2. Test of the questionnaire with 2-3 subjects
3. Survey (interviews, on-line or written)
4. Coding and data verification + scale construction
5. Analysis

Writing it up

- Compare results to theory
- Marry good practise of results presentation and discussion, but also make it readable

4.2 Levels of reasoning within a statistical approach

Reasoning level	Variables	cases	Relations (causes)
theoretical	concept / category	depends on the scope of your theory	verbal
hypothesis	variables and values (attributes)	mother population (students, schools,)	clearly stated causalities or co-occurrences
operationalization	dimensions and indicators	good enough sampling	statistical relations between statistical variables (e.g. composite scales, socio-demographic variables)
measure	observed indicators (e.g. survey questions)	subjects in the sample	
statistics	measures (e.g. response items to questions) scales (composite measures)	data (numeric variables)	

(Just for your information. If it looks too complicated, ignore)

4.3 Typology of internal validity errors

Error of type 1: you believe that a statistical relation is meaningful

... but "in reality" it doesn't exist

- In complicated words : You wrongly reject the null hypothesis (no link between variables)

Error of type 2: you believe that a relation does not exist

... but "in reality" it does

- E.g. you compute a correlation coefficient, results show that is very weak. Maybe because the relation was non-linear, or because an other variable causes an interaction effect ...
- In complicated words: Your wrongly accept the null hypothesis

The are useful statistical methods to diminish the risks

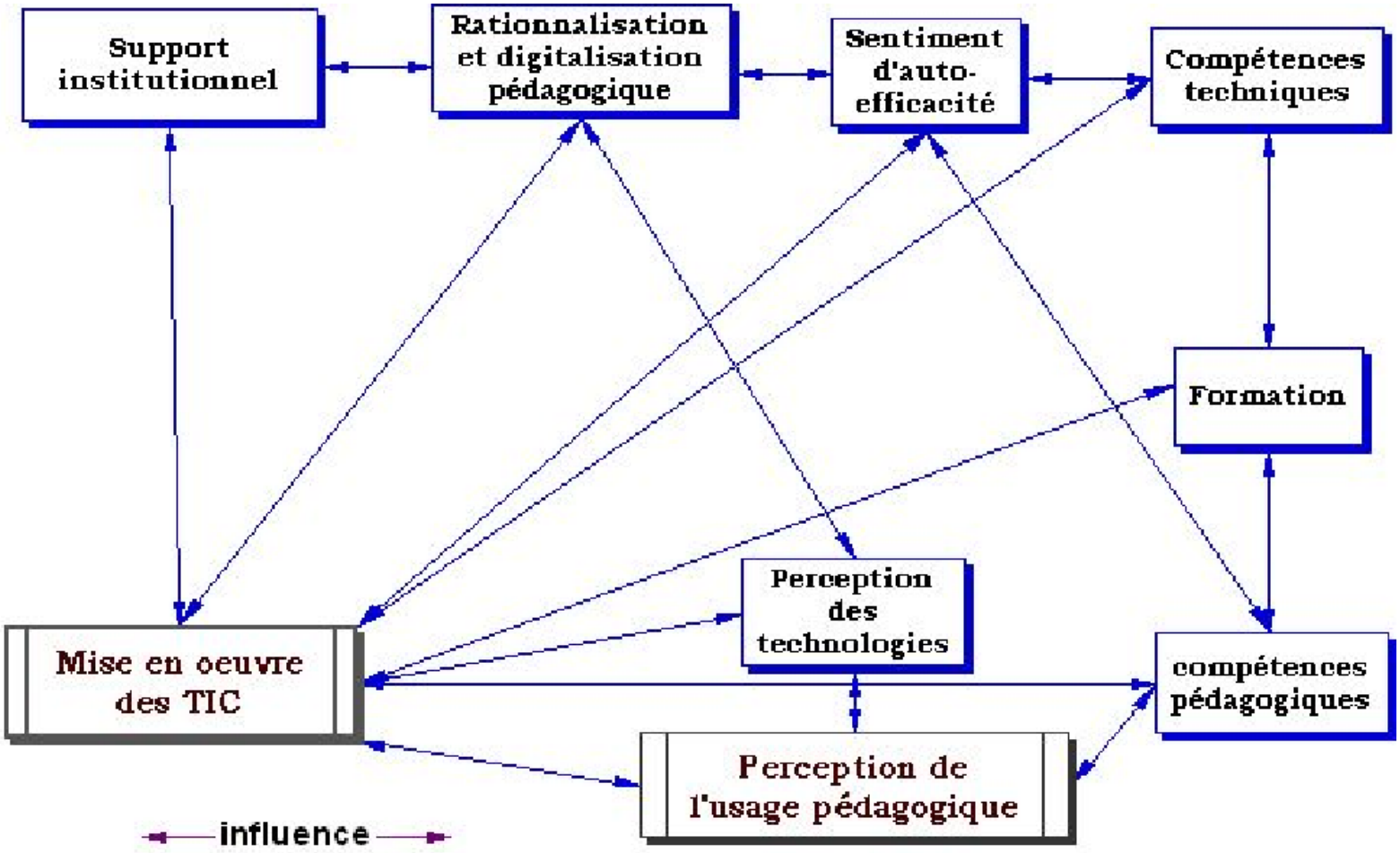
- See statistical data analysis techniques
- Think !

4.4 Survey research examples

- see also quantitative data gathering and quantitative analysis modules for some examples

Exemple 4-1: Etude pilote sur la mise en oeuvre et les perceptions des TIC

- (Luis Gonzalez, DESS thesis 2004): Main goal: "Study factors that favor teacher's use of ICT". The author defines 8 factors and also postulates a few relationships among them



- Below we quote from the thesis (and not the research plan):

  << Mon hypothèse principale postule l'existence d'une corrélation entre les facteurs suivants et la mise en œuvre des TIC par les enseignants :
  - Le ***type de support*** offert par le cadre institutionnel
  - Leurs ***compétences pédagogiques***
  - Leurs ***compétences techniques***
  - La ***formation reçue***, que se soit la formation de base ou la formation continue
  - Leur ***sentiment d'auto-efficacité***
  - Leur ***perception des technologies***
  - Leur ***perception de l'usage pédagogique*** des TIC
  - Leur rationalisation et ***digitalisation pédagogique***

  Mes hypothèses secondaires sont :

  1. La perception de l'usage péd. est corrélée avec les compétences pédagogiques de l'enseignant.
  2. La perception des technologies est corrélée avec celle de l'usage pédagogique.
  3. Rationalisation et digitalisation péd. est corrélée avec la perception des technologies.
  4. La formation est corrélée avec les compétences pédagogiques et techniques.
  5. Le sentiment d'auto-efficacité est corrélé avec les compétences pédagogiques et techniques.
  6. Rationalisation et de digitalisation péd. est corrélée avec le sentiment d'auto-efficacité." >>

Sampling method

- Representative sample of future primary teachers (students), N = 48
- Non-representative sample of primary teacher's, N = 38
  - All teachers with an email address in Geneva were contacted, auto-selection (!)
  - Note: the questionnaire was very long, some teachers who started doing it, dropped out after a while
- This sort of sampling is ok for a pilot study

Questionnaire design

- Definition of each "conceptual domain" (see above, i.e. main factors/variables identified from the literature).
- Create item sets (questions). Scales have been adapted from the literature if possible
  - L'échelle d'auto-efficacité (Dussault, Villeneuve & Deaudelin, 2001)
  - Enquête internationale sur les attitudes, représentations et pratiques des étudiantes et
  - étudiants en formation à la profession enseignante au regard du matériel pédagogique ou didactique, informatisé ou non (Larose, Peraya, Karsenti, Lenoir & Breton, 2000)
  - Guide et instruments pour évaluer la situation d'une école en matière d'intégration des TIC (Basque, Chomienne & Rocheleau, 1998).
  - Les usages des TIC dans les IUFM : état des lieux et pratiques pédagogiques (IUFM, 2003).
- Collect data with an on-line questionnaire (using the ESP program)
- Purification of the instrument. For each item set, a factor analysis was performed and indicators were constructed according to auto-correlation of items (typically the first 2-3 factors were used).
  - Note: If you used fully tested published scales, you don't need to do this !

Example regarding the concept "perception of pedagogical ICT use"

- In the questionnaire this concept is measured by two ***questions sets*** (scales).

  << La perception de l'usage pédagogique des TIC comporte deux séries de questions s'intéressant respectivement au degré d'accord des enseignants avec les discours gouvernementaux et scientifiques sur le recours aux ressources éducatives informatisées en éducation (question 34, 10 items) et au degré d'importance accordé à diverses ressources informatisées (question 43, 12 items). >>

Here we show one of these 2 question sets:

Question 34. PUP1: Les énoncés suivants reflètent des opinions " fort présentes " dans les discours gouvernementaux ainsi que " scientifiques " qui portent sur le recours aux ressources éducatives informatisées en éducation. Indiquez votre degré d'accord par rapport à chacun d'entre eux.

(Tout à fait en désaccord=1 Plutôt en désaccord=2 Plutôt d'accord=3 Tout à fait d'accord=4

	1	2	3	4
Pour l'élève, le recours aux ressources de réseau favorise l'autonomie dans l'apprentissage.	○	○	○	○
Faire communiquer les élèves entre eux grâce à la télématique rend l'apprentissage collaboratif.	○	○	○	○
Utiliser des ressources éducatives informatisées à l'école favorise le développement de la créativité chez l'élève.	○	○	○	○
Utiliser les ressources de réseau favorise les scénarios d'apprentissage de type constructiviste.	○	○	○	○
Naviguer sur l'Internet contribue fortement à développer des compétences méthodologiques indispensables à l'apprentissage scolaire.	○	○	○	○
Faire partager par les élèves les postes de travail disponibles en classe favorise le travail collaboratif.	○	○	○	○
Apprendre dans un environnement informatique motive les élèves.	○	○	○	○
Recourir aux ressources éducatives informatisées est surtout utile pour soutenir l'apprentissage des matières de base	○	○	○	○
Utiliser les TIC et les ressources éducatives informatisées constitue généralement une innovation pédagogique.	○	○	○	○
L'enseignement par projet est facilité par les TIC	○	○	○	○

Note: these 10 items and the 12 items from question 43 have been later reduced to 3 indicators:

Var_PUP1 Degré d'importance des outils d'entraide et de collaboration pour les élèves

Var_PUP2 Degré d'importance des outils de communication entre élèves

Var_PUP3 Accord sur ce qui favorise les apprentissages de type constructiviste

5. Similar comparative systems design

Principle

Make sure to have good variance within "*operative variables*" (dependant + independent)

Make sure that no other variable shows variance (i.e. that there are no hidden control variables that may produce effects)

$$\frac{\text{variance of operative variables}}{\text{variance of control variables}} = \text{maximum}$$

In more simple words: Select cases that are different in respect to the variables that are of interest to your research, but otherwise similar in all other respects.

E.g. don't select an prestige school that does ICT and a normal school that doesn't do ICT if you want to measure the effect of ICT. Either stick to prestige schools or "normal" schools, otherwise, you can't tell if it was ICT that made the difference ...

Advantages and inconvenients of this method

less reliability and construction validity problems

better control of "unknown" variables

worse external validity (possibility to generalize)

6. Summary of theory-driven designs discussed

approach	some usages
2. "Experimental designs" [3]	• Psycho-pedagogical investigations • User-interface design
3. "Quasi-experimental designs" [12]	• Instructional designs (as a whole) • Social psychology • Public policy analysis • Educational reform • Organizational reform
4. "Statistical designs" [24]	• Teaching practise • Usage patterns
5. "Similar comparative systems design" [32]	• Public policy analysis • Comparative education

Of course, you can combine these approaches within a research project. You even can use combinations to triangulate answers for a single research question.

Theory-finding Research Designs

(version 0.9, 1/4/05 - examples in french)

Code: res-design-quali

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. The concept of qualitative methodology

What is qualitative methodology ?

- 2 frequent stereotypes: synonym of “simple description” or “interview analysis”
- In reality there is a huge pool of design approaches and methods.
- Qualitative designs are usually more difficult than quantitative designs

examples qualitative approaches (there are more !)

Family	Names	Description
investigative journalism	case description	explanatory story
collaborative research	action research	practical experimentation with a social goal
	participatory observation	analytic immersion
	collaborative research	participatory design of something
language	text analysis	analysis of relations bet. elements (grammars)
	dialogue analysis	organization and structure of dialogue
observation in context	anthropology	structured and non-structured observation
	“field research”	(same, but less in depth, more formal)
interpretism	hermeneutics	human activity as "text"
	phenomenology	empathy of “Lebenswelt”
	symbolic interactionism	symbolic interactions between actors

2. The qualitative research process

Qualitative research works in cycles (see later)

Most common features:

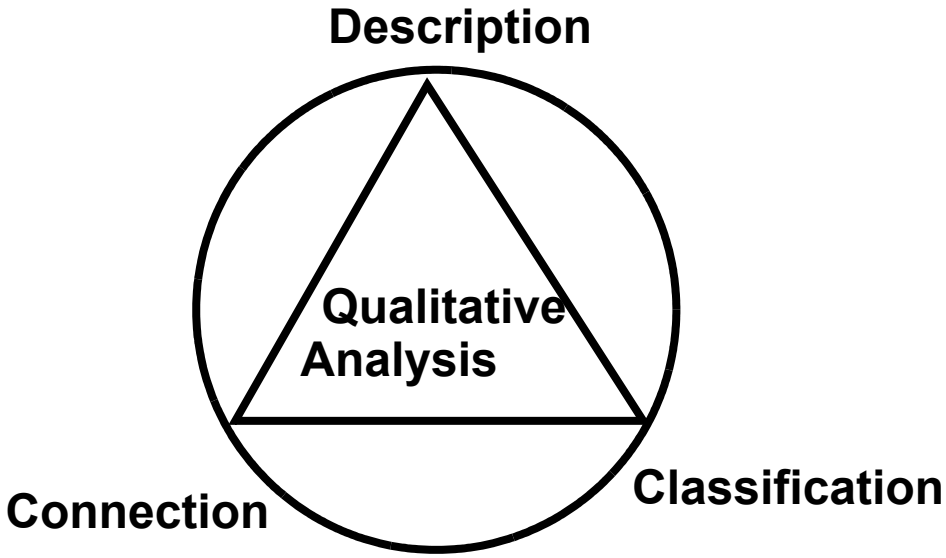
- Research must be ***anchored*** in “rich” descriptions
- Each theoretical ***proposition*** must be anchored in ***observations***
- The researcher play a ***delicate role***. He always is visible and even can play an active role.
- Most modern designs also insist on reliability and validity issues.

Regarding the role of theory: 2 very different doctrines:

little theory (grounding of research questions and analysis grids)		**A lot of theory (grounding)**	
	openness of mind		linking to other research
			closeness of mind
	allows to tackle new subjects		integration of your results with other knowledge
	tendency to collect too much data		tendency to ignore phenomena
	difficult comparison with other work		easier generalization
	non-explicit preconceptions		explicit preconceptions (therefore controllable

2.1 The description - classification - connection triangle

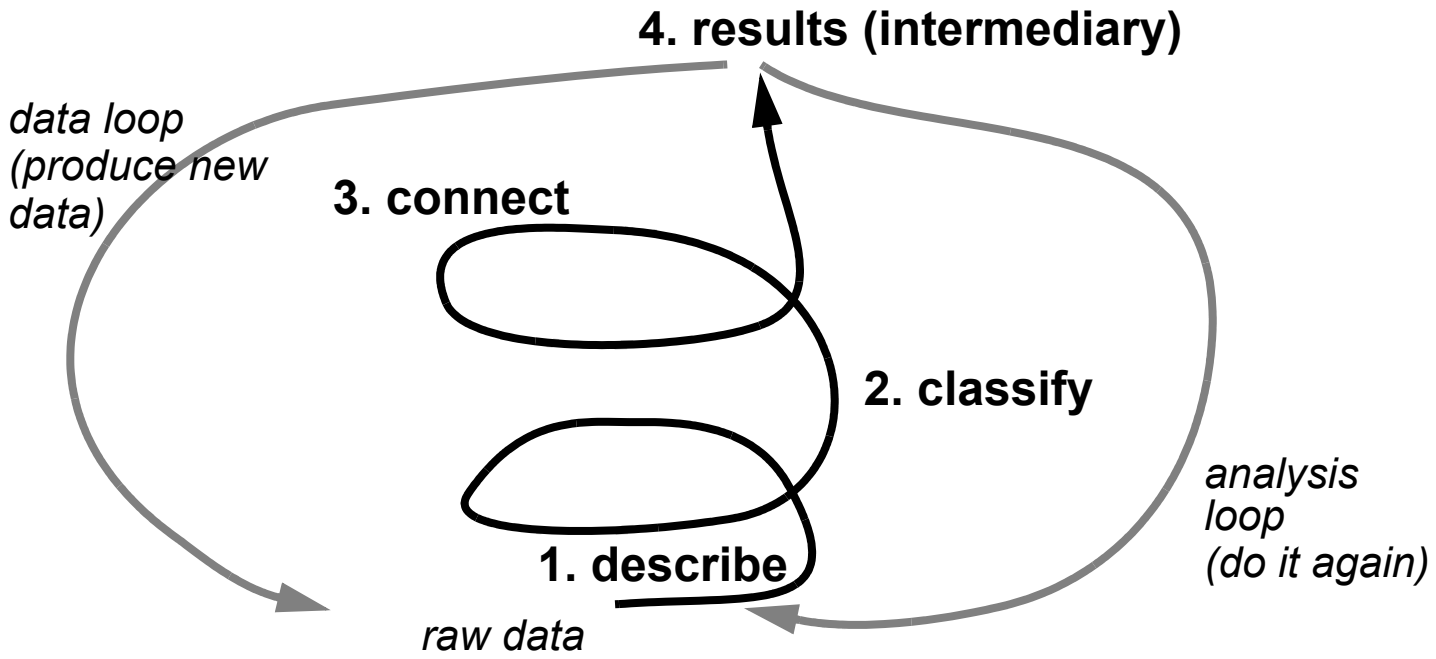
Dey (1993:31):



- ***description***: each qualitative analysis relies on “rich” data
  - otherwise you can’t interpret the full meaning of an observation !
- ***classification***: data structuring and reduction according to coding principles
  - the mass of data can be staggering !
- ***connection***: Identification of relationships between concepts
  - to make relations (and other structure) appear !

2.2 A dynamic vision

also Dey (1993:53)



This figure show the ***circularity*** of a qualitative approach:

- classify and connect data
- The need to look at data again or to produce new data

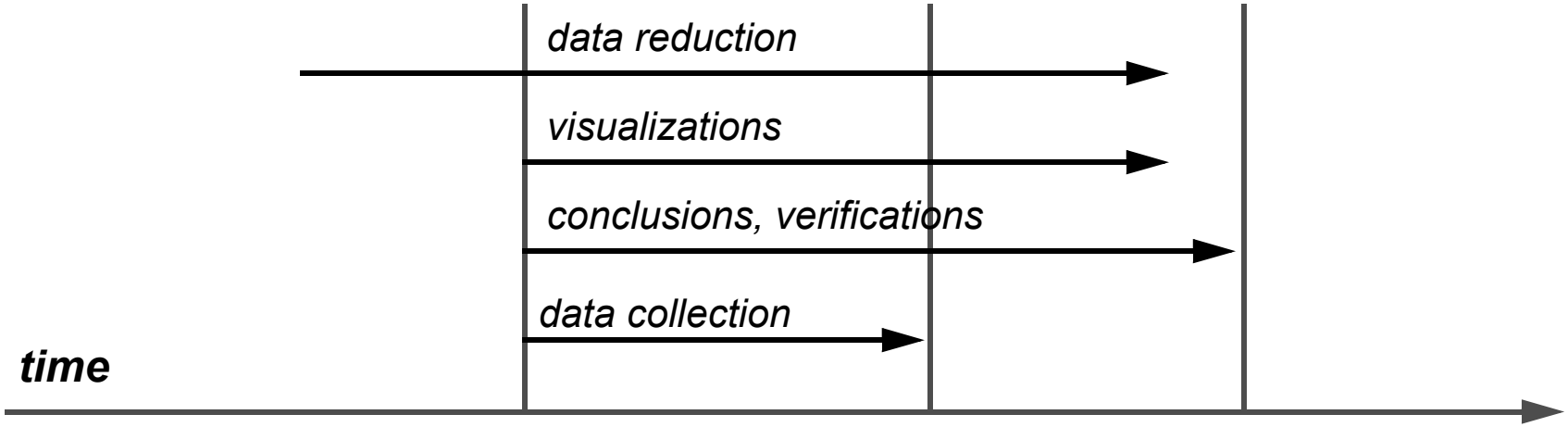
"Modern" qualitative researchers:

- ***produce a lot of drawings***
- use ***matrices***
- use (sometimes) ***quantitative data exploration techniques***

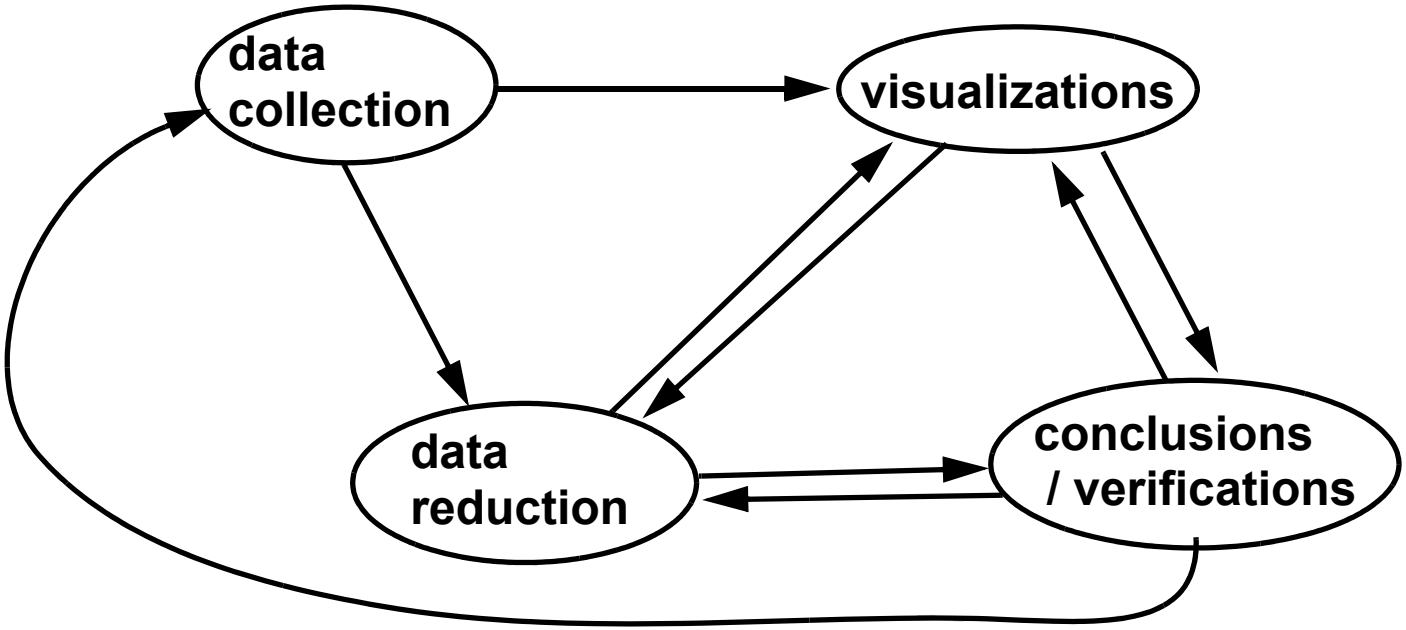
☞ Difficulty = Do something with the huge mass of data

2.3 The principle again over time

Miles & Huberman (1994:10)



dynamic version of the same schema



3. The role of data

- Qualitative data are most frequently generated by the researcher (same as in quantitative designs)
- However, qualitative approaches prefer "***natural***" data and refers to the concepts of ***meaning*** and ***process*** (the last issue is shared with systems analysis).

Some elements that distinguish between typical quantitative and qualitative research:

Types of approach	
Quantitative approaches search:	**Qualitative approaches search:**
social or individual structures: ***laws***	social construction: ***rules and languages"*** as they are ***perceived*** and ***created*** by subjects
observable facts	***units de meaning***, interpretations by people e.g. subjective meaning and goal of an action
abstract behavior and attitudes or experimental situations	actions and thoughts in *context*
standardized macro-observations (applied to a population)	***"thick"*** micro-observations (few "settings", small groups, etc.)

4. Examples

- Also consult the module on design-oriented research designs

Exemple 4-1: Master thesis of M-A Thibaut

Title: Le cartable électronique®. Un Environnement Numérique de Travail en construction. Pratiques éducatives et mutualisation

Research questions (quotes from the thesis: p. 26)

1. Dans l'utilisation que font les enseignants du cartable électronique®, stabilisent-ils des stratégies pédagogiques ?
   - Recourent-ils à ces outils dans la mesure où cela ne perturbe pas leur habitus d'enseignement ou de gestion de la classe ?
   - Est-ce que l'on voit apparaître la mise en place de scénarios sociopédagogiques, collaboratifs ?
2. Compte tenu de l'impact du sentiment d'utilité dans l'intégration d'une innovation, pouvons-nous attester dans le cadre de ce dispositif de bénéfices retirés par les enseignants ?
3. Quelles sont leurs habiletés actuelles en terme de mutualisation au sein du cartable mais également à l'extérieur ?
   - A travers l'idée qu'ils doivent être les constructeurs des contenus pédagogiques du cartable électronique®, quelle est leur position vis-à-vis de cet investissement ?
   - Quelles sont les stratégies qu'ils mettent en place pour exploiter les ressources qu'ils ont à disposition sur Internet et quelles sont les ressources dont ils ont besoin au sein du cartable ?

Method

(quotes from the thesis: 27-29)

- Mon travail est une enquête, un regard posé sur les utilisateurs du dispositif. Il est basé sur une étude qualitative et la rencontre de 11 enseignants de différents collèges qui utilisent le cartable électronique® de Savoie. Nous avons préféré questionner plusieurs équipes pour que l'étude soit la plus représentative possible.
- Le type d'entretien s'oriente vers le « Story telling » ou « récit de vie ». Peu directif, parfois une seule question suffit et ne comporte aucune question directe et fermée. Dans ce cadre, il faut insister sur ce qu'ils font concrètement et essayer de modérer les appréciations sur ce qu'ils pensent. Ils doivent raconter par exemple un événement difficile ou au contraire enrichissant.
- Mes entretiens ont duré en moyenne 40 minutes. J'ai construit un canevas reprenant mes points principaux. Dans mes entretiens je me suis tenu à rester au maximum sur les faits, les pratiques et les applications mais certains passages renvoient à leurs représentations, passages que j'ai séparés dans mon analyse. C'est la particularité des récits autobiographiques où l'on retrouve toujours deux types d'information : des indications évènementielles (faits, pratiques…) et des réflexions subjectives (représentations, ressentis, avis…)
- Un questionnaire à la fin de l'entretien leur a été adressé pour connaître leur équipement informatique et leur utilisation à domicile d'Internet. Il se trouve qu'ils sont tous équipés d'une connexion Internet et qu'ils utilisent le web quotidiennement.
- J'ai rencontré progressivement les enseignants et retranscrit parallèlement les entretiens (Annexe D) ce qui m'a permis de réorienter certaines questions. J'ai traité mes données par rapport à mon canevas (Annexe A et B). Le but de l'analyse est de mettre en évidence les constantes des récits, les régularités mais également les cas de particularité.

Exemple 4-2: Master thesis by D. Touvet

Title: Vers de nouvelles formes d'organisation de l'enseignement. Analyse d'experiences de mediatisation de cours

Research questions (thesis: 11)

Pour chacun des cas étudiés, nous cherchons à savoir :

1. Comment se déroulent les processus de médiatisation ?
2. Quelles sont ces nouvelles formes d'organisation de l'enseignement ?
3. Quels sont les nouveaux rôles qui apparaissent tout au long d'un processus de médiatisation d'un cours ?

Method (quotations from the thesis: 37-48)

- Nous avons choisi d'effectuer une recherche qualitative selon une approche s'inspirant en grande partie de celle proposée par Huberman et Miles (1991). Ils proposent une méthode de recueil et d'analyse de données qualitatives comprenant les phases de recueil, condensation, présentation et vérification des données.
- Nous avons décidé de constituer un échantillon de trois projets homogènes, c'est-àdire relativement proches dans leurs caractéristiques pour permettre une meilleure focalisation et comparaison. Ils présentent cependant une bonne variété de choix et de situations possibles.
- Deux méthodes ont été retenues pour recueillir les données :
  - 1. Passation d'entretiens auprès du coordinateur de chaque projet.
  - 2. Consultation des sites web de chaque projet (deux des trois projets retenus ont noté toute leur démarche sur le site web du projet) ce qui nous a permis d'obtenir des informations pertinentes

complétant celles obtenues par les entretiens. Ces adresses nous ont été fournies par les coordinateurs.

- Le recueil de données s'est effectué à l'aide d'une grille d'entretien8 dont les différentes rubriques ont été définies en étroite articulation avec la partie théorique de cette recherche. Ainsi, cette grille permet de comprendre de quelle manière se déroulent les processus de médiatisation, quelles sont les nouvelles formes d'organisation de l'enseignement qui se dégagent et quels nouveaux rôles apparaissent tout au long d'un processus de médiatisation d'un cours.
- Des phases successives de condensation des données recueillies (simplification et synthèse) ont ensuite été initiées et ont abouti à un format de présentation permettant une discussion sur les résultats obtenus.

Design-oriented Approaches

(version 0.9, 1/4/05)

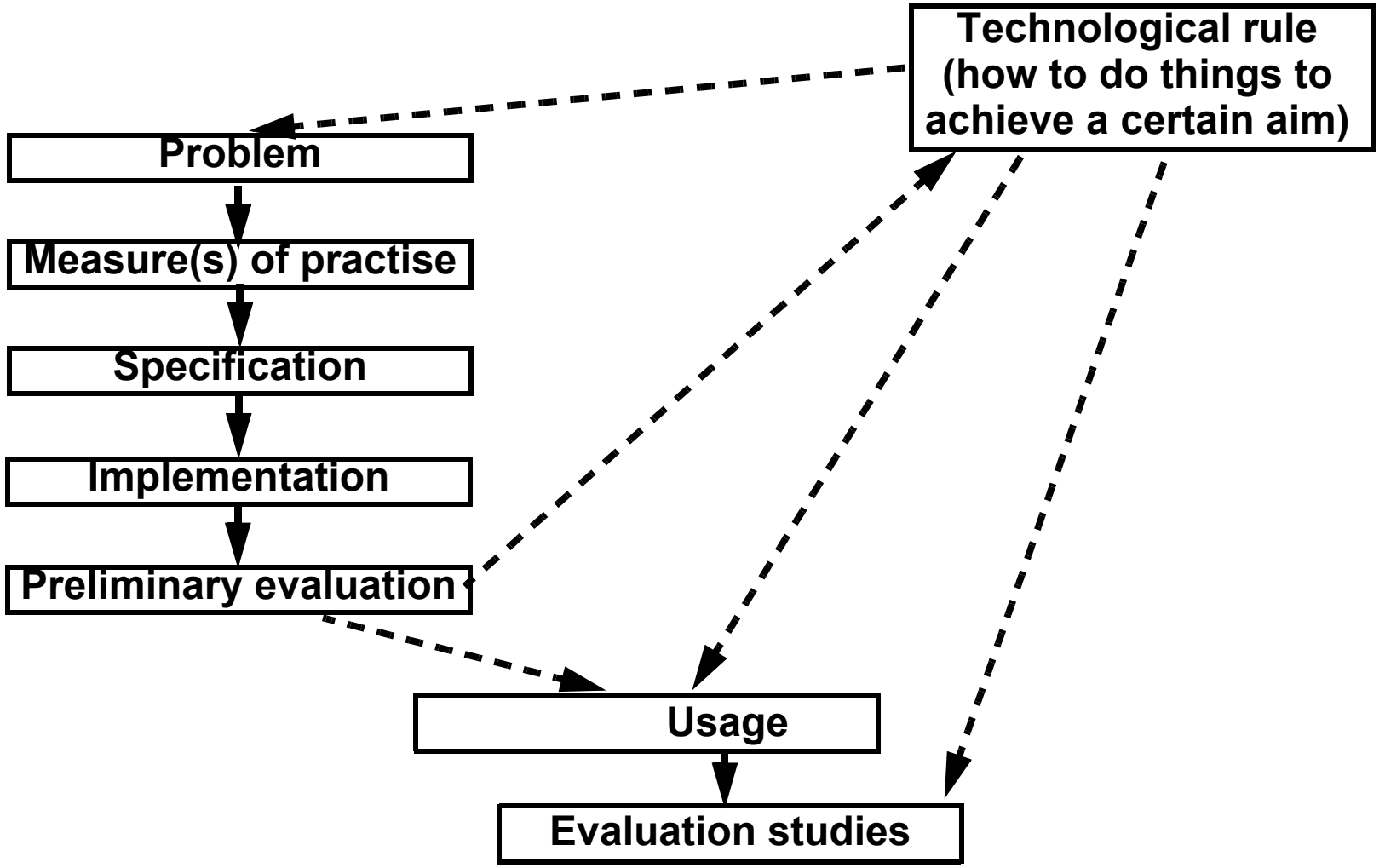
Code: res-design-design

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Key elements of a design-oriented approach:

1.1 The global picture



- investigate at least one of the dotted lines
- Technological rule as (theory on how to things) can be input, output, or both

1.2 Ingredients of design research

(Pertti Järvinen, 2004)

Technological rules

- tell you how to do things and are dependant on other theories (and beliefs)
- Bunge (quoted by Järvinen:99): "A technological rule: an instruction is defined as a chunk of general knowledge, linking an intervention or artifact with a desired outcome or performance in a certain field of application".

Types of outcomes (artifacts, interventions):

- Constructs (or concept) form the "***language***" of a domain
- Models are sets of propositions expressing ***relationships*** among constructs
- Methods are a ***set of steps*** to perform a task (guidelines, algorithms)
- Instantiations are ***realizations*** of an artifact in its environment

Types of research:

- Build: Demonstrate feasibility of an artifact or intervention
- Evaluate: Development of criteria, and assessment of both artifact building and artifact usage

What does this mean ?

- There are 4*2 ways to lead interesting design research.
- Usually, it’s the not the program you build that is interesting, but something behind (constructs, models, methods) or around (usage).

1.3 Instructional design rules

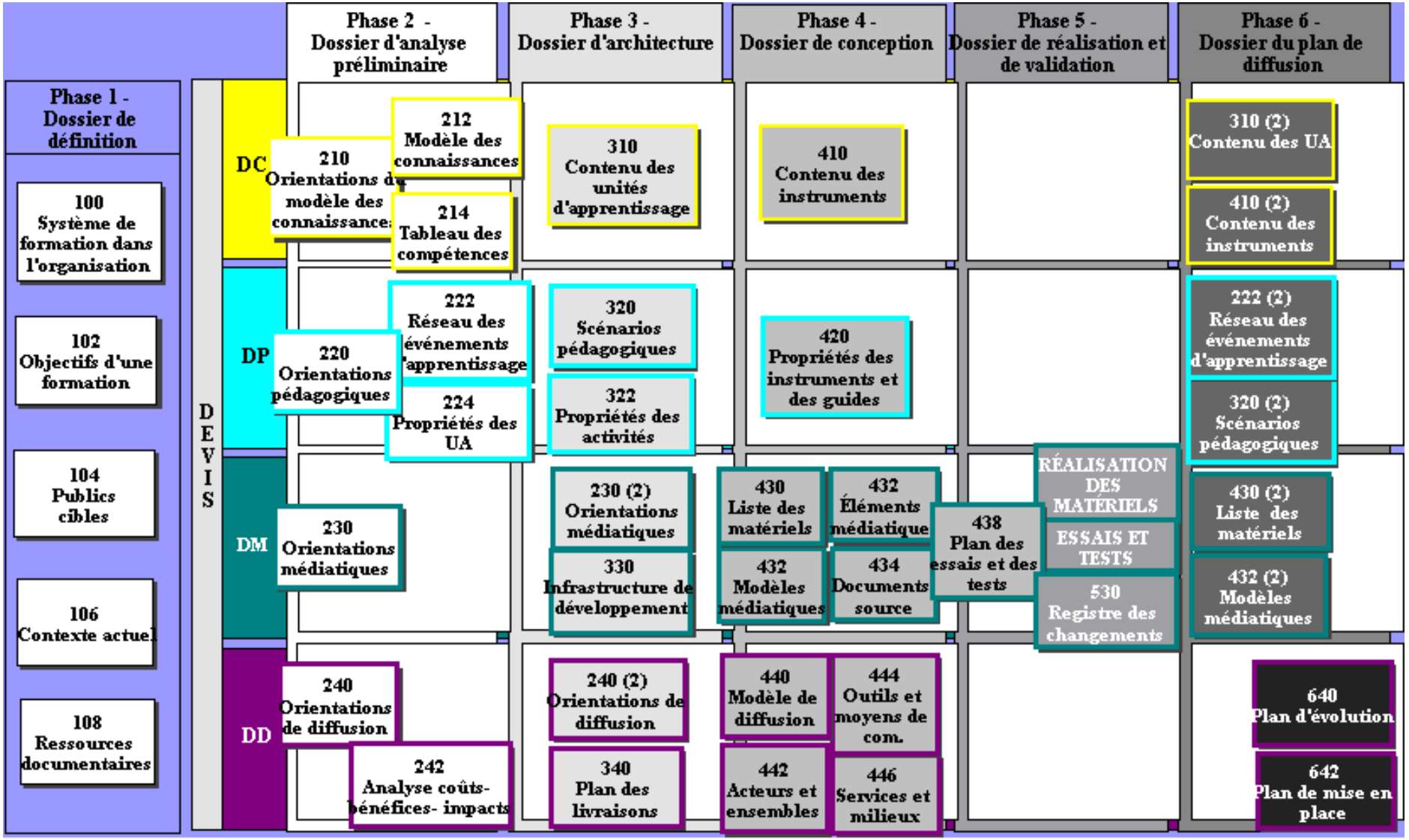
Exemple 1-1: The MISA/MOT/ADISA technical rule

E.g. MISA/MOT/ADISA: Course designer works on "4 models"

1. Knowledge and Skill Representation
   DC: Design of Content (know-that and know-how)
2. Application of Teaching Methods and Approaches
   DP: Design of Pedagogical specifications
3. Specification of Learning Materials
   DM: Design of Materials
4. Delivery Planning
   DD: Design of Delivery

Using such a method (see next slide) is worth the effort:

- if you plan do it right (e.g. buy the MOT editor)
- if you focus on a whole course instead of difficult problems
- if you plan to train yourself in instructional design
  url: http://www.cogigraph.com



Too much for you ?

Exemple 1-2: Gagné's 9 steps of instruction for learning

a. **Gain attention** e.g. present a good problem, a new situation, use a multimedia advertisement.

b. **Describe the goal**: e.g. state what students will be able to accomplish and how they will be able to use the knowledge, give a demonstration if appropriate.

c. Stimulate **recall of prior knowledge** e.g. remind the student of prior knowledge relevant to the current lesson (facts, rules, procedures or skills). Show how knowledge is connected, provide the student with a framework that helps learning and remembering. Tests can be included.

d. **Present the material** to be learned e.g. text, graphics, simulations, figures, pictures, sound, etc. Chunk information (avoid memory overload, recall information).

e. Provide **guidance for learning** e.g. presentation of content is different from instructions on how to learn. Use of different channel (e.g. side-boxes)

f. Elicit **performance "practice",** let the learner do something with the newly acquired behavior, practice skills or apply knowledge. At least use MCQ's.

g. Provide **informative feedback**, show correctness of the trainee's response, analyze learner's behavior, maybe present a good (step-by-step) solution of the problem

h. **Assess** performance test, if the lesson has been learned. Also give sometimes general progress information

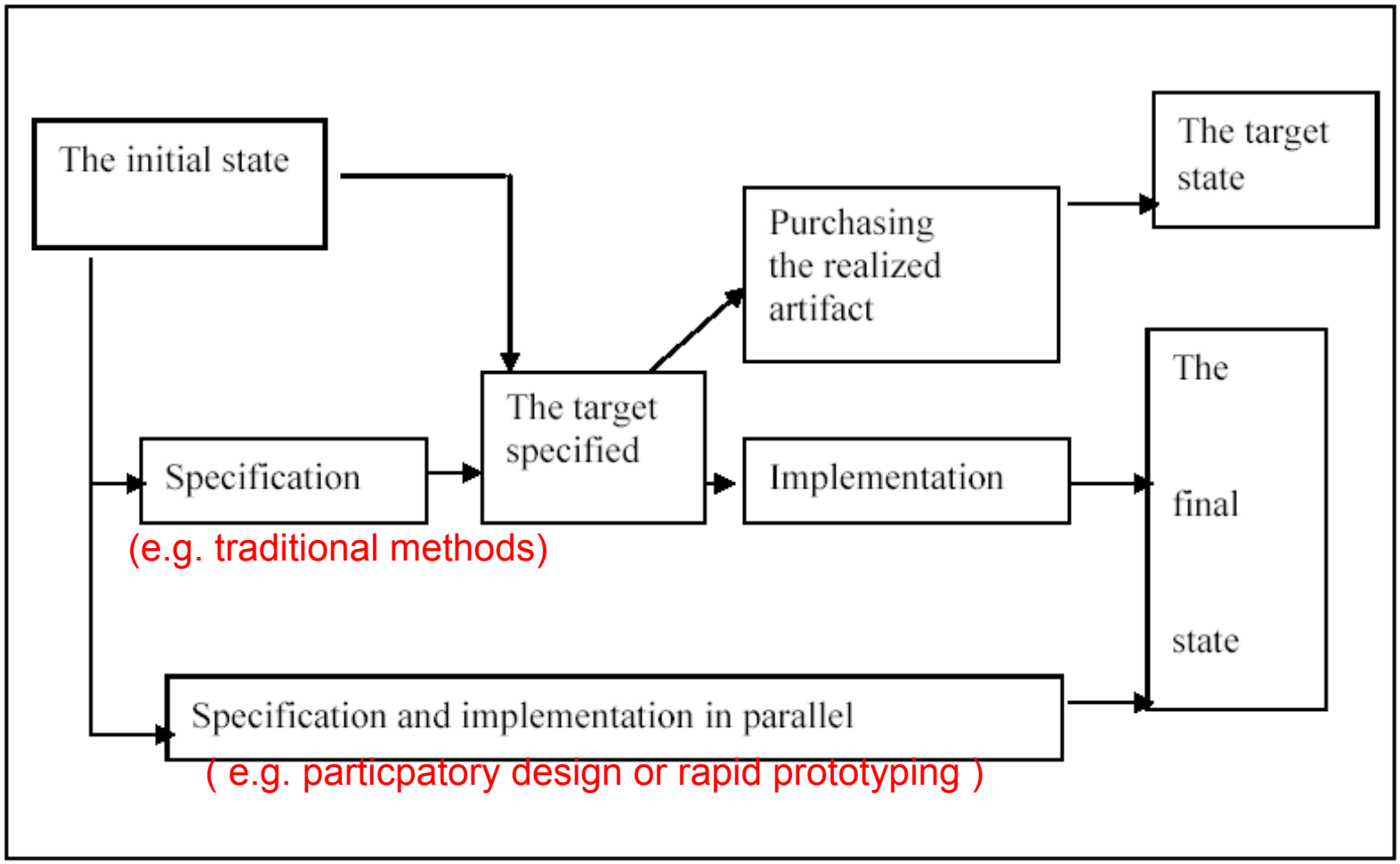
Enhance retention and transfer: inform the learner about similar problem situations, provide additional practice. Put the learner in a transfer situation. Maybe let the learner review the lesson.

1.4 Design rules from computer science

(not here sorry, e.g. have a look at various UML-based cases/rules)

2. The design process

Alternatives: (Pertti Järvinen, 2004: 103)



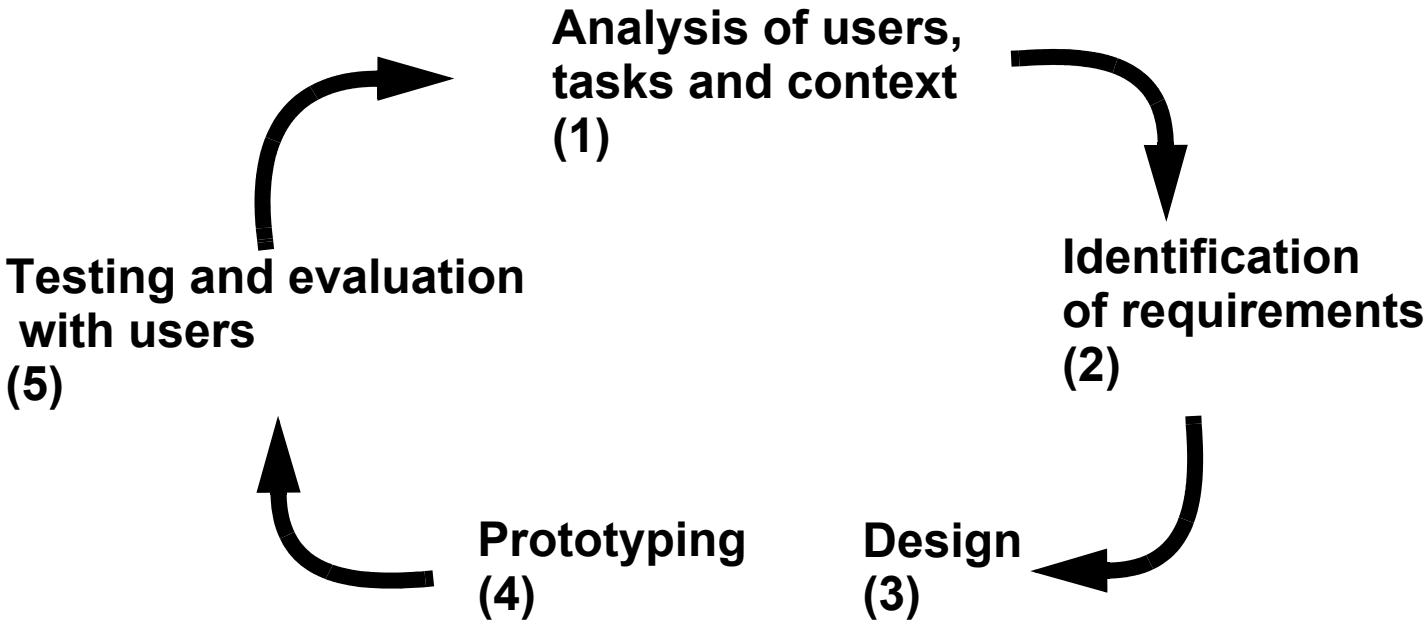
- Annotations in red by me (DKS)

2.1 The participatory design model

Note: This whole chapter draws a lot from Maria Håkansson, 2003

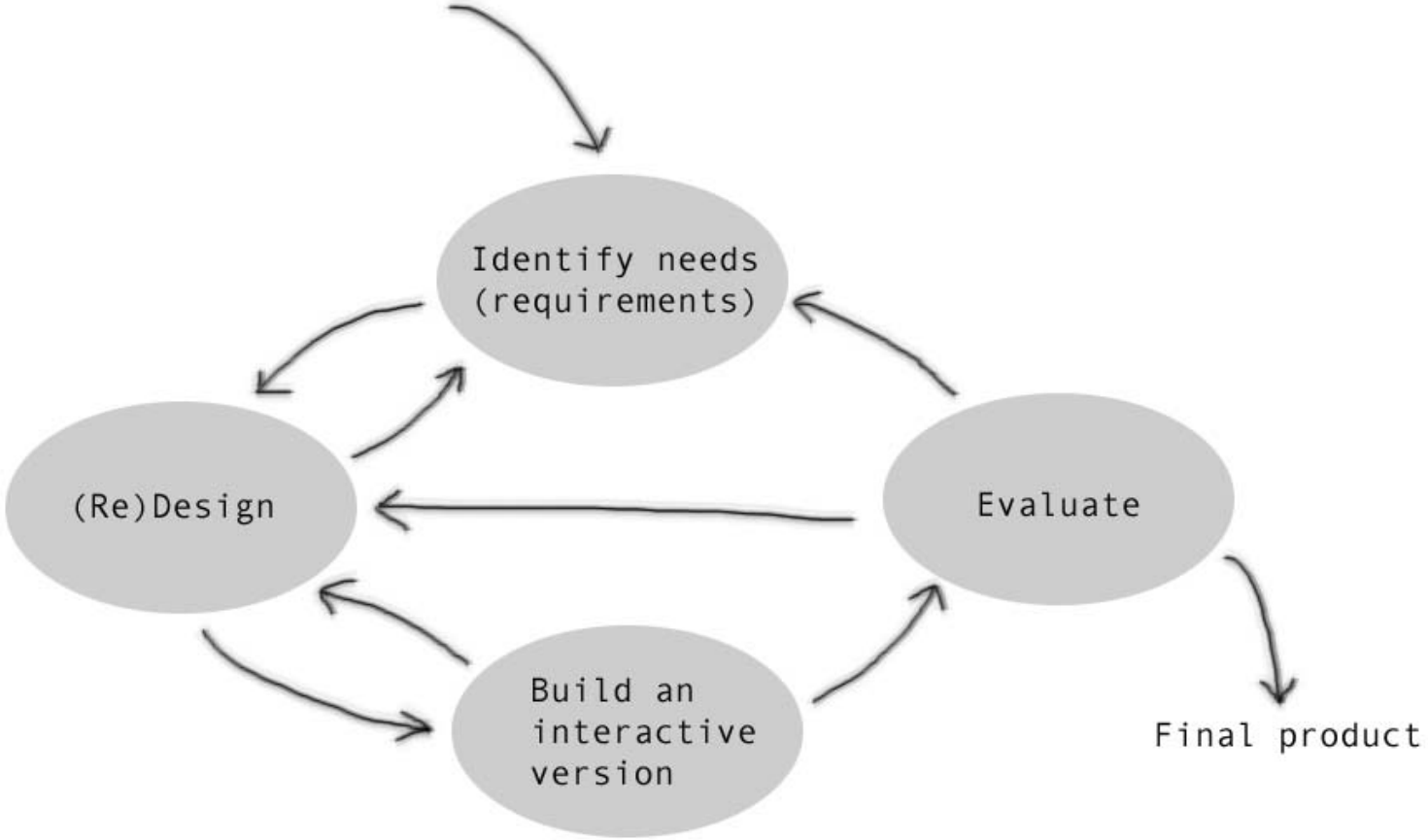
User-centred design:

- ***involves users as much as possible*** so that they can influence it
- integrates knowledge and expertise from other disciplines than just IT
- is highly ***iterative*** so that testing can insure that design meets users' requirements



adapted from Håkansson

A similar model from Preece, Rogers and Sharp (2002), figure also from Hakansson



2.2 Typical user analysis techniques

(Adapted from Håkansson, see also the modules on qualitative data gathering and analysis)

- Questionnaires
  - if user number is high
  - if you know precisely what to ask (e.g. to identify user profiles, to test hypothesis gained from in-depth studies, etc.
- Semi-structured Interviews
  - to explore new issues
  - to let participants develop argumentation (subjective causalities)
- Focus groups
  - group interview", collecting multiple viewpoints
- Observations/Ethnography
  - To observe work as it happens in its natural setting (observe task related workflow, interactions)
  - to understanding context (other interactions, conditions)
- Scenarios (for task description)
  - An "informal narrative description", e.g. write ***real*** stories that describe in detail how someone will use your software (do not try to present specifications here !)
- Cultural probes
  - Alternative approach to understanding users and their needs, developed by Gaver (1999) ?

2.3 Definition of requirements

Different types

- Functional requirements
- Environmental requirements
- Physical, social, organizational, technical
- User requirements
- Usability requirements

2.4 Building prototypes

- Prototypes can be anything !!
- Quote: "From paper-based storyboards to complex pieces of software: 3D paper models, cardboard mock-ups, hyperlinked screen shots, video simulations of a task, metal or plastic versions of the final product" (Håkansson).
- Prototypes are of different nature according to the stage and the evolution of the design process:
  - Useful aid when discussing ideas (e.g. you only need a story-board here)
  - Useful for clarifying vague requirements (e.g. you only need some UI interface mockup)
  - Useful for testing with users (e.g. you only need partial functionality of the implementation)

3. Evaluation

3.1 Evaluation criteria

- Evaluation usually happens according to some "technological rule"

Exemple 3-1: Example: Merril's criteria for 5 Star Instructional Design's

Not applicable to transmissive ("spray-and-pray" / or exploratory designs ("sink-or swim").

5. Does the courseware relate to real world problems?
   - **a. ... show learners the task or the problem they will be able to do/solve ?**
   - **b. are students engaged at problem or task level not just operation or action levels?**
   - **c. ... involve a progression of problems rather than a single problem?**
6. Does the courseware activate prior knowledge or experience?
   - **a. do learners have to recall, relate, describe, or apply knowledge from past experience (as a foundation for new knowledge) ?**
   - **b. does the same apply to the present courseware ?**
   - **c. is there an opportunity to demonstrate previously acquired knowledge or skill ?**
7. Does the courseware demonstrate what is to be learned ?
   - **a. Are examples consistent with the content being taught? E.g. examples and non-examples for concepts, demonstrations for procedures, visualizations for processes, modeling for behavior?**
   - **b. Are learner guidance techniques employed? (1) Learners are directed to relevant information?, (2) Multiple representations are used for the demonstrations?, (3) Multiple demonstrations are explicitly compared?**

c. Is media relevant to the content and used to enhance learning?

8. Can learners practice and apply acquired knowledge or skill?

a. Are the application (practice) and the post test consistent with the stated or implied objectives? (1) Information-about practice requires learners to recall or recognize information. (2) Parts-of practice requires the learners to locate, name, and/or describe each part. (3) Kinds-of practice requires learners to identify new examples of each kind. (4) How-to practice requires learners to do the procedure. (5) What-happens practice requires learners to predict a consequence of a process given conditions, or to find faulted conditions given an unexpected consequence.

b. Does the courseware require learners to use new knowledge or skill to solve a varied sequence of problems and do learners receive corrective feedback on their performance?

c. In most application or practice activities, are learners able to access context sensitive help or guidance when having difficulty with the instructional materials? Is this coaching gradually diminished as the instruction progresses?

9. Are learners encouraged to integrate (transfer) the new knowledge or skill into their everyday life?

a. Is there an opportunity to publicly demonstrate their new knowledge or skill?

b. Is there an opportunity to reflect-on, discuss, and defend new knowledge or skill?

c. Is there an opportunity to create, invent, or explore new and personal ways to use new knowledge or skill?

=> This is rather a list of evaluation criteria

let's now look at learning types and instructional methods before we look a design method

3.2 Evaluation methodology

Design evaluation methodology draws all major social science approaches,

e.g. Håkansson cites:

- Heuristics
- Experiments
- Questionnaires
- Interviews
- Observations
- Think-aloud

Therefore:

- have a look at my others slides :)

Exemple 3-2: Nielsons (1993) usability methods

url: **http://fdlwww.kub.nl/~krahmer/evaluation-introduction.ppt**

Table 10 *Summary of the usability methods covered in Chapters 5–7.*

Method Name	*Lifecycle Stage*	*Users Needed*	*Main Advantage*	*Main Disadvantage*
Heuristic evaluation	Early design, "inner cycle" of iterative design	None	Finds individual usability problems. Can address expert user issues.	Does not involve real users, so does not find "surprises" relating to their needs.
Performance measures	Competitive analysis, final testing	At least 10	Hard numbers. Results easy to compare.	Does not find individual usability problems.
Thinking aloud	Iterative design, formative evaluation	3–5	Pinpoints user misconceptions. Cheap test.	Unnatural for users. Hard for expert users to verbalize.
Observation	Task analysis, follow-up studies	3 or more	Ecological validity; reveals users' real tasks. Suggests functions and features.	Appointments hard to set up. No experimenter control.
Question-naires	Task analysis, follow-up studies	At least 30	Finds subjective user preferences. Easy to repeat.	Pilot work needed (to prevent misunderstandings).
Interviews	Task analysis	5	Flexible, in-depth attitude and experience probing.	Time consuming. Hard to analyze and compare.
Focus groups	Task analysis, user involvement	6–9 per group	Spontaneous reactions and group dynamics.	Hard to analyze. Low validity
Logging actual use	Final testing, follow-up studies	At least 20	Finds highly used (or unused) features. Can run continuously.	Analysis programs needed for huge mass of data. Violation of users' privacy.
User feedback	Follow-up studies	Hundreds	Tracks changes in user requirements and views.	Special organization needed to handle replies.

4. Examples

Exemple 4-1: V. Synteta's master thesis

Title: EVA_pm: Design and Development of a Scaffolding Environment For Students Projects

Objectives (quotations from the thesis,

- This study is also an intervention for improving PBL efficiency. It entails the development of a Scaffolding Learning Environment (SLE1) that is trying to learn from the lessons of the past and leverage from stresses on new technologies like XML2 and the World Wide Web making a lightweight and easily portable environment.
- Most of the research for improving PBL efficiency tries to remediate specific weaknesses of PBL, but doesn't propose a complete system that supports a substantial student project through all it's phases and for all contexts.
- Our key goal was to develop a constructivist environment and a method for scaffolding students' projects (assignments) from their management up to the writing of their final report.

So, the objectives of this SLE are:

- to help students develop scientific inquiry and knowledge integration skills, to focus on important and investigate key issues;
- to support them directing investigations;
- to make students better manage the time and respect the time constraints;
- to overcome possible writer's block, or even better to avoid it;
- to help students acquire knowledge on project design and research skills;
- to improve team management and collaboration (especially collaborative editing of student groups);
- to make students reflect on their work;

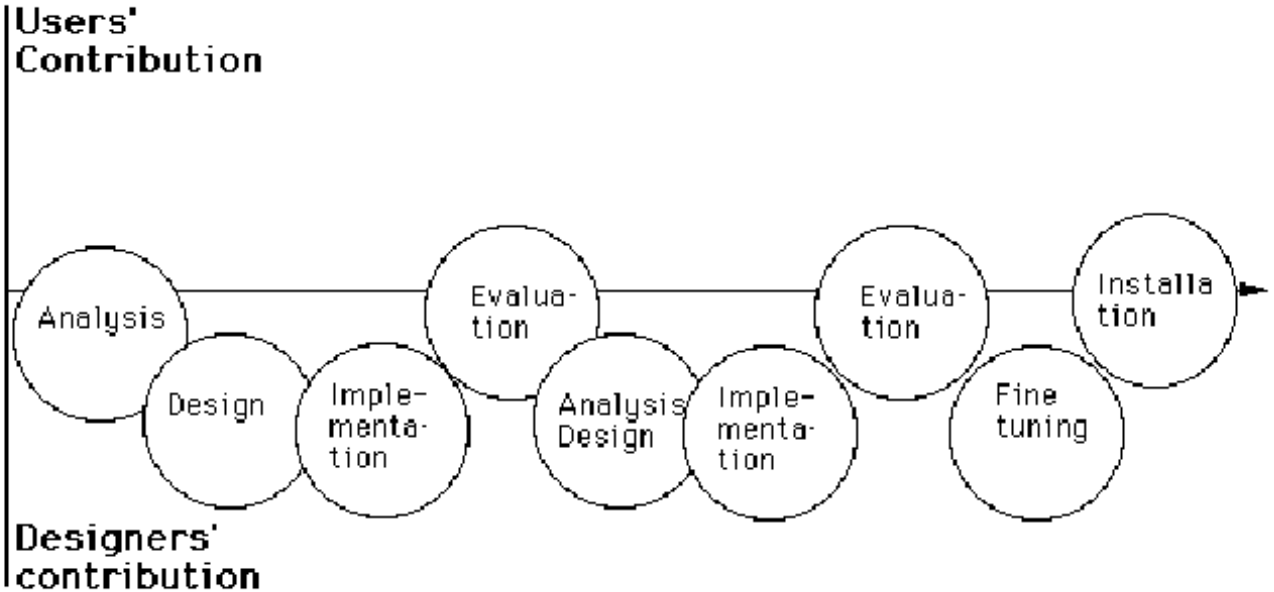
- to support the tutor's role in a PBL approach;
- to facilitate monitoring and evaluation for the tutor;
- to help the tutor verify whether knowledge is being acquired;
- to motivate the peers, and eventually to distribute the results to bigger audiences.

Research questions: see above

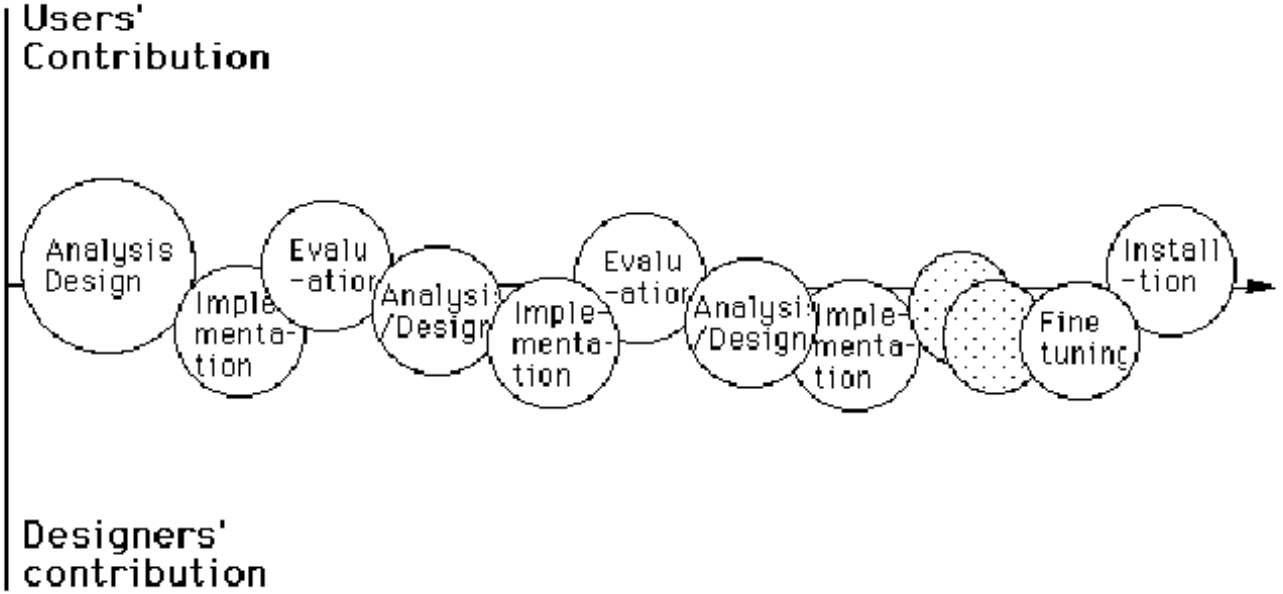
Method

- Field exploration:
  - A very important part of this research was to conceive a grammar that would model the work of an academic project. There are different sources of information that have been used to achieve this goal. (....)
- Survey of needs with a questionnaire:
  - In order to gather precious information from the key persons involved in projects, like professors and their assistants, a questionnaire was articulated in such a way that would provoke a productive discussion, leading to comments and suggestions that would improve this research. The idea was to give the questionnaire to a small sample of the unit and stop the survey when the same answers came up again.
- The development method
  - ... that has been adopted corresponds to participatory design and specifically to ***cooperative prototyping***.
  - Both "prototyping" and "user involvement" (or "user centered design") are concepts that have frequently been suggested to address central problems within system development in recent years. The problems faced in many projects reduce to the fact that the systems being developed do not meet the needs of users and their organizations. [...]

Traditional Information System prototyping approaches (after Grønbæk, 1991).



Cooperative prototype approach used in this study (after Grønbæk, 1991)



Exemple 4-2: F. Radeff's master thesis

Title: Le portail personnalisable comme interface d'optimisation de ressources académiques

Research questions

La question principale de ce travail est : pourquoi les bibliothèques universitaires ne proposent-elles pas de portails personnalisables, ces derniers constituant vraisemblablement une bonne solution pour l'optisation des ressources des bibliothèques à l'ère numérique.

Cette question peut s'articuler en 3 sous-questions :

• pourquoi pas plus de portails personnalisables ?

• pourquoi les gens ne personnalisent-ils pas ?

• la personnalisation correspond-elle à un besoin ?

Method, not clearly articulated, e.g.:

- La méthodologie retenue est une revue de la littérature, afin d'expliciter les concepts, de dégager les grands modèles et d'examiner les dispositifs existants, accompagnée d'un monitoring sur l'***implémentation partielle d'un prototype de dispositif*** de portail personnalisable.
- L'implémentation partielle n'ayant pu être menée à terme, le monitoring a été supprimé et j'ai élargi le champ de la revue de littérature. L'analyse est donc qualitative, les données quantitatives initialement prévues n'ayant pu être collectées.
- Le matériel recueilli lors du prototype MyBCU ainsi que l'expérience acquise en 2001-2002 comme webmaster [...] m'ont néanmoins permis de tenter de répondre aux questions initiales.

Quantitative data acquisition methods (e.g. surveys and tests)

(version 0.7, 1/4/05)

Code: data-quant

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Basics

1. Make a list of concepts (theoretical variables) in your research questions for which you need data.
2. For each of these concepts make sure that you identify its dimensions (or make sure that they are not multi-dimensional)
   - Consult the literature
   - Discuss with domain experts
   - Read the literature or discuss with researchers if you can
   - Make a list of conceptual variables (either simple concepts or dimensions of complex concepts)
3. For each conceptual variable think about how you plan to measure it
   - First of all (!!) go through the literature and find out if and how other people went about it
   - It is much better to use a suitable published instrument than to build your own. You can then compare your results and you will have much less explanations and justifications to produce !
4. Think about redundancy and triangulation
   - Do not measure a conceptual variable with just one question or observation
   - Maybe get data of different nature, e.g. combine surveys with objective data and observations
5. Rather ask people how they behave instead of how they think they behave
   - E.g. don’t ask: "Do you use socio-constructivist pedagogies ?"
   - Ask several questions about typical tasks assigned to students.
6. Do not ask people to confirm your research questions
   - E.g. Don’t ask: Did you manage to make your teaching more socio-constructivist with this new tech.
   - (Again) Ask what the person really does

2. Survey design

2.1 The basics of question and response item design

- Only ask questions that your target population understands (test your questionnaire with at least 2 people)
- Questions should avoid addressing 2 issues in 1 question!
- Make questions short
- Ask several questions that measure the same concept
  - Try be all means to find sets of published items (questions) in the literature that you can reuse
- Avoid open-ended answers (these will give a lot of coding work)
- Use scales that have at least a range of 5 response options
  - otherwise people will have a tendency to drift to the "middle" and you will have no variance.
  - e.g. avoid:

```
agree ()   neither/or ()   disagree ()
```

- Response options should ideally be consistent across items measuring a same concept
- If you feel that most people will check a "middle" value, use a large "paired" scale without a middle point

```
e.g. 1=totally disagree, 10=totally agree
1 2 3 4 5   6 7 8 9 10
```

2.2 Examples

Exemple 2-1: Social presence

Gunawerda, C.N., & Zittle, F.J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. The American journal of distance education, 11(3), 8-26.

The GlobalEd questionnaire was developed to evaluate a virtual conference. Participants (n=50) of the conference filled out the questionnaire. Internal consistency of the social presence scale was a=0.88. Social presence was found to be a strong predictor of user satisfaction.

url: **http://www.presence-research.org/Overview.html (Compendium of Presence Measures)**

- Messages in GlobalEd were impersonal
- CMC is an excellent medium for social interaction
- I felt comfortable conversing through this text-based medium
- I felt comfortable introducing myself on GlobalEd
- The introduction enabled me to form a sense of online community
- I felt comfortable participating in GlobalEd discussions
- The moderators created a feeling of online community
- The moderators facilitated discussions in the GlobalEd conference
- Discussions using the medium of CMC tend to be more impersonal than face-to-face discussion
- CMC discussions are more impersonal than audio conference discussions
- CMC discussions are more impersonal than video teleconference discussions
- I felt comfortable interacting with other participants in the conference
- I felt that my point of view was acknowledged by other participants in GlobalEd
- I was able to form distinct individual impressions of some GlobalEd participants even though we communicated only via a text-based medium.

A 5-point rating scale was used for each question

Exemple 2-2: Socio-constructivist teachers

Class (and Schneider) 2005, PhD thesis project (scale based on Dolmans 2004)

The problem was how to identify socio-constructivist elements in a distance teaching course for interpreter trainers.

Decomposition of "socio-constructivist design" in (1) active or constructive learning, (2) self-directed learning, (3) contextual learning and (4) collaborative learning, (5) teacher's interpersonal behavior (according to Dolmans et al., 1993)

Note that headers regarding these dimensions (e.g. "Constructive/active learning" are not shown to the subjects. We do not want them to reflect about theory, but just to answer the questions ... So they are just shown below to help your understanding

	Statements: Teachers stimulated us …	Totally disagree	Disagree	Somewhat agree	Agree	Totally agree
		1	2	3	4	5
(Constructive/active learning)						
4	… to search for explanations during discussion	O	O	O	O	O
5	… to summarize what we had learnt in our own words	O	O	O	O	O
6	… to search for links between issues discussed in the tutorial group	O	O	O	O	O
7	… to understand underlying mechanisms/theories	O	O	O	O	O
8	… to pay attention to contradictory explanations	O	O	O	O	O
(Self-directed learning)						

	Statements: Teachers stimulated us …	Totally disagree	Disagree	Somewhat agree	Agree	Totally agree
9	… to generate clear learning issues by ourselves unclear	O	O	O	O	O
10	… to evaluate our understanding of the subject matter by ourselves	O	O	O	O	O
	(Contextual learning)					
11	… to apply knowledge to the problem discussed	O	O	O	O	O
12	… to apply knowledge to other situations/problems	O	O	O	O	O
13	… to ask sophisticated questions	O	O	O	O	O
14	… to reconsider earlier explanations	O	O	O	O	O
	(Collaborative learning)					
15	… to think about our strengths and weaknesses concerning our functioning in the tutorial group	O	O	O	O	O
16	… to give constructive feedback about our group work	O	O	O	O	O
17	… to evaluate our group cooperation regularly	O	O	O	O	O
18	… to arrange meetings with him/her to discuss how to improve our functioning as a group	O	O	O	O	O

2.3 The questionnaire

The Introduction in written questionnaires (on paper or on-line)

- Write a short introduction that states the purpose of this questionnaire
  - Example (in french): The purpose of this questionnaire is to help us understand how well you liked the on-line delivery of the first blended edition of the Certificate for Interpreter Trainers. Each one of the 117 statements below asks about your experience in the on-line part of the Certificate. Data will be processed and published only statistically. The following questions will be dealt with: personal information, teachers' behavior, learning environment, tutoring support structure, tools and skills. Filling in this questionnaire will take you about 20 minutes. Please be assured that your responses will be treated confidentially, and that they will not affect your assessment. Thank you very much for your cooperation.
- guarantee that you only will publish statistical data (no names !)
- specify how long it will take to fill it in

Coding information for the researcher

- Assign a code (e.g. number) to each question item (variable) and assign a number (code) to each response item
  - see example on previous and next slide
- This will help you when you transcribe data or analyze data
- use "small fonts" (this information is for you)

Ergonomics

- Do not include anything else than questions and response items (besides the introduction)
- Make sure that people understand where to "tick".

Exemple 2-3: Example of a question set (one question with several sub questions):

Teachers' behavior

Below you will find general statements about teachers' behavior. Please indicate to what extent you agree or disagree with them? Please tick the appropriate circle on the scale (totally disagree - totally agree) for each statement.

	Statements: Teachers stimulated us …	Totally disagree	Disagree	Some-what agree	Agree	Totally agree
		1	2	3	4	5
4	… to search for explanations during discussion	O	O	O	O	O
5	… to summarize what we had learnt in our own words	O	O	O	O	O
14	… to reconsider earlier explanations	O	O	O	O	O

3. Experiments

- Designing a true experiment needs advice from some expert. Typically, a beginner makes the mistake to differentiate 2 experimental conditions by more than one variable !!

There are many kinds of experimental measures

- observations (e.g. Video, or recordings of computer input)
- tests (similar to surveys)
- tests (similar to examination questions)
- tests (performance in seconds)
- tests (similar to IQ tests)

Consider all the variables you want to measure

- most times the dependant variables (to explain) are measured with tests
- usually the independent (explanatory) variables are defined by the experimental conditions (so you don't need to measure anything, just remember to which experimental group the subject belonged)

See the literature !!

- First of all, read articles about similar research !
- Consult test psychologists if you need to measure intellectual performance, personality traits, etc.
- Use typical school tests if you want to measure typical learning achievement

4. Sampling

4.1 The ground rules

The number of cases you have to take into account is rather an absolute number

- therefore not dependent on the size of the total "population" you study

The best sampling is random, because:

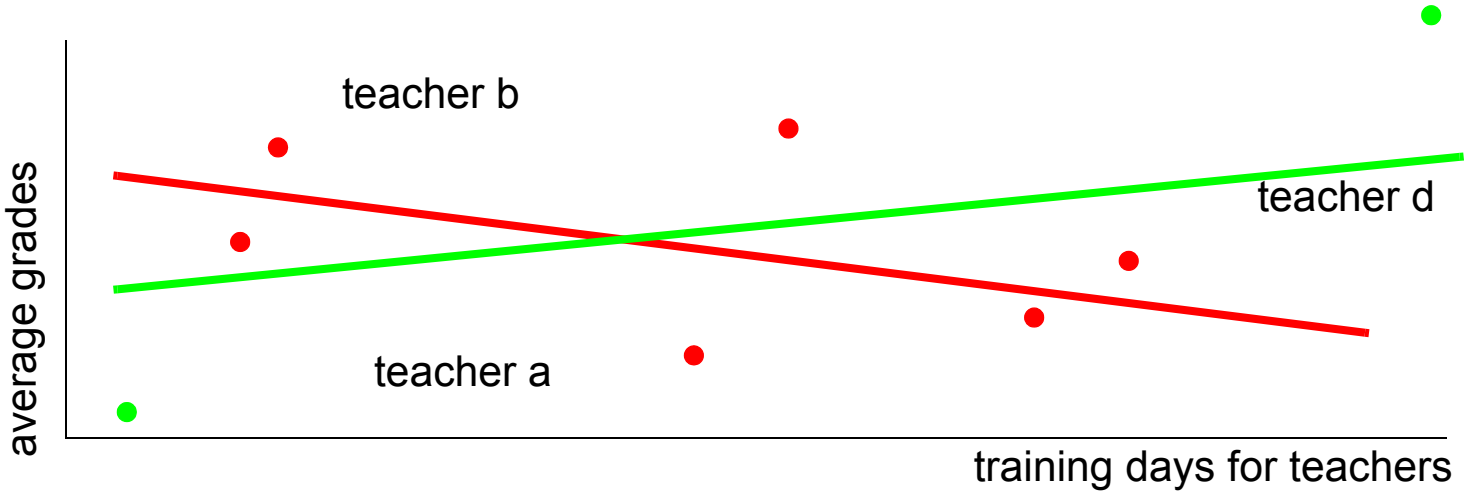
- you have a likely chance to find representatives of each "kind" in your sample
- you avoid auto-selection (i.e. that only "interested" persons will answer your survey or submit to experiments

When you work with small samples, you may use a quota system

- e.g. make sure that you have both "experts" and "novices" in a usability study of some software
- e.g. make sure that you (a) both interview teachers who are enthusiastic users and the contrary, (b) schools that are well equipped and the contrary in a study on classroom use of new technologies.

4.2 A first look at significance

- Significance of results depend both on strength of correlations and size of samples
  - therefore: the more cases you have got, the more likely your results will be interpretable !



- Let's assume you have data from only 6 teachers (the red dots):
  - your data suggest a negative correlation: more training days lead to worse averages
- By only adding 2 teachers (the 2 green dots) this relation will switch from negative to positive
  - data suggests a (weak) positive correlation.
  - So: doing a statistical analysis on very small data sets is like gambling. If your data set included 20 teachers, adding these 2 more wouldn't have changed the relationship

4.3 Typical sampling for experiments

- ***preferably*** 20 subjects / experimental condition
- ***at least*** 10 / experimental condition (but expect most relations to be non-significant)

Exemple 4-1: Study the effect of multimedia on retention

Explanatory (independent) variable X: ***Static diagrams*** vs. ***animation*** vs. ***interactive animation***

Dependant (to be explained) variable Y1: Short term recall

Dependant (to be explained) variable Y2: Long-term recall

- Both dependant variables (Y1 and Y2) can be measured by recall tests
- For variable X we have three conditions
- Therefore we need 3 * 20 = 60 subjects
  - If you expect very strong relations (don't for this type of research !) you can get away with 3 * 15
  - Note: we can not administer the three different conditions to each individual (because by moving from one experiment to another they will learn). You may consider building 3 * 3 = 9 different kinds of experimental materials however and have each individual do each experiment in a different condition. However, they may get tired or show other experimentation effects ... and producing good material is more expensive than finding subjects.

4.4 Typical samples for survey research

- As much as you can if you use written or on-line surveys
- 50 or more, 40 is a minimum, 100 is good and 200 is excellent for a MSc thesis.
  - otherwise you can't do any sort of interesting data analysis, because your significance levels will be too high (i.e. bad) when you analyze detailed or complex relationships.

4.5 Typical samples for aggregate data

- e.g. schools, districts, countries etc.
- Since these data reflect real "realities" you can do with less (however talk to an expert, a lot depends on the kinds of analysis you plan to do).

Qualitative data acquisition methods (e.g. Interviews and observations)

(version 0.9, 1/4/05)

Code: data-quali

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Sampling strategies in qualitative research

☞ Often you only work with 1-2 big cases (i.e. classes, organizations)
- Qualitative analysis is highly labor intensive

☞ But within each case you also have to think about sampling !

example: organizational study (innovation research)
- informants within the organization
- external experts (domain/subject experts/practitioners)
- clients and other interacting organizations
- observed processes (e.g. workflow analysis)
- texts (e.g. written decisions, files, ...)

example: impact of an initiative on a living area (e.g. publicly accessible computer rooms)
- external decision makers and interest groups
- organized local groups (e.g. parent's associations)
- population of the area
- events and behaviors associated with this initiative

☞ Sampling is often multi-stage (by waves)
- Research in progress can show new phenomena that need investigation and therefore sampling

1.1 General sampling strategies

Miles & Huberman (1994:28)

Type of case	Usage	
maximal variation	will give better scope to your result s (but needs more complex models !!)	major strategies
homogeneous	provides better focus and conclusions will be "safer" since it will be easier to identify explaining variables and to test relations	
critical	exemplify a theory with a "natural" example	
according to theory, i.e. your research questions	will give you better guarantees that you will be able to answer your questions	
confirming / infirming	test the limits of an explanation	validation
extremes and deviant cases	test the boundaries of your explanations, seek new adventures	
typical	Show what is “normal” or “mean” or "typical"	
intense	complete a quantitative study with an in-depth study	specialization
according to dimension	Study of particular phenomena	
“snow ball”	According to information received during study	inductive approach
“opportune”	Follow new “leads”	

Type of case	Usage	
all	(rarely possible)	representativeness
quota	selection of subgroups	
according to reputation	recommendations of experts	
comparative method	according to operative variables	
according to criteria	according to criteria you want to study	
convenient	those who are willing ...	bad
polititical	Exclusion/inclusion for political reasons	

Use this big list to think about your own strategy

- The are no general rule !
  - Use this table to think the kind of sampling you need for ***your*** research.
- Choose well your cases = avoid trouble later ...
- ... avoid adopting a sampling-by-induction strategy (more difficult)
- Look at your research questions !!
  - can you answer all of them (measure concepts, find causalities, etc.)
- Understand the scope of the sampling task (see next slide)
  - roles (functions organization),
  - groups, organizations, institutions, ...
  - “programs”,
  - processes,
  - ....

Advice for intra-case sampling:

- identify ***types of informations*** you need.
- sample ***all categories*** (activities, processes, events, dates, locations, agents, ...)
- again: think about your the theory you want to produce and its scope
- reduce your ambitions (research questions) when your sampling lists get to large
- you always can add cases (snow-ball strategy)

Advice for inter-case sampling:

- It's a good strategy to adopt a kind of similar systems design:
  - select similar cases that have a nice variance within your operative variables (dependant and independent)
  - E.g. to test an e-learning design, select relatively similar domains, or relatively similar target population
- You then can add contrasted (extreme) cases to test the external validity (generalization potential) of your analysis

Remember: qualitative research is very expensive

- 2-3 big cases (e.g. courses, schools, designs) are enough for a master thesis
- 12-30 cases within all cases (e.g. people, processes) are enough for a master thesis
- else complete qualitative strategies with quantitative

2. Data gathering techniques (empirical measures)

Overview:

activity	medium	principal objective
look	**observation**	Global observation of an organization, culture, activity, etc. see: 3. “Observation, transcription and text analysis” [8]
examine activities	**transcriptions of natural activities**	In-depth study of activities and interactions in context see: 3. “Observation, transcription and text analysis” [8]
provoked activities	**transcriptions of provoked activities**	In-depth study of formal activities you engage somebody in see: 3. “Observation, transcription and text analysis” [8]
study	**texts**	Written traces of activities (e.g. decision protocols, guidelines) See: 3. “Observation, transcription and text analysis” [8]
ask	**interviews**	Extraction of information in peoples head see: 4. “Interviews” [12].
participate	**share**	Participatory observation shares research and work

Different roles for qualitative technology

☞ Don't confuse the technique and approach levels when you talk about qualitative methods

	Some different objectives and preferred techniques for different kinds methodologies (approaches)	
method	**quantitative**	**qualitative**
look	• preliminary work for questionnaire design	• "Deep understanding of an institution's or culture's working
examine activities	• quick studies of work activities and interactions to prepare initial design specifications • systematic usability studies	• dialogue analysis
provoked activities		• understanding of reasoning processes
study	• formal content analysis • most often work counting or more sophisticated like LSA	• categorization and understanding of concepts
ask	• fixed questions to systematically gather relatively complex attitudes, opinions and descriptions of behaviors	• open interviews or semi-structured interviews to engage subjects in

- This table is not very complete, but it shows that qualitative designs are more geared towards going in depth whereas mostly quantitative designs put more emphasis on scale or preparation of quantitative studies, ...

3. Observation, transcription and text analysis

3.1 Observation of behaviors in natural contexts

☞ Essential instrument for ***in-depth studies*** of cultures and/or organizations

- Takes ***time*** and requires ***skills*** (see below)
- Needs assessment:
  - of the researcher's role in the organization, group, culture, ...
  - on investigation methods, research goals (in order to focus observations), etc.
- Needs a good "field notes" technique:
  - notational conventions for sessions
  - notational conventions after session notes
  - a journaling technique
- Example:

Marks	Usage
"..."	verbatim quotations
' ... '	paraphrases
(...)	contextual data (or researchers interpretations)
< ... >	Analytical categories) derived from the subject's conceptual frameworks
/ ...	Analytical categories) derived from the researcher's conceptual frameworks
____	time elapsed

3.2 Computer mediated transcriptions

- ... are very popular in educational technology
- Media: experimental artifacts, portals, CSCL, CSCW
- Tools are sometimes rigged to register detailed user acts for research purposes
- Types of activities observed:
  - user-machine interactions
  - mediated user-user interactions
- In addition, screen activities can be filmed or electronically registered
  - give extra informations, also allows to register non CMC-mediated user-user communication

Data

- can be enormous amounts
- Analysis of transcriptions take an enormous amount of time
  - either you have to spend days/weeks for manual coding (preferably using specialized software adapted to the media type)
  - or you need high technical skills to write scripts to reduce and "massage" data
- Likely you also have to invent your own data analysis and visualization techniques
- Be sure to search the literature for coding and analysis techniques !

Advice

- think very hard about the concepts you need to measure !

3.3 Elicitation of cognitive processes

- The "***thinking aloud***" method combined with protocol analysis (Ericsson & Simon, 1983) is a popular method in cognitive science and expert system design
- Used to collect relatively "objective" data about thinking processes, problem solving in particular.
- There can be important experimentation effects:
  - ex-post rationalization of behavior,
  - analytical thinking instead of case-based/pattern matching
  - influence of experimenter
  - subject may become silent and confused ...
- Basic principle: Users are given tasks and are asked to think aloud what they do.

The Ecrisson & Simon procedure for elicitation cognitive processes

- Experimenter is completely silent...
- ...except when subject is ± 15s silent
- "Keep talking"

Boren & Ramey: Usability testing practice is different:

- Subjects asks for help,
- Testers ask questions (clarification, opinion, ...),
- 'Push' subjects in certain directions.

3.4 Transcriptions of user activities in semi-formal situations

☞ Usually audio or video recordings

- Take time to analyze (like above) !
- Ask permission to use a tape-recorder or a camera if you do this in a work context
- Can also modify user's behaviors

(more details to follow in a next version, sorry ...)

3.5 Texts

- Text analysis (other than "texts" mentioned above) concerns artifacts like official documents, student/teacher paper productions, etc.
- Don't ask for everything when you start your research
  - People don't always like to give away written traces of their activities, and therefore you need to establish a confidence relation first.
- There are a large amount of analysis techniques
  - will not be covered in this short "crash course".

4. Interviews

Type	composition	function / advantages
Information interviews	check-list	**Initial studies** • See 4.2 “The information interview” [13]
Semi-structured interviews	list of questions and “probes”	**Main interview type in qualitative research** • subjects are allowed to "talk" and therefore to think • difficult to analyze • See 4.4 “The semi-structured interview” [15]
Structured (directive) interviews	list of fixed questions	**Semi-quantitative studies:** • easier analysis • better comparison • faster than semi-structured • See 4.3 “The structured interview” [14]
Interviews with a fixed list of questions and closed questions (see quantitative modules)	list of questions with response items	**Quantitative studies** • fast interview • reliable • easy to analyze • needs good understanding of the studied phenomenon

4.1 General advice for interviews

☞ Interviewing is a well documented technique (in most textbooks)

Interviewees (in natural settings) don't have time to loose

- focus on the ***essential***
- check if some information is available in other forms (e.g. written memos, rules, etc.)
- learn the ***"jargon"***
- consult all other available information before the interview

4.2 The information interview

- Possible Objectives:
  - determine your research goals, e.g. you need to find out if your potential research subject is of any interest, etc. ;
  - prepare your research questions ;
  - prepare field research, e.g. you need information about the workings of an organization, process, procedure, about people and their roles, etc.
- Find ***the*** person:
  - often you may first interview ***a domain specialist ;***
  - sometimes ***any person*** that has knowledge on your subject area ***and time*** will also do***.***
- In "natural contexts" avoid to "over-tax" key actors:
  - You must make sure that key actors will agree to in-depth semi-structured interviews in later stages, interviewing twice may not please some of them.

4.3 The structured interview

- Definition: A list of questions and open responses (usually a few sentences)
  - Useful to systematically gather comparable informations about relatively complex variables (beliefs, behaviors, etc.)
- The questionnaire needs a ***lot of preparation !***
  - make sure that each concept can reliably be measured and lead to valid indicators.
- To prepare the questionnaire you ought to do 2-3 semi-structured interviews (or at least some information interviews)
- In addition, make ***pre-tests*** with 2-3 subjects in order to be sure that your questions are understandable
- You have to think about analysis methods beforehand
  - manual or machine coding?
  - code books
  - cost estimations, remember that any sort of text analysis is very costly (!)
  - etc.
- .... Consider surveys with closed response items as cheaper alternative !

4.4 The semi-structured interview

- This is preferred type of interview in typical qualitative research.
- You will get answers for your questions.
- Concurrently, this inteview type allows the interviewee to ***reason.***

☞ General remarks

- (again): ***preparation*** !
- (again): ***read your research questions*** and identify the ones that need interviewing

☞ Usual structure of the interview: 2 layers

- prepare a ***list of general question***
- for each of these questions you make a "secret" list of points (***"probes"***) that need to be covered
  - during the interview you must "probe" the interviewee for all those points

☞ Interviewer's behavior

- ***Let the person talk !!!***
  .... and cover your questions and probes later !
- it is important that the interviewee is allowed to develop chains of reasoning (e.g. perceptions of causality, associations between concepts, etc.).
- The goal is to extract "meaning", i.e. so called "deep" or "think" structures.

☞ Carefully word your questions

- Watch out for sensitive questions
  - put them at the end
  - if you are lucky the subject will mention them anyhow.
- Use indirect questions that project the interviewee into a situation
- Example:
  - don't ask: "do you work well with person A ?"
  - but: "do you have frequent contacts with A", "how do you coordinate", etc.
  - don't ask: "do you know how to use this software" ?
  - but: "how frequently do you use this software", etc. ?
- When appropriate, ask about concrete cases
  - e.g. present a hypothetical case and ask how they solve it.
  - e.g. (in usability testing) give them tasks to solve

En résumé:

- rather ask what people ***do*** than what they feel
- in many situations, it is useful to present the interviewee with a scenario and use it also to let people reflect on more general issues

Quantitative Data Analysis

(version 0.7, 1/4/05)

Code: analysis-quant

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Menu

1. Scales and "data assumptions"

1.1 Types of quantitative measures (scales)

Types of measures	Description	Examples
nominal or category	enumeration of categories	male, female district A, district B, software widget A, widget B
ordinal	ordered scales	1st, 2nd, 3rd
interval or quantitative or "scale" (in SPSS)	measure with an interval	1, 10, 5, 6 (on a scale from 1-10) 180cm, 160cm, 170cm

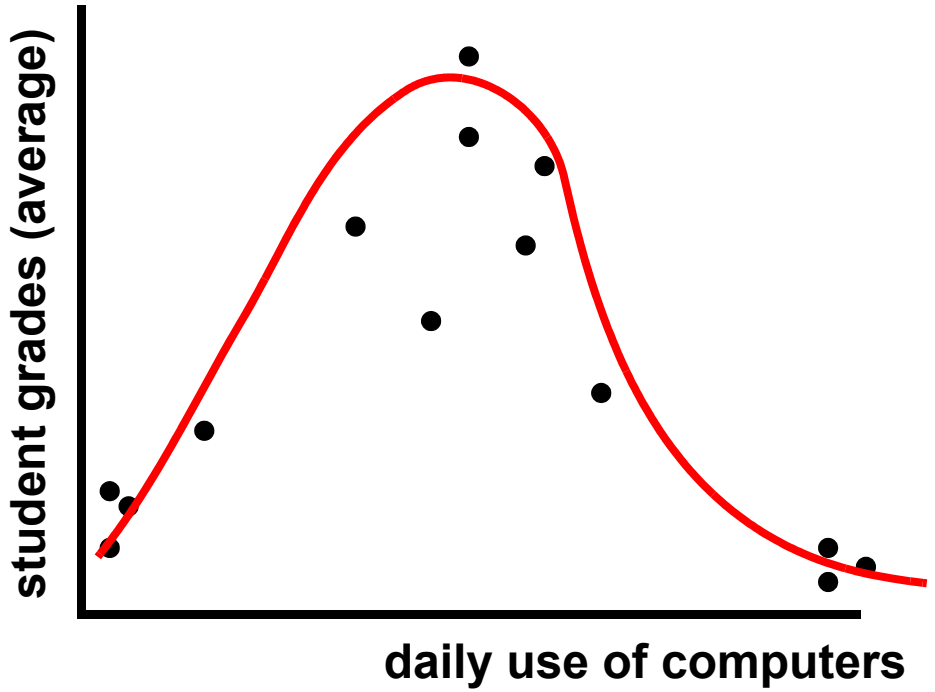
- For each type of measure or combinations of types of measure you will have to use different analysis techniques.
- For interval variables you have a bigger choice of statistical techniques.
  - Therefore scales like (1) strongly agree, (2) agree, (3) somewhat agree, etc. usually are treated as interval variables.

1.2 Data assumptions

- not only you have to adapt your analysis techniques to types of measures but they also (roughly) should respect other data assumptions.

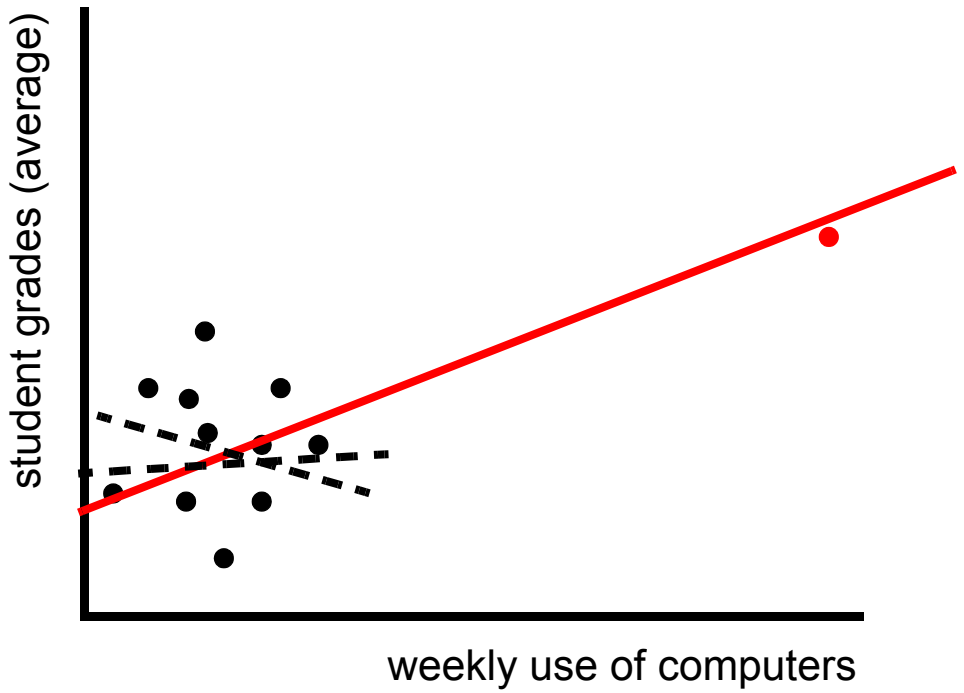
A. Linearity

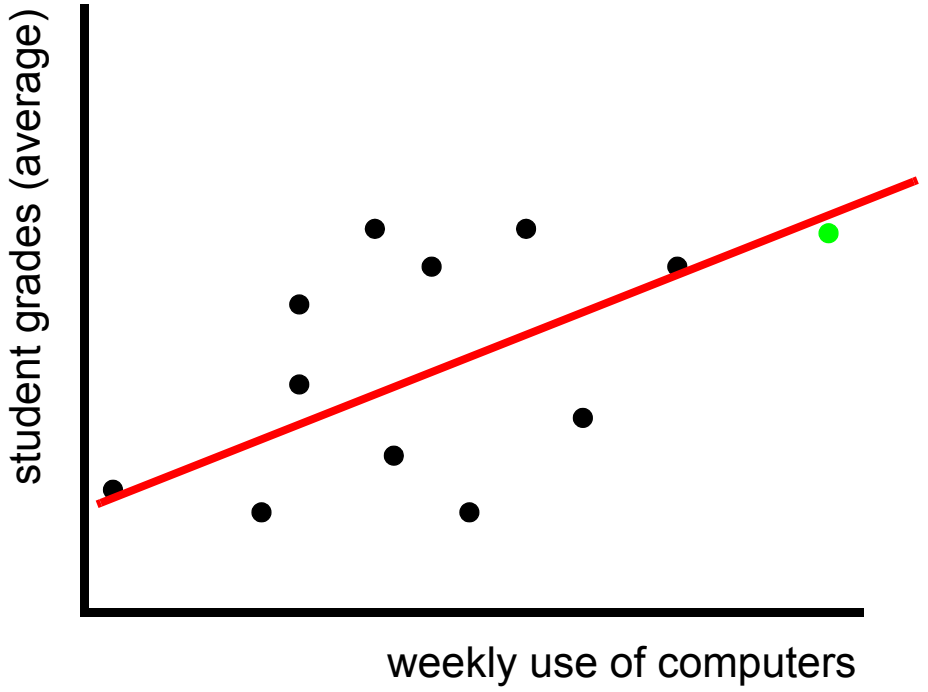
- Example: Most popular statistical methods for interval data assume ***linear relationships***:
  - In the following example the relationship is non-linear: students that show weak daily computer use have bad grades, but so do they ones that show very strong use.
  - Popular measures like the Pearson's r will "not work", i.e. you will have a very weak correlation and therefore miss this non-linear relationship



B. Normal distribution

- Most methods for interval data also require "***normal distribution***"
- If you have data with "extreme cases" and/or data that is skewed, some individuals will have much more "weight" than the others.
- Hypothetical example:
  - The "red" student who uses the computer for very long hours will determine a positive correlation and positive regression rate, whereas the "black" ones suggest an inexistent correlation. Mean use of computers does not represent "typical" usage.
  - The "green" student however, will not have a major impact on the result, since the other data are well distributed along the 2 axis. In this second case the "mean" represents a "typical" student.





2. The principle of statistical analysis

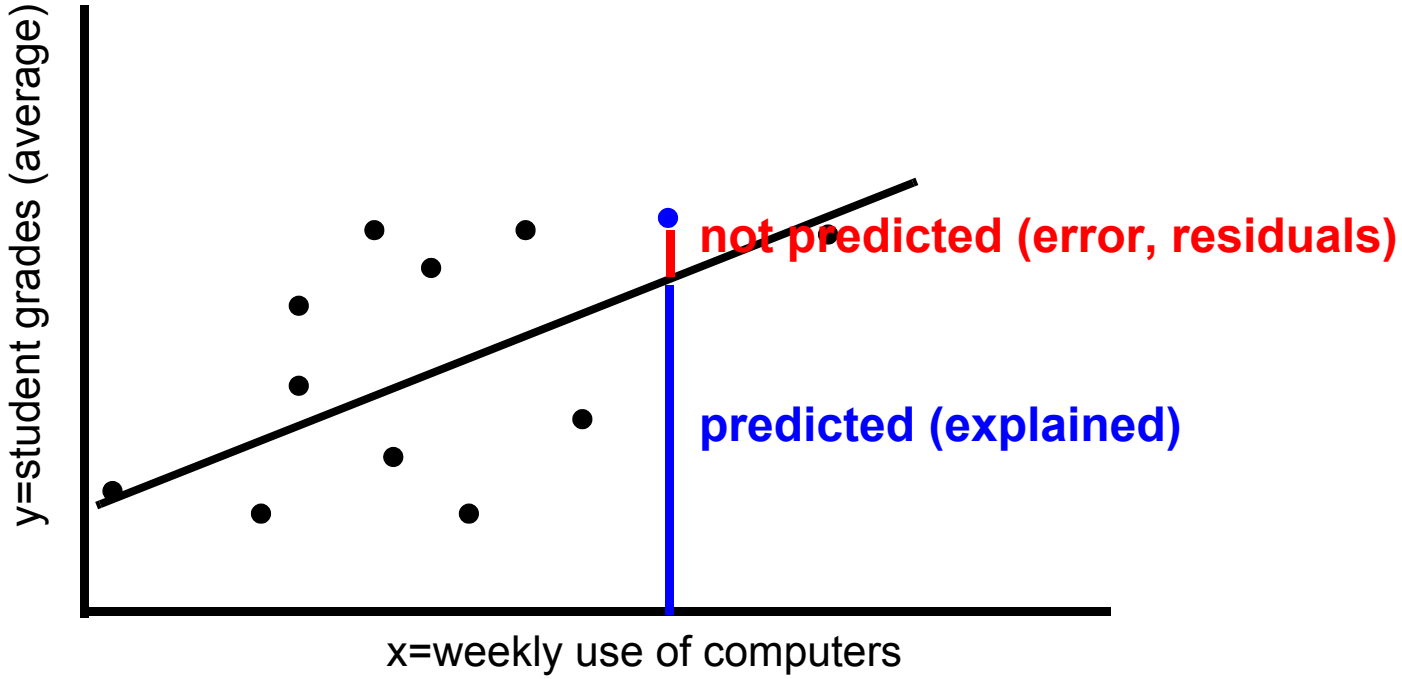
- The goal of statistical analysis is quite simple: find structure in the data

DATA = STRUCTURE + NON-STRUCTURE

DATA = EXPLAINED VARIANCE + NOT EXPLAINED VARIANCE

Example: Simple regression analysis

- DATA = **predicted** regression line + **residuals**
- in other words: regression analysis tries to find a line that will maximize prediction and minimize residuals



3. Stages of statistical analysis

Note: With statistical data analysis programs you easily can do several steps in one operation.

1. Clean your data
   - Make very sure that your data are correct (e.g. check data transcription)
   - Make very sure that missing values (e.g. not answered questions in a survey) are clearly identified as missing data
2. Gain knowledge about your data
   - Make lists of data (for small data sets only !)
   - Produce descriptive statistics, e.g. means, standard-deviations, minima, maxima for each variable
   - Produce graphics, e.g. histograms or box plot that show the distribution
3. Produce composed scales
   - E.g. create a single variable from a set of questions
4. Make graphics or tables that show relationships
   - E.g. Scatter plots for interval data (as in our previous examples) or crosstabulations
5. Calculate coefficients that measure the strength and the structure of a relation
   - Strength examples: Cramer's V for crosstabulations, or Pearson's R for interval data
   - Structure examples: regression coefficient, tables of means in analysis of variance
6. Calculate coefficients that describe the percentage of variance explained
   - E.g. R^2 in a regression analysis
7. Compute significance level, i.e. find out if you have to right to interpret the relation
   - E.g. Chi-2 for crosstabs, Fisher's F in regression analysis

4. Data preparation and composite scale making

4.1 Statistics programs and data preparation

Statistics programs

- If available, plan to use a real statistics program like SPSS or Statistica
- Good freeware: WinIDAMS (statistical analysis require the use of a command language)
  url: **http://portal.unesco.org/ci/en/ev.php-URL_ID=2070&URL_DO=DO_TOPIC&URL_SECTION=201.html**
- Freeware for advanced statistics and data visualization: R (needs good IT skills !)
  url: **http://lib.stat.cmu.edu/R/CRAN/**
- Using programs like Excel will make you loose time
  - only use such programs for simple descriptive statistics
  - ok if the main thrust of your thesis does not involve any kind of serious data analysis

Data preparation

- Enter the data
  - Assign a number to each response item (planned when you design the questionnaire)
  - Enter a clear code for missing values (no response), e.g. -1
- Make sure that your data set is complete and free of errors
  - Some simple descriptive statistics (minima, maxima, missing values, etc.) can help
- Learn how to document the data in your statistics program
  - Enter labels for variables, labels for responses items, display instructions (e.g. decimal points to show)
  - Define data-types (interval, ordinal or nominal)

4.2 Composite scales (indicators)

Basics:

- Most scales are made by simply adding the values from different items (sometimes called "Lickert scales")
- Eliminate items that have a high number of non responses
- Make sure to take into account missing values (non responses) when you add up the responses from the different items
  - A real statistics program (SPSS) does that for you
- Make sure when you create your questionnaire that all items use the same range of response item, else you will need to standardize !!

Quality of a scale:

- Again: use a published set of items to measure a variable (if available)
  - if you do, you can avoid making long justifications !
- Sensitivity: questionnaire scores discriminate
  - e.g. if exploratory research has shown higher degree of presence in one kind of learning environment than in an other one, results of presence questionnaire should demonstrate this.
- Reliability: internal consistency is high
  - Intercorrelation between items (alpha) is high
- Validity: results obtained with the questionnaire can be tied to other measures
  - e.g. were similar to results obtained by other tools (e.g. in depth interviews),
  - e.g. results are correlated with similar variables.

Exemple 4-1: The COLLES surveys

url: **http://surveylearning.moodle.com/colles/**

- The Constructivist On-Line Learning Environment Surveys include one to measure preferred (or ideal) experience in a teaching unit. It includes 24 statements measuring 6 dimensions.
- We only show the first two (4 questions concerning relevance and 4 questions concerning reflection).
- Note that in the real questionnaire you do not show labels like "Items concerning relevance" or "response codes".

Statements	Almost Never	Seldom	Some-times	Often	Almost Always
response codes	**1**	**2**	**3**	**4**	**5**
Items concerning relevance					
a. my learning focuses on issues that interest me.	O	O	O	O	O
b. what I learn is important for my prof. practice as a trainer.	O	O	O	O	O
c. I learn how to improve my professional practice as a trainer.	O	O	O	O	O
d. what I learn connects well with my prof. practice as a trainer.	O	O	O	O	O
Items concerning Reflection					
… I think critically about how I learn.	O	O	O	O	O
… I think critically about my own ideas.	O	O	O	O	O
… I think critically about other students' ideas.	O	O	O	O	O
… I think critically about ideas in the readings.	O	O	O	O	O

Algorithm to compute each scale:

for each individual add response codes and divide by number of items

or use a "means" function in your software package:

relevance = mean (a, b, c, d)

Examples:

Individual A

```
who answered a=sometimes, b=often, c=almost always, d= often gives:
(3 + 4 + 5 + 4 ) / 4 = 4
```

Missing values (again)

- Make sure that you do not add "missing values"

  Individual B

  ```
  who answered a=sometimes, b=often, c=almost always, d=missing gives:
  (3 + 4 + 5) / 3 = 4
  ```

  and certainly NOT:

  ```
  (3 + 4 + 5 + 0) / 4 or (3 + 4 + 5 -1) / 4 !!
  ```

5. Overview on statistical methods and coefficients

5.1 Descriptive statistics

- Descriptive statistics are not very interesting in most cases
  (unless they are used to compare different cases in comparative systems designs)
- Therefore, do not fill up pages of your thesis with tons of Excel diagrams !!

Some popular summary statistics for interval variables

- Mean
- Median: the data point that is in the middle of "low" and "high" values
- Standard deviation: the mean deviation from the mean, i.e. how far a typical data point is away from the mean.
- High and Low value: extremes a both end
- Quartiles: same thing as median for 1/4 intervals

5.2 Which data analysis for which data types?

Popular bi-variate analysis

		Dependant variable Y: Quantitative (interval)	Dependant variable Y: Qualitative (nominal or ordinal)
Independent (explaining) variable X	Quantitative	Correlation and Regression	Transform X into a qualitative variable and see below
	Qualitative	Analysis of variance	Crosstabulations

Popular multi-variate anaylsis

		Dependant variable Y: Quantitative (interval)	Dependant variable Y: Qualitative (nominal or ordinal)
Independent (explaining) variable X	Quantitative	Factor Analysis, multiple regresstion, SEM, Cluster Analysis,	Transform X into a qualitative variable and see below
	Qualitative	Anova	Multidimensional scaling etc.

5.3 Types of statistical coefficients:

- First of all make sure that the coefficient you use is more or less appropriate for you data

The big four:

1. Strength of a relation
   - Coefficients usually range from **-1** (total negative relationship) to **+1** (total positive relationship). **0** means no relationship.
2. Structure (tendency) of a relation
3. Percentage of variance explained
4. Signification level of your model
   - Gives that chance that you are in fact gambling
   - Typically in the social sciences a sig. level lower than 5% (0.05) is acceptable
   - Do not interpret data that is above !

These four are mathematically connected:

E.g. Signification is not just dependent on the size of your sample, but also on the strength of a relation.

6. Crosstabulation

- Crosstabulation is a popular technique to study relationships between normal (categorical) or ordinal variables

Computing the percentages (probabilities)

- See the example on the next slides

1. For each value of the explaining (independent) variable compute de percentages
   - Usually the X variable is put on top (i.e. its values show in columns). If you don't you have to compute percentages across lines !
   - Remember this: you want to know the probability (percentage) that a value of X leads to a value of Y
2. Compare (interpret) percentages across the dependant (to be explained) variable

Statistical association coefficients (there are many!)

- Phi is a chi-square based measure of association and is usually used for 2x2 tables
- The Contingency Coefficient (Pearson's C). The contingency coefficient is an adjustment to phi, intended to adapt it to tables larger than 2-by-2.
- Somers' d is a popular coefficient for ordinal measures (both X and Y). Two variants: symmetric and Y dependant on X (but less the other way round).

Statistical significance tests

- Pearson's chi-square is by far the most common. If simply "chi-square" is mentioned, it is probably Pearson's chi-square. This statistic is used to text the hypothesis of no association of columns and rows in tabular data. It can be used with nominal data.

Exemple 6-1: Crosstabulation Avez-vous reçu une formation à l'informatique ?* Créer des documents pour afficher en classe

			X= Avez-vous reçu une formation à l'informatique ?		Total
			Non	Oui	
Y= Utilisez-vous l'ordinateur pour créer des documents pour afficher en classe ?	Régulièrement	Effectif	**4**	**45**	49
		% dans X	**44.4%**	**58.4%**	57.0%
	Occasionnellement	Effectif	**4**	**21**	25
		% dans X	**44.4%**	**27.3%**	29.1%
	2 Jamais	Effectif	**1**	**11**	12
		% dans X	**11.1%**	**14.3%**	14.0%
Total		Effectif	**9**	**77**	86
		% dans X	**100.0%**	**100.0%**	100.0%

- The probability that computer training ("oui") leads to superior usage of the computer to prepare documents is very weak (you can see this by comparing the % line by line.

Statistics:

- Pearson Chi-Square = 1.15 with a signification= .562
  - This means that the likelihood of results being random is > 50% and you have to reject relationship
- Contingency coefficient = 0.115, significance = .562
  - Not only is the relationship very weak (but it can't be interpreted)

Exemple 6-2: Crosstabulation: Pour l'élève, le recours aux ressources de réseau favorise l'autonomie dans l'apprentissage * Rechercher des informations sur Internet

			X= Pour l'élève, le recours aux ressources de réseau favorise l'autonomie dans l'apprentissage				
			0 Tout à fait en désaccord	1 Plutôt en désaccord	2 Plutôt en accord	3 Tout à fait en accord	Total
Y= Rechercher des informations sur Internet	0 Régulièrement	Count	0	2	9	11	22
		% within X	.0%	18.2%	19.6%	42.3%	25.6%
	1 Occasionnellement	Count	1	7	23	11	42
		% within X	33.3%	63.6%	50.0%	42.3%	48.8%
	2 Jamais	Count	2	2	14	4	22
		% within X	66.7%	18.2%	30.4%	15.4%	25.6%
	Total	Count	3	11	46	26	86
		% within X	100.0%	100.0%	100.0%	100.0%	100.0%

- We have a weak significant relationship: the more teachers agree that students will increase learning autonomy from using Internet resources, the more they will let students do so.

Statistics: Directional Ordinal by Ordinal Measures with Somer's D

Values	Somer's D	Significance
Symmetric	-.210	.025
Y = Rechercher des informations sur Internet Dependent	-.215	.025

7. Simple analysis of variance

- Analysis of variance (and it's multi-variate variant Anova) are the favorite tools of the experimentalists.
- X is an experimental condition (therefore a nominal variable) and Y usually is an interval variable.
  - E.g. Does presence or absence of ICT usage influence grades ?
- You can show that X has an influence on Y if means achieved by different groups (e.g. ICT vs. non-ICT users) are significantly different.
- Significance improves when:
  - means of the X groups are different (the further apart the better)
  - variance inside X groups is low (certainly lower than the overall variance)

Exemple 7-1: Differences between teachers and teacher students

Population		COP1 Fréquence de différentes manières de travailler des élèves	COP2 Fréquence des activités d'exploration à l'extérieur de la classe	COP3 Fréquence des travaux individuels des élèves
1 Etudiant(e) LME	Mean	1.528	1.042	.885
	N	48	48	48
	Std. Deviation	.6258	.6260	.5765
2 Enseignant(e) du primaire	Mean	1.816	1.224	1.224
	N	38	38	38
	Std. Deviation	.3440	.4302	.5893
Total	Mean	1.655	1.122	1.035
	N	86	86	86
	Std. Deviation	.5374	.5527	.6029

- COP1, COP2, COP3 sont des indicateurs composé allant de 0 (peu) et 2 (beaucoup)
- The difference for COP2 is not significant (see next slide)
- Standard deviations within groups are rather high (in particular for students), which is a bad thing: it means that among students they are highly different.

Anova Table and measures of associations

		Sum of Squares	df	Mean Square	F	Sig.
Var_COP1 Fréquence de différentes manières de travailler des élèves * Population_bis Population	Between Groups	1.759	1	1.759	6.486	.013
	Within Groups	22.785	84	.271		
	Total	24.544	85			
Var_COP2 Fréquence des activités d'exploration à l'extérieur de la classe * Population_bis Population	Between Groups	.703	1	.703	2.336	.130
	Within Groups	25.265	84	.301		
	Total	25.968	85			
Var_COP3 Fréquence des travaux individuels des élèves * Population_bis Population	Between Groups	2.427	1	2.427	7.161	.009
	Within Groups	28.468	84	339		
	Total	30.895	85			

Measures of Association

	Eta	Eta Squared
Var_COP1 Fréquence de différentes manières de travailler des élèves * Population	.268	.072
Var_COP2 Fréquence des activités d'exploration à l'extérieur de la classe * Population	.164	.027
Var_COP3 Fréquence des travaux individuels des élèves * Population	.280	.079

- associations are week and explained variance very weak

8. Regression Analysis and Pearson Correlations

Exemple 8-1: Does teacher age explain exploratory activities outside the classroom ?

- Independant variable: AGE
- Dependent variable: Fréquence des activités d'exploration à l'extérieur de la classe

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Pearson Correlation	Sig. (1-tailed)	N
.316	.100	.075	.4138	.316	.027	38

Model Coefficients

	Coefficients		Stand. coeff.	t	Sig.	Correlations
	B	Std. Error	Beta			Zero-order
(Constant)	.706	.268		2.639	.012	
AGE Age	.013	.006	.316	1.999	.053	.316

Dependent Variable: Var_COP2 Fréquence des activités d'exploration à l'extérieur de la classe

All this means:

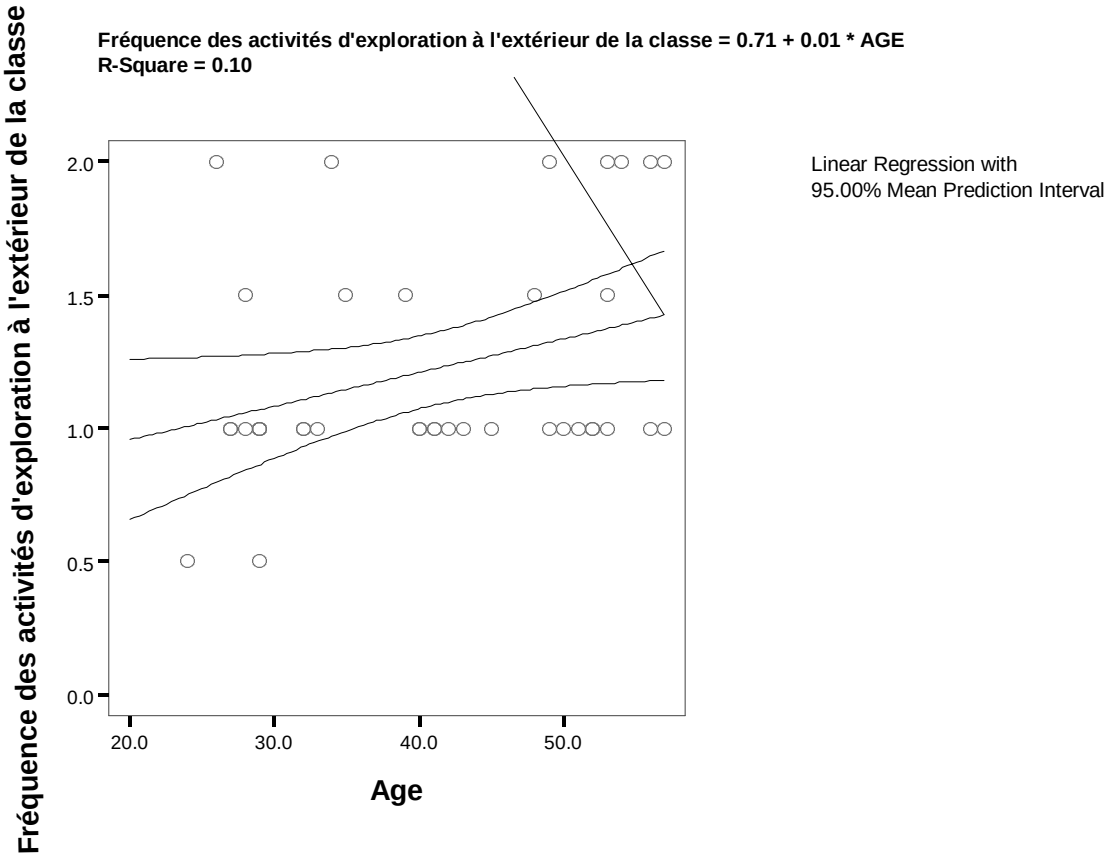
- We have a week relation (.316) between age and exploratory activities. It is significant (.027)
- Formally the relation is:

```
exploration scale = .705 + 0.013 * AGE
```

(roughly: only people over 99 are predicted a top score of 2)

Here is a scatter plot of this relation

- No need for statistical coefficients to see that the relation is rather week and why the prediction states that it takes a 100 years ... :)



9. Exploratory Multi-variate Analysis

There many techniques, here we just introduce cluster analysis, e.g. Factor Analysis (principal components) or Discriminant analysis are missing here

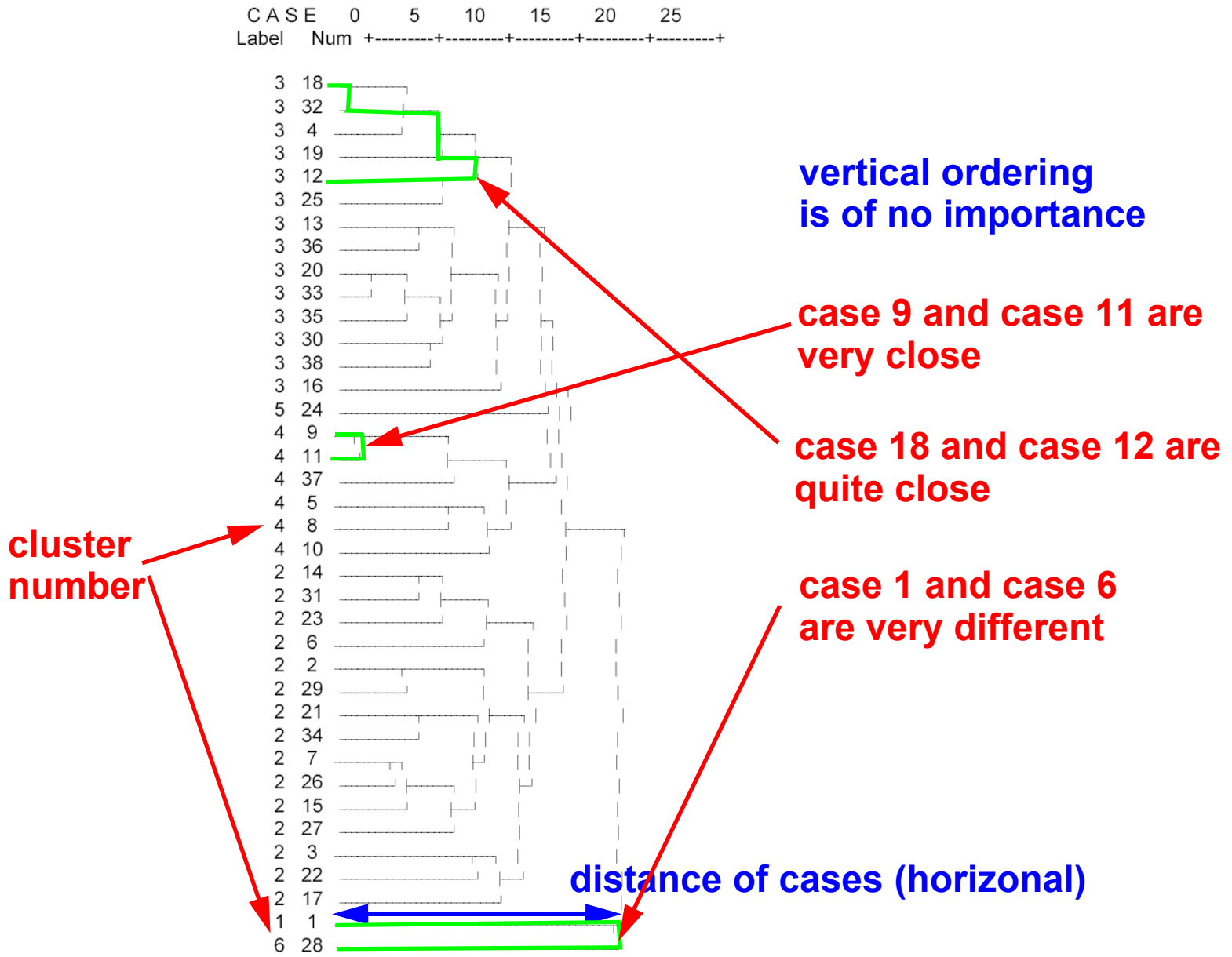
9.1 Cluster Analysis

- Cluster analysis or classification refers to a set of multivariate methods for grouping elements (subjects or variables) from some finite set into clusters of similar elements (subjects or variables).
- There 2 different kinds: hierarchical cluster analysis and K-means cluster.
- Typical examples: Classify teachers into 4 to 6 different groups regarding ICT usage

Exemple 9-1: Gonzalez classification of teachers

- A hierarchical analysis allow to identify 6 major types of teachers
- Type 1 : l'enseignant convaincu
- Type 2 : les enseignants actifs
- Type 3 : les enseignants motivés ne disposant pas d'un environnement favorable
- Type 4 : les enseignants volontaires, mais faibles dans le domaine des technologies
- Type 5 : l'enseignant techniquement fort mais peu actif en TIC
- Type 6 : l'enseignant à l'aise malgré un niveau moyen de maîtrise

Dendogram (tree diagram of the population)



Statistics of a subset of the 36 variables used for analysis:

	Types [nb d'enseignants]					
	1 [1]	2 [15]	3 [14]	4 [6]	5 [1]	6 [1]
	Moyenne	Moyenne	Moyenne	Moyenne	Moyenne	Moyenne
Degré d'importance des outils d'entraide et de collaboration pour les élèves	4.7	2.1	1.5	2.9	.0	5.0
Degré d'importance des outils de communication entre élèves	4.0	2.4	1.7	2.7	1.0	4.3
Accord sur ce qui favorise les apprentissages de type constructiviste	3.0	1.7	1.5	1.9	1.0	2.7
Accord par rapport à l'influence du milieu familial sur les apprentissages	3.0	2.7	2.6	2.1	3.5	3.5
Accord sur le sentiment de sûreté face aux élèves et de contrôle sur leurs apprentissages	3.0	3.0	2.5	2.7	2.0	2.0
Accord par rapport à la maîtrise des relations avec les élèves	4.0	3.3	2.8	2.8	5.0	3.0
Effets de l'utilisation de l'ordinateur sur la préparation et la gestion de l'enseignement	3.0	2.9	2.2	2.8	2.3	2.3
Préoccupations liées au projet et aux ressources disponibles	1.3	1.0	.5	.4	.0	2.8
Préoccupations liées aux relations avec les élèves, parents et collègues et leur statut	2.0	.8	1.0	.5	.0	1.8
Accord sur l'importance d'utiliser l'informatique dans la classe	.0	2.7	1.9	2.3	1.0	3.0
Matériel informatique "avancé" que les enseignants possèdent chez eux	.5	.8	.4	.3	1.0	.0
Niveau de maîtrise de l'utilisation d'outils TIC de communication et de documentation	2.3	2.6	2.3	1.7	3.0	1.8

- Final note: confirmatory multivariate analysis (e.g. structural equation modelling) is not even mentionnend in this document

Qualitative Data Analysis

(version 0.5, 1/4/05)

Code: analysis-quali

Daniel K. Schneider, TECFA, University of Geneva

Menu

1. Introduction: classify, code and index

☞ Coding and indexing is necessary for systematic data analysis.

☞ Information coding allows to identify variables and values, therefore

- allows for systematic analysis of data (and therefore reliability)
- ensures enhanced construction validity, i.e. that you look at things allowing to measure your concepts

Before we start: Keep your documents and ideas safe !

Write memos (conservation of your thoughts)

- if is useful to write short memos (vignettes) when an interesting idea pops up, when you looked at something and want to remember your thoughts

Write contact sheets to allow remembering and finding things

After each contact (telephone, interviews, observations, etc.), make a short data sheet

- Indexed by a clear filename or tag on paper, e.g. CONTACT_senteni_2005_3_25.doc
- type of contact, date, place, and a link to the interview notes, transcripts.
- principal topics discussed and research variables addressed (or pointer to the interview sheet)
- initial interpretative remarks, new speculations, things to discuss next time

Index your interview notes

- Put your transcription (or tapes) in a safe place
- Assign a code to each "text", e.g. INT-1 or INTERVIEW_senteni_3_28-1
- You also may insert the contact sheet (see above)
- number pages !

2. Codes and categories


A code is a “label” to tag a variable (concept) and/or a value found in a "text"

Basics:

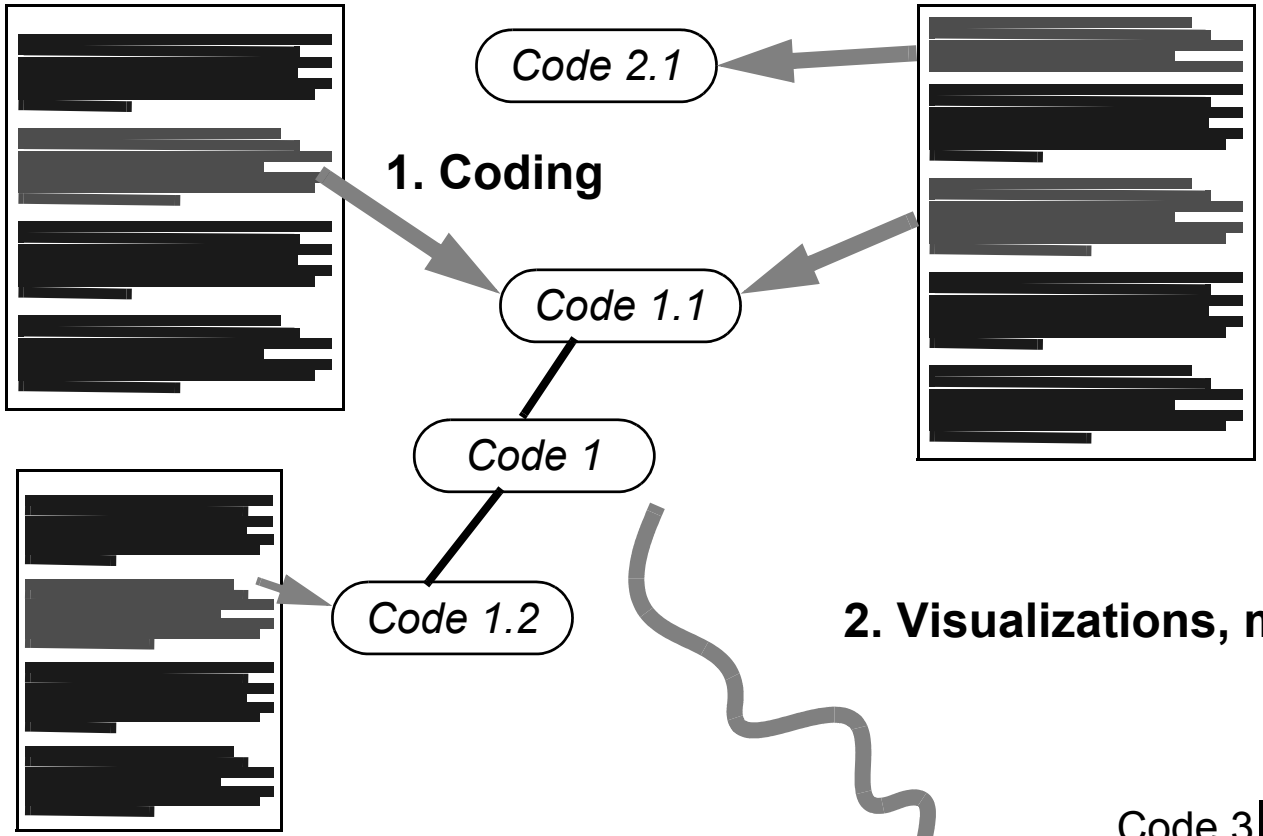
1. A code is assigned to each (sub)category you work on
   - In other words: you must identify ***variable names***
2. In addition, you can for each code assign a set of possible values (e.g.: “positive”/”neutral/ ”negative)
3. You then will systematically scan all your texts (documents, interview transcripts, dialogue captures, etc.) and tag all occurrences of variables.

- Three very different coding strategies exist
  - 3.1 “Code-book creation according to theory” [6]
  - 3.2 “Coding by induction (according to “grounded theory”)” [7]
  - 3.3 “Coding by ontological categories” [8]
-

Benefit

- Coding will allow you to find all informations regarding variables of interest to your research
- Reliability will be improved

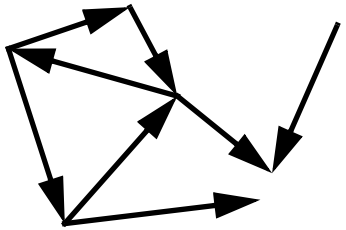
2.1 The procedure with a picture



2. Visualizations, matrices and "grammars"

Code 3	Code 1.1	Code 4
Val 1	Val 2x	Val 3y
	.....	

3. Analysis



2.2 Technical Aspects

- The safest way to code is to use specialized software
  - e.g. Atlas or Nvivo (NuDist),
  - however, this takes a lot of time !
- For a smaller piece (of type master), we suggest to simply tag the text on paper
  - you can make a reduced ***photocopy*** of the texts to gain some space in the margins
  - overline or circle the text elements you can match to a variable
  - make sure to distinguish between codes and other marks you may leave.
- Don’t use "flat" and long code-books, introduce hierarchy (according to dimensions identified)
- Each code should be short but also mnemonic (optimize)
  - e.g. to code according to a schema “principal category” - “sub-category” (“value”):

```
use:         CE-CLIM(+)
instead of: external_context -climate (positive)
```

- Don’t start coding before you have good idea on your coding strategy !
  - either your code book is determined by you research questions and associated theories, frameworks, analysis grids
  - or you really learn how to use an inductive strategy like "grounded theory".

3. Code-book creation and management

3.1 Code-book creation according to theory

☞ The list of variables (and their codes), is defined by theoretical reasoning, e.g.

- analytical frameworks, analysis grids
- concepts found in the list of research questions and/or hypothesis

Example from an innovation study (about 100 codes):

	categories	codes	theoretical references
properties of the innovation		PI	
external context		CE	
	demography	CE-D	
	support for the reform	CE-S	
internal context		CI	.... (fill for your own code book) .....
adoption processes		PA	
	official chronology	PA-CO	
dynamics of the studied site		DS	
external and internal assistance		AEI	
causal links		LC	

3.2 Coding by induction (according to “grounded theory”)

Principle:

- The researcher starts by coding a small data set and then increases the sample in function of emerging theoretical questions
- Categories (codes) can be revised at any time

Starting point = 4 big abstract observation categories:

- conditions (causes of a perceived phenomenon)
- interactions between actors
- strategies and tactics used by actors
- consequences of actions

(... many more details: to use this approach you ***really*** must document yourself)

3.3 Coding by ontological categories

Example:

Types	
Context/Situation	information on the context
Definition of the situation	interpretation of the analyzed situation by people
Perspectives	global views of the situation
Ways to look at people and objects	detailed perceptions of certain elements
Processes	sequences of events, flow, transitions, turning points, etc.
Activities	structures of regular behaviors
Events	specific activities (non regular ones)
Strategies	ways of tackling a problem (strategies, methods, techniques)
Relations and social structure	informal links
Methods	comments (annotations) of the researcher

- This is a compromise between “grounded theory” and “theory driven” approaches

3.4 Pattern codes

- Some researchers also code patterns (relationships)

Simple encoding (above) breaks data down to atoms, categories)

"***pattern coding***" identifies relationships between atoms.

The ultimate goal is to detect (and code) regularities, but also variations and singularities.

Some suggested operations:

1. Detection of ***co-presence*** between two values of two variables
   - E.g. people in favor of a new technology (e.g. ICT in the classroom) have a tendency to use it.
2. Detection of ***exceptions***
   - e.g. technology-friendly teachers who don't use it in the classroom
   - In this case you may introduce new variable to explain the exception, e.g. the attitude of the superior., of the group culture, the administration, etc.
   - Exceptions also may provoke a change of analysis level (e.g. from individual to organization)

Attention: a co-presence does not prove causality

4. Descriptive matrices and graphics

♡ Qualitative analysis attempts to put structure to data
(as exploratory quantitative techniques)
In short: ***Analysis = visualization***

☞ **2 types of analyses:**

1. A ***matrix*** is a tabulation engaging at least one variable, e.g.
   - Tabulations of central variables by case (equivalent to simple descriptive statistics like histograms)
   - Crosstabulations allowing to analyze how 2 variables interact
2. Graphs (***networks***) allow to visualize links:
   - temporal links between events
   - causal links between several variables
   - etc.

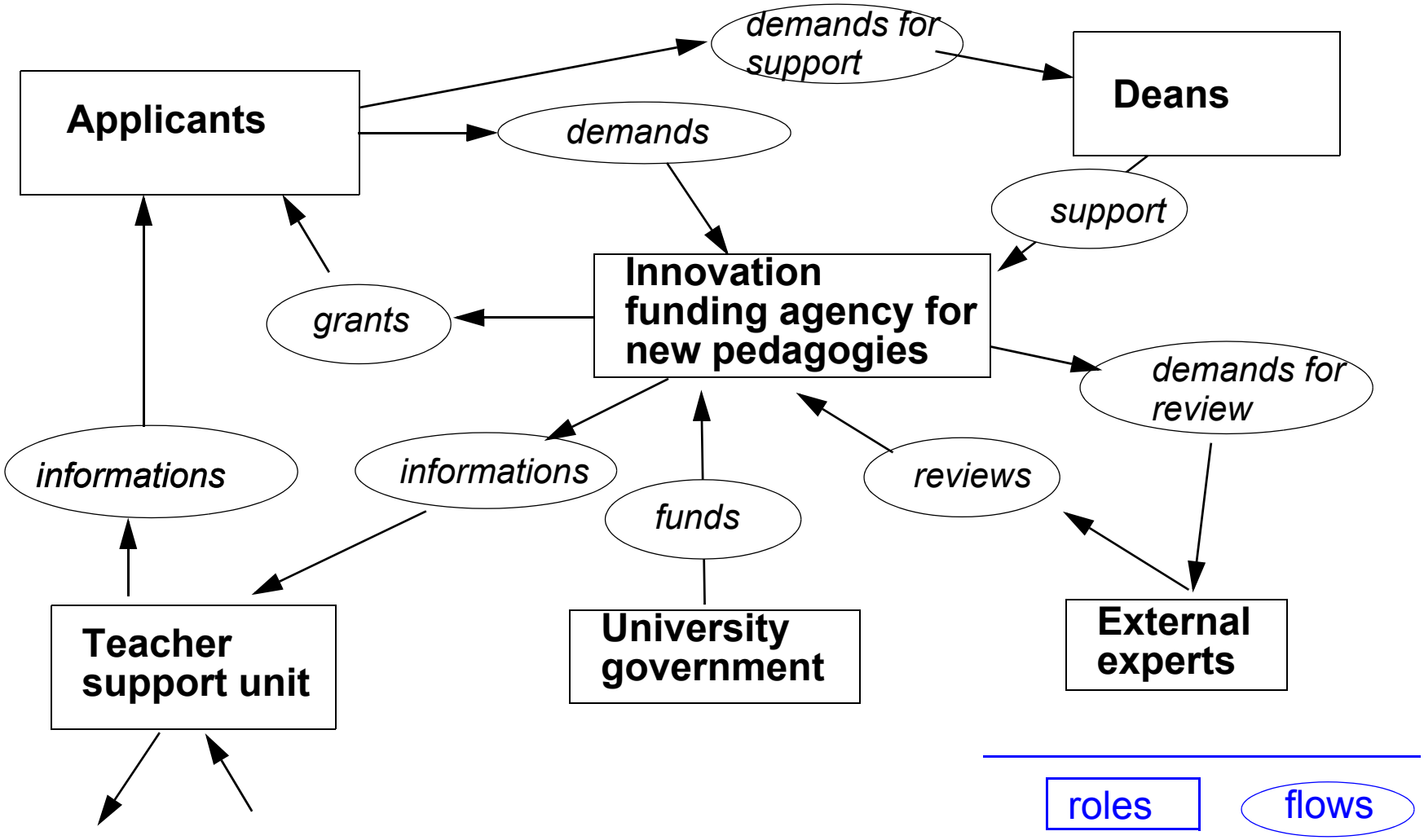
☞ Some advice:

- when use these techniques always keep a link to the source (coded data)
- try to fit each matrix or graph on a ***single page*** (or make sure that you can print things made by computer on a A3 pages)
- you have to favor synthetic vision, but still preserve enough detail to make your artifact interpretable
- Consult specialized manuals e.g. Miles & Huberman, 1994 for recipes or get inspirations from qualitative research in the same domain

4.1 The “context chart”,Miles & Huberman (1994:102)

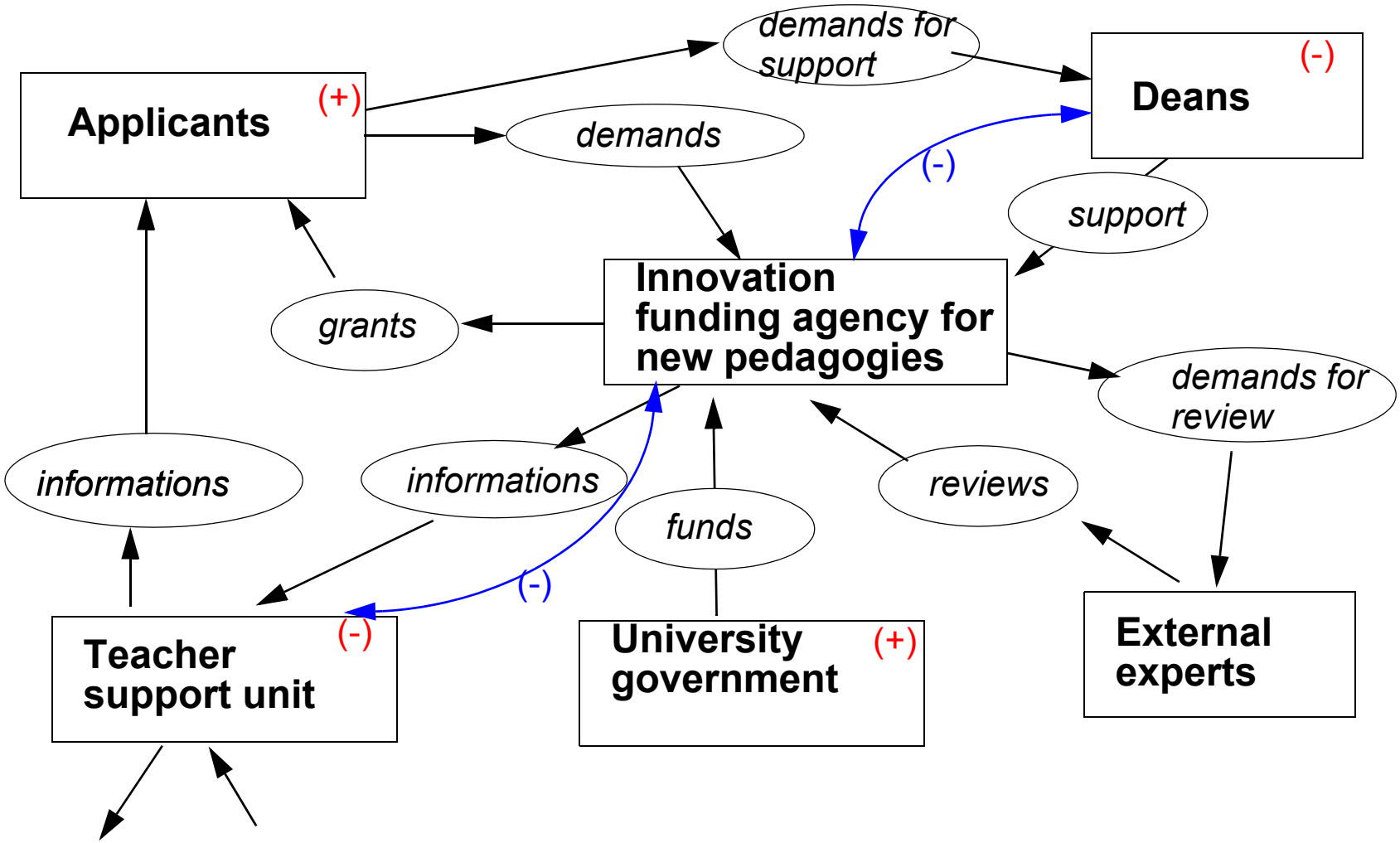
☞ Allows to visualize relations and information flows between rôles and groups

Exemple 4-1: Work flow for a "new pedagogies" program at some university



- There exist codified "languages" for this type of analysis, e.g. UML or OSSAD

Once you have clearly identifed and clarified formal relations, you can use the graph to make annotations (like below)



(+) (-) () positive or negative attitudes towards a legal program

\+ - good or bad relations between authorities (or people)

4.2 Check-lists, Miles & Huberman (1994:105)

☞ Usage: Detailed summary for an analysis of an important variable

Example: “external support is important for succeeding a reform project

Examples for external support	At counselor level	At teacher level
Analysis of deficiencies	**Fill in each cell as below**	
Teaching training		
Change monitoring		
Incentives		
Group dynamics	adequate: “we have met an organizer 3 times and it has helped us” (ENT-12:10)	not adequate: “we just have informed” (ENT-13:20)
etc. ..		

- such a table displays various dimensions of and important variable (external support), e.g. in the example = left column
- in the other columns we insert summarized ***facts*** as reported by different roles.
- Question: Imagine how you would build such a grid to summarize teacher’s, student’s and assistant’s opinion about technical support for an e-learning platform

4.3 Chronological tables Miles & Huberman (1994:110)

- Can summarize a studied object's most important events in time

Exemple 4-2: Task assignments for a blended project-oriented class

	Activity	Date	imposed tools (products)
1	Get familiar with the subject	21-NOV-2002	links, wiki, blog
2	project ideas, Q&R	29-NOV-2002	classroom
3	Students formulate project ideas	02-DEC-2002	news engine, blog
4	Start project definition	05-DEC-2002	ePBL, blog
5	Finish provisional research plan	06-DEC-2002	ePBL, blog
6	Finish research plan	11-DEC-2002	ePBL, blog
7	Sharing	17-DEC-2002	links, blog, annotation
8	audit	20-DEC-2002	ePBL, blog
9	audit	10-JAN-2003	ePBL, blog
10	Finish paper and product	16-JAN-2003	ePBL, blog
11	Presentation of work	16-JAN-2003	classroom

- This type of table is useful to identify important events.
- You can add other information, e.g. tools used in this example

4.4 Matrices for roles (function in an organization or program)

Miles & Huberman (1994:124)

Crossing social roles with one or more variables, abstract example (also see next page):

rôles	persons	variable 1	variable 2	variable 3
rôle 1	person 1	cells are filled in with values (pointing to the source)		
	person 2			
	.....			
rôle 2	person 9			
	person 10			
.....	.....			
rôle n	person n			
	.....			

Crossing roles with roles

s

	rôle 1	...	rôle 3
rôle 1	fill in all sorts of informations about interactions		
...			
rôle 3			

Example: Evaluation of the implementation of a help desk software

Actor	Evalu-ation	assistance given	Assistance received	Immediate effects	Long term effects	Explanation of the researcher
Manager	-	-	-	demotivating	threatened the program	Felt threatened by new procedures
Consult-ant	+	help choosing the right soft. involved himself	-	contributed to the start of the experiment	-	....
"Help-desk worker"	+/-	debugging of machines, little help with software		better job satisfaction because of the tool	slight improvement of throughput	is still overloaded with work
Users	+/-	A few users provided help to peers with the tool	debugging of machines, little help with software	Were made aware of the high amount of unanswered questions	slight improvement of work performance	....

Crossing between roles to visualize relations:

	rôle 1	rôle 1	rôle 3
rôle 1			
trainers		"don't coordinate very much" (1)	doesn't receive all the information (2)
rôle 3			

5. Techniques to hunt correlations

5.1 Matrices ordered according to concepts (variables)

A. Clusters (co-variances of variables, case typologies)

- An idea that certain values should "go together": Hunt co-occurrences in cells
- E.g.: “Can we observe a correlation between expressed ***needs for support*** and expressed ***needs for training*** for a new collaborative platform (data from teachers’s interviews)?

case	var 1	need for support	need for training	need for directives
case 1		important	important	important
case 2		not important	not important	not important
case 3		important	important	important
case 4	yyy	not important	not important	not important
case 5	.....	important	important	important
case 6....		important	not important	not important

- This table shows e.g. that nedd for support and need for training seem to go together, e.g. cases 1,3,5 have association of "important", cases 2 and 4 have association of "not important".
- See next page how we can summarize this sort of information in a crosstab

B. Co-variance expressed in a corresponding crosstab:

training needs * support needs		need for support	
		yes	no
need for training	yes	3	1
	no	1	2

- .... we can observer a correlation here: "blue cells" (symmetry) is stronger than "magenta"!
- check with the data on last slide

C. Example typology with the same data:

	Type 1: "anxious"	Type 2: "dependent"	Type 3: "bureaucrats"	Type 4: "autonomists"
case 1	X			
case 2				X
case 3	X			
case 4				X
case 5	X			
case 6		X		
Total	3	1	0	2

- we can observe emergence of 3 types to which we assign "labels"
- Note: for more than 3 variables use a cluster analysis program

Additional example

The table shows co-occurrence between values of 2 variables. The idea is to find out what effect different types of pressure have on ICT strategies adopted by a school.

	Strategies of a school				
Type of pressure	strategy 1: no reaction	strategy 2: a task force is created	strategy 3: internal training programs are created	strategy 4: resources are reallocated	strat 5: .....
Letters written by parents	(N=4) (p=0.8)	(N=1) (p=0.2)			
Letters written by supervisory boards		(N=2) (p=0.4)	(N=3) (p=0.6)		
newspaper articles				(N=1) (p=100%)	
type ...	.....	....			

D. Recall: Interpretation of crosstabulation

Procedure

- calculate the % for each value of the independent variable
  - Note: this can be either the line or the column depending on how you orient your table
- compute the % in the other direction
- We would like to estimate the probability that a given value of the independent (explaining) variable entails a given value of the dependent (explained) variable

	Variable y to explain = Strategies of action			
Explaining variable x	**do nothing**	**send a mail**	**write a short tutorial**	**Total**
Students making indirect suggestion	4 (80%)	1 (20%)		5 (100 %)
Students explicitly complaining		2 (40%)	3 (60%)	5 (100%)

Interpretation: “... if students explicitly complain, the tutor will react more strongly and engage in more helpful acitities.”

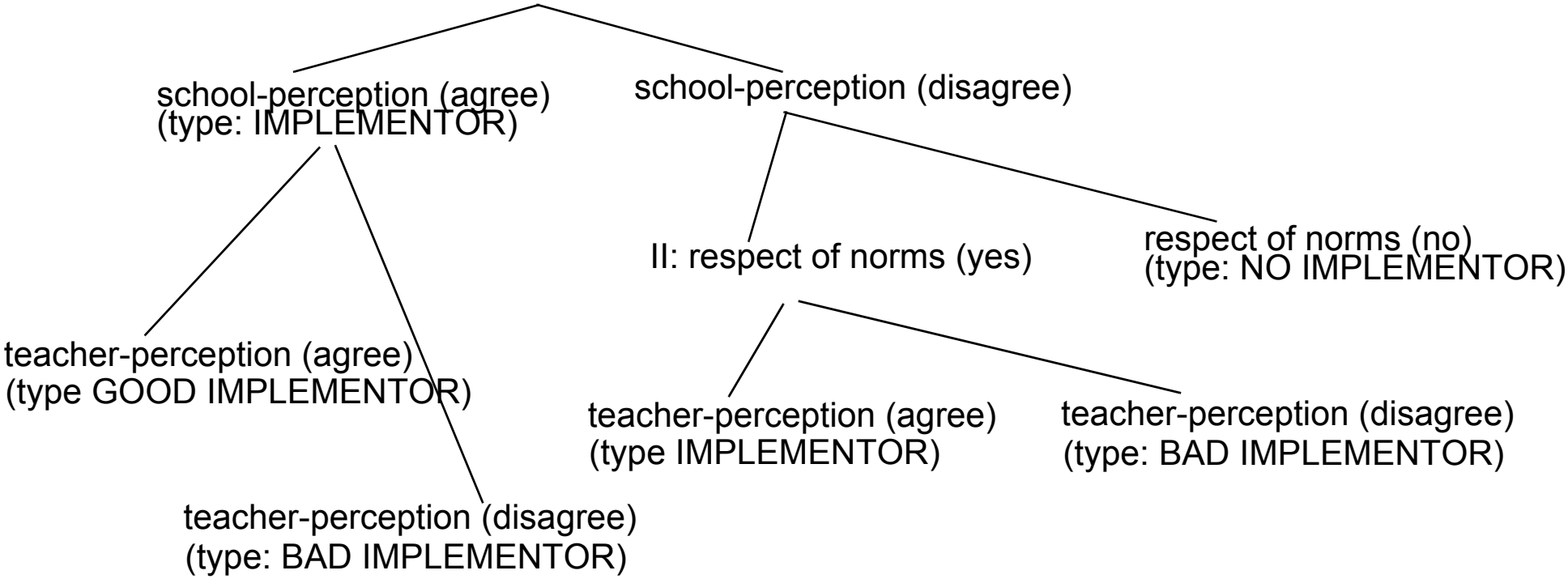
- See also: quantitative data analysis.

6. Typology and causality graphs

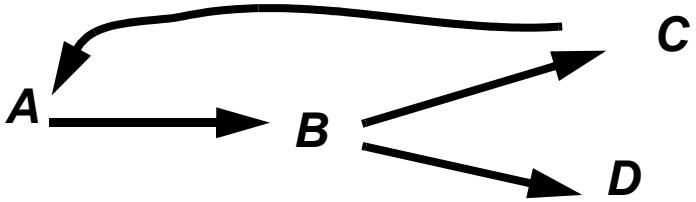
6.1 Typology graphs

- Display attributes of types in a tree-based manner

Exemple 6-1: Perception of a new program by different implementation agencies (e.g. schools) and its actors (e.g. teachers)

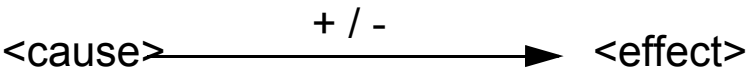


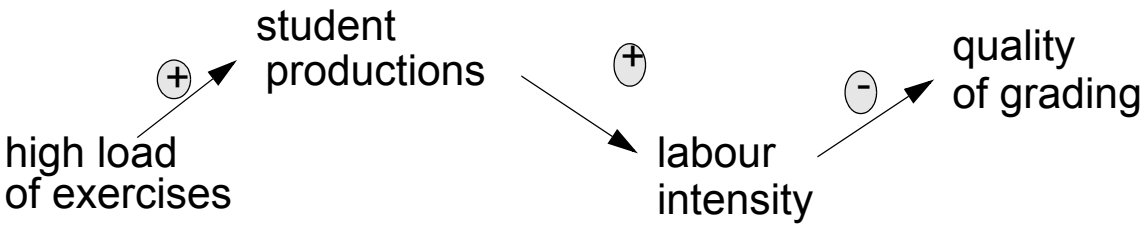
6.2 Subjective causality graphs



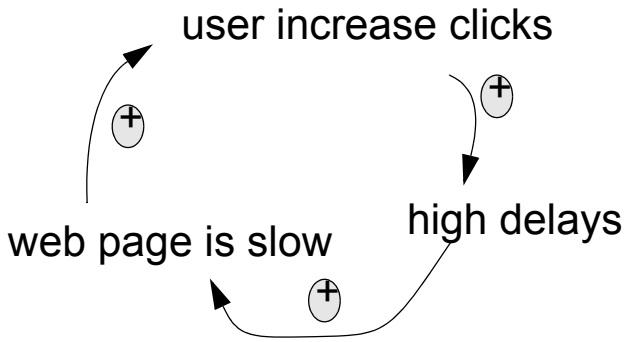
- Cognitive maps à la “operational coding”, AXELROD, 1976
- Allow to compute outcomes of reasoning chains
- Example: Teacher talking about active pedagogies, ICT connections, Forums

About active pedagogies:

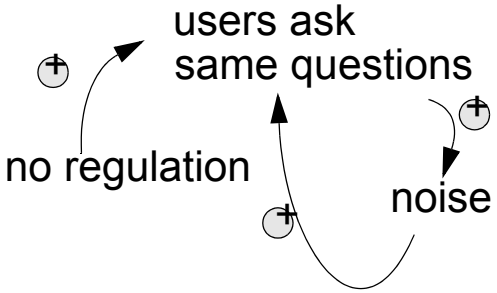




About slow ICT connections:



About forum management:



The master thesis

(version 0.1, 1/4/05 - fix: translation !)

Code: thesis-writing

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Menu

1. Introduction: A thesis is an “argument”

The Link between writing and research activity

☞ **Research design *not* = research phases *not* = written thesis.**

- A ***research plan*** (i.e. the research design) defines and organizes your work according to research logical critiera.
- The research ***planning*** (i.e. the little section at the end of your research plan) organizes your time according to workpackages and deliverables.
- Research is ***done*** (and usually you don’t tell people your personal experience with this).
- A thesis presents the "results" of your research (including literature review and an explanation on how you did it)

Structure of your thesis

1. according to methodological criteria,
2. according to rethorics

☞ **le lecteur doit comprendre avant tout les objectifs, les résultats et votre démarche (y compris les analyses)**

2. La présentation et la structuration

2.1 Maîtrise du traitement de texte

☞ **Vous ne le maîtrisez pas si vous ne savez pas:**

- générer tables et indexes automatiquement, numéroter automatiquement titres et listes, mettre en page différents éléments du texte automatiquement, etc.

☞ **Ne perdez pas du temps avec des éternels formatages.**

- soit vous créez une feuille de style avant de commencer à écrire,
- soit vous formattez un texte “écrit à la ligne” à la fin

☞ **Faites comme les “pros”**

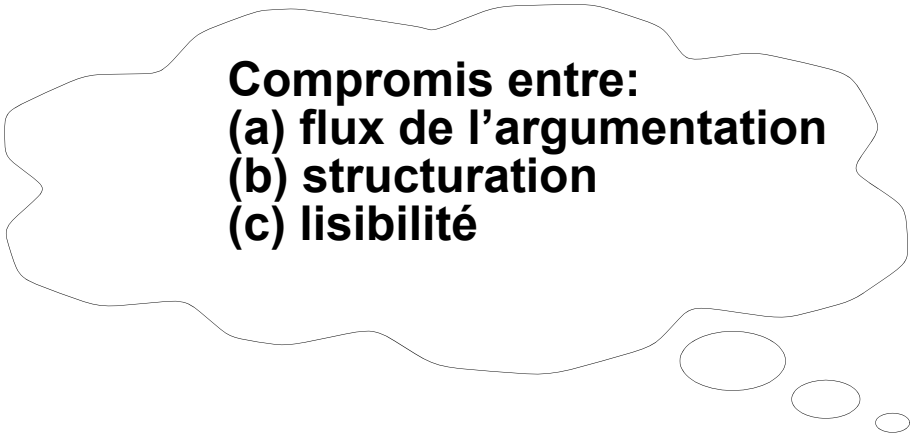
- Les gens productifs travaillent avec des feuilles de style très détaillés qui font la mise en page de chaque type de paragraphe.
- Evitez donc de jouer avec des “tabs”, des lignes vides etc. !

- Il vous faut (au moins) les définitions pour les éléments suivants:
  - chapitre, section, sous-section numérotés et titres sans numéros
  - éléments de liste (“bullets” et items numérotés sur 2 niveaux)
  - paragraphes ordinaires, citations longues (paragraphes indentés)
  - un style pour afficher des données en format fixe

2.2 Titres et sections

Quelques conseils:

- La table des matières indique le flux de votre argumentation
- Evitez trop de niveaux de sections (genre 12.3.4.1.a).
  - Cela rend difficile l'orientation par rapport à l'ensemble.
  - Si le texte dans une section devient trop long, on peut y introduire des titres sans numéros, ou quelque chose comme (a) .... (1) ....
- Une sous-section numérotée pour chaque sujet important
  - mais trop de sous-sections coupent le texte !
- Les titres indiquent ce que l'on trouve dans une section.
  - Evidemment ils ne peuvent pas être trop longs



2.3 La mise en page

- il existe plusieurs “écoles”, voilà quelques règles utiles:

☞ Numérotez les pages:

- l’introduction: chiffres romains, partie principale: chiffres arabes
- annexes: de façon spéciale (par example A-1, etc.)

☞ “Headers”

- titre du chapitre (pages gauches)
- titre de la section principale (pages droites)

☞ Pas de lignes longues:

- Si vous utilisez un petit “font”, évitez d’écrire des lignes trop longues.
- Ce n’est pas par hasard que l’on retrouve 2 colonnes dans les revues et plusieurs dans les journaux.
- Il est très difficile de se retrouver dans une longue ligne
  (pensez au lecteur qui saute parfois en avant et en arrière).
- Il existe évidemment des questions de coût. Faites un compromis

☞ La structuration moderne ...

- Mise en évidence des titres par un décalage
- Mise en évidence de certains éléments (“boites”, icônes dans les marges,..)

3. L'organisation d'un mémoire

Les éléments les plus importants d'un écrit scientifique

Eléments	Importance	Fonction principale
3.1. Préface (avant-propos)	*	Contexte personnel
3.2. Table des matières (etc.)	**	Navigation
3.3. Résumé (abstract)	*	Objectif, résultat et portée
3.4. Introduction	***	Objectifs, démarche
3.5. Partie principale	**	Développement
3.6. Conclusion	***	Résultat et Portée
3.7. Liste des sources	*	Ancrage avec données
3.8. Indexes	*	Navigation
3.10. Bibliographie	**	Ancrage
3.9. Annexes	*	Ancrage avec données

On n'a pas envie de lire votre travail en entier !!

3.1 Préface (avant-propos)

☞ **La préface ne fait pas partie du travail**

On peut l'utiliser pour:

- remercier des gens
- dire pourquoi on s'est intéressé à la thématique
- s'excuser pour des choses que l'on n'a pas fait
- annoncer une suite, etc.

☞ **En bref, il ne faut pas confondre préface et introduction !**

3.2 Table des matières (etc.)

☞ **Obligatoire pour un tout travail d'une certaine longueur.**

- Dans certains livres on en retrouve parfois plusieurs, par ex. une courte pour la structure principale et une longue avec toutes les sous-sections.
- Position: Normalement au début du texte et juste après la préface
  - car c'est l'endroit où on la trouve le plus facilement.
- Correspondance des titres dans la table et du texte
  - (maîtrisez votre traitement de texte!)
- Des tables pour les figures et tables sont moins importantes,
  - mais comme les gens aiment bien retrouver toute information synthétique il est utile d'en produire aussi.

3.3 Résumé (abstract)

- souvent obligatoire pour les articles qui paraissent dans une revue
- Pour un travail de séminaire ou un mémoire de licence/diplôme on peut l'inclure dans l'introduction (et la conclusion).

3.4 Introduction

☞ **L'introduction est (avec la conclusion) la partie la plus importante de votre travail sur le plan rhétorique.**

- Les gens la regardent d'abord et décident ensuite s'il veulent regarder le reste

Le lecteur doit avoir compris au moins...

Eléments	
La question	**.... quelle *question* est adressée ?**
	.... avec quelles *limites ?*
Le langage utilisé	**.... avec quels *concepts ?, définitions***
La démarche	**.... selon quelle *méthodologie ?***
	.... selon quelle *structuration* ?

En règle générale, l'introduction contient:

☞ La ***problématique de recherche*** et les questions de recherche qui en découlent.

☞ Une ***discussion sur la pertinence*** et sur la portée du travail (y compris ce que ne vous faites pas)

☞ **Les hypothèses de travail**

- sinon vous le faites après ou pendant la discussion théorique dans la partie principale.

- Notez qu'il ne faut en principe pas confondre "hypothèse scientifique" et hypothèses de travail qui ne sont que des questions de recherche.
- Une véritable hypothèse a du sens dans une certaine tradition de recherche: elle découle de la discussion théorique et prend la forme d'une explication (ou loi) qui doit être testée avec des données.

Les définitions les plus importantes

- notamment celles qui se trouvent dans le titre de votre travail.

Une discussion de la méthodologie (ou "approach")

- sauf si vous dédiez un chapitre entier à cela (dans ce cas il faut just mentionner les grandes lignes de votre démarche)

Un petit guide de lecture

- aide le lecteur
- en même temps vous lui montrez que vous ne faites rien par hasard.

Une introduction de l'objet que vous étudiez,

- par example si vous étudiez une mise en oeuvre d'une loi,
  il faut résumer la loi.

3.5 Partie principale

- Curieusement c'est ici qu'il existe le plus de ***variété***.
- Elle dépend fortement de l'***approche méthodologique***
- Parfois il faut respecter un certain ***agencement*** des chapitres.

☞ **Dans toutes les études empiriques, il faut:**

- ***discuter et analyser*** vos données
- se ***confronter*** au savoir qui existe dans le domaine
- ***mettre en rapport*** résultats et questions/hypothèses formulées au début
- ***éviter*** de longement réciter des ***indices*** statistiques
  - utilisez des tables et figures pour cela ! (votre texte doit être ***lisible*** !!)

Conseils pour la partie "théorique" d'un travail empirique:

- Souvent on sépare la "discussion de littérature" de la présentation de la recherche proprement dite: légitime pour des raisons de clarté.

☞ **Il *faut revenir sur la discussion de la littérature* dans les parties plus "pratiques" (ancrage de votre travail dans le savoir de la discipline)**

- L'omission est une erreur fréquemment observée. Si discuter une théorie ou d'autres travaux empiriques ne sert à rien pour votre recherche, il ***ne faut pas en parler*** !!

3.6 Conclusion

☞ Rappelez les résultats principaux de votre recherche.

- on peut aussi être contre avec l'argument que cela entraîne un simplification qui peut faire croire que êtes peu différencié.

☞ Discutez la porté des résultats à plusieurs niveaux, on peut:

- discuter la (les) ***validité***(s) de vos résultats,
- mettre en avant des questions auxquelles vous ***n'avez pas répondu*** (et pourquoi),
- s'interroger sur la ***généralisation*** des résultats,
- voire même ***formuler une théorie*** qui nécessiterait d'autres travaux empiriques pour la tester et/ou développer.

☞ Comparez vos résultats à ceux d'autres études empiriques

- dans le domaine et/ou avec les ***connaissances théoriques*** du domaine
  (si cela n'a pas été fait dans la partie principale)

☞ Vous pouvez formuler de nouvelles questions.

- Souvent vous serez cités parce que vous avez mis le doigt sur des ***choses intéressantes*** qui n'ont pas encore été étudiées
  (qui par example peuvent devenir un sujet de thèse)

☞ Vous pouvez discuter de l'utilité pratique de votre travail.

- (surtout si le travail n'a pas de vocation principalement pratique)
- si votre travail était pratique, rappelez encore une fois vos ***suggestions principales*** aux destinataires du travail.

3.7 Liste des sources

☞ Indication de toutes les sources primaires

- (textes de lois, règlements, etc.) que vous utilisez
- peut faire partie de la bibliographie.

3.8 Indexes

☞ Indexes d'auteurs et de concepts

- surtout lorsqu'il s'agit d'un travail important sur le plan théorique.
- permettent à un lecteur pressé de mieux "surfer" votre travail
- (utile, mais pas obligatoire)

3.9 Annexes

Tout ce qui n'est pas nécessaire à la compréhension

- mais qui permet au lecteur de mieux reproduire et comprendre vos analyses empiriques.
- On peut pour des raisons de place pas y inclure tout le matériel d'analyse (données, entretiens, textes primaires, etc.). Faites un choix ou éventuellement des résumés.

3.10Bibliographie

doit contenir l'ensemble des textes scientifiques ou autres auxquels vous avez fait référence.

- Il ne faut pas gonfler une bibliographie avec des ouvrages non cités. Cette pratique est inutile et mal vue

Respectez une certaine norme (vous pouvez choisir) et restez cohérents !

Il faut commencer à faire une bibliographie dès le début.

- A chaque fois que vous lisez un texte, insérez-le dans la bibliographie!
- Il existe des logiciels comme EndNotes pour gérer la bibliographie

3.11Citations

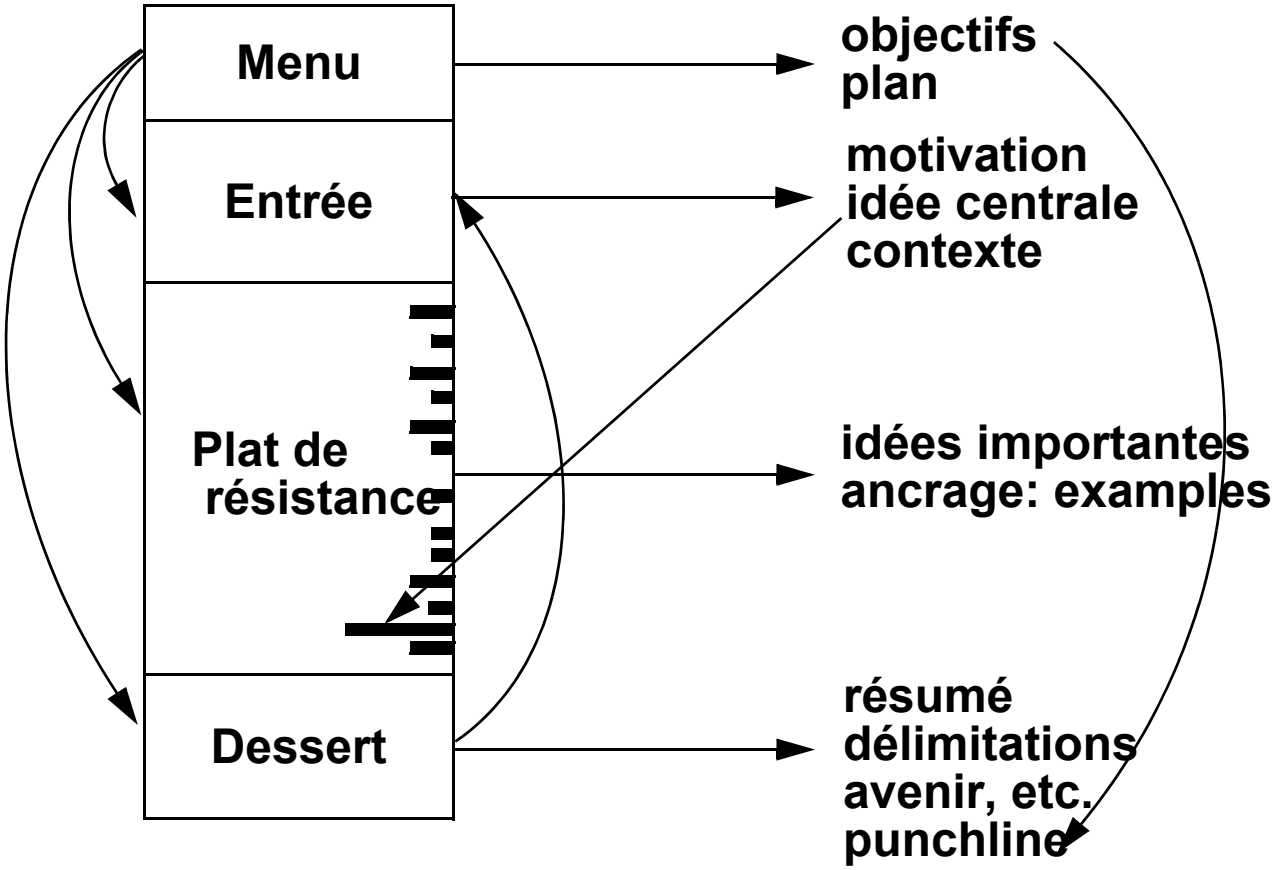
- Respectez une certaine norme (à votre choix)

3.12..... un dernier mot

Pensez a 3 types de lecteurs:
(a) le lecteur rapide
(b) le lecteur qui vous croit
(c) ... et le lecteur qui veut "savoir"

Pour conclure :
(a) un bon travail peut être "surfé" rapidement
(b) il n'est pas chiant à lire !!

4. La présentation en un seul transparent



à surveiller:

- forme
- contenu
- aspects didactiques et rhétoriques

REPETEZ TROIS FOIS A HAUTE VOIX !!

Planning techniques

(version 0.1, 1/4/05 - fix: translation)

Code: thesis-planning

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Menu

1. Introduction

- Utiliser une véritable gestion de projets n'est pas obligatoire, mais peut s'avérer utile (surtout pour les personnes qui ont un "budget temps" très limité)
- Techniques utilisées dans l'industrie (notamment en informatique)
- Il existe des outils de gestion de projet
- Faire un plan de gestion de projets sert surtout à l'auto-contrôle (un mirroir !)

Le minimum

Si la gestion de projets vous intéresse, faites quelque chose de "light":

1. une liste d'échéances importantes
2. une estimation du volume des "gros morceaux"

2. Scheduling (planification dans le temps)

Principe de base:

- On découpe un projet en ***tâches*** (“Work packages”, WPs) et on estime le temps et les ressources nécessaires pour *chaque* “WP”
  - un “WP” correspond normalement à une étape de projet (design, travail de terrain, analyse) à un but de recherche ou combinaison des deux (étape X pour le but Y).
- On essaye d’éviter des trop grandes dépendances entre WPs, ainsi on peut les poursuivre en parallèle et/ou de façon autonôme.
- Plusieurs WP peuvent aboutir à des “***milestones***” et/ou “***deliverables***”
  - un “milestone” est une étape importante (par ex. déposition du projet)
  - un “deliverable” est un objet fourni (par ex. un texte)
- Pour le scheduling on élabore 2 types de graphiques:
  - un ***graphique d’activités*** qui montre les dépendances et le “chemin critique” (le chemin le plus long qui risque de poser un problème)
  - un ***diagramme de barres*** qui montre le déroulement dans le temps

A retenir:

- Planifier l’inattendu (perte de vos fichiers, sous-estimation de difficultés)

2.1 Les graphiques d'activités

- Ces graphiques vous permettent de mieux estimer le temps et de planifier vos activités, mais ils servent également à monitorer (au moins une fois par mois) le statut de votre projet !!

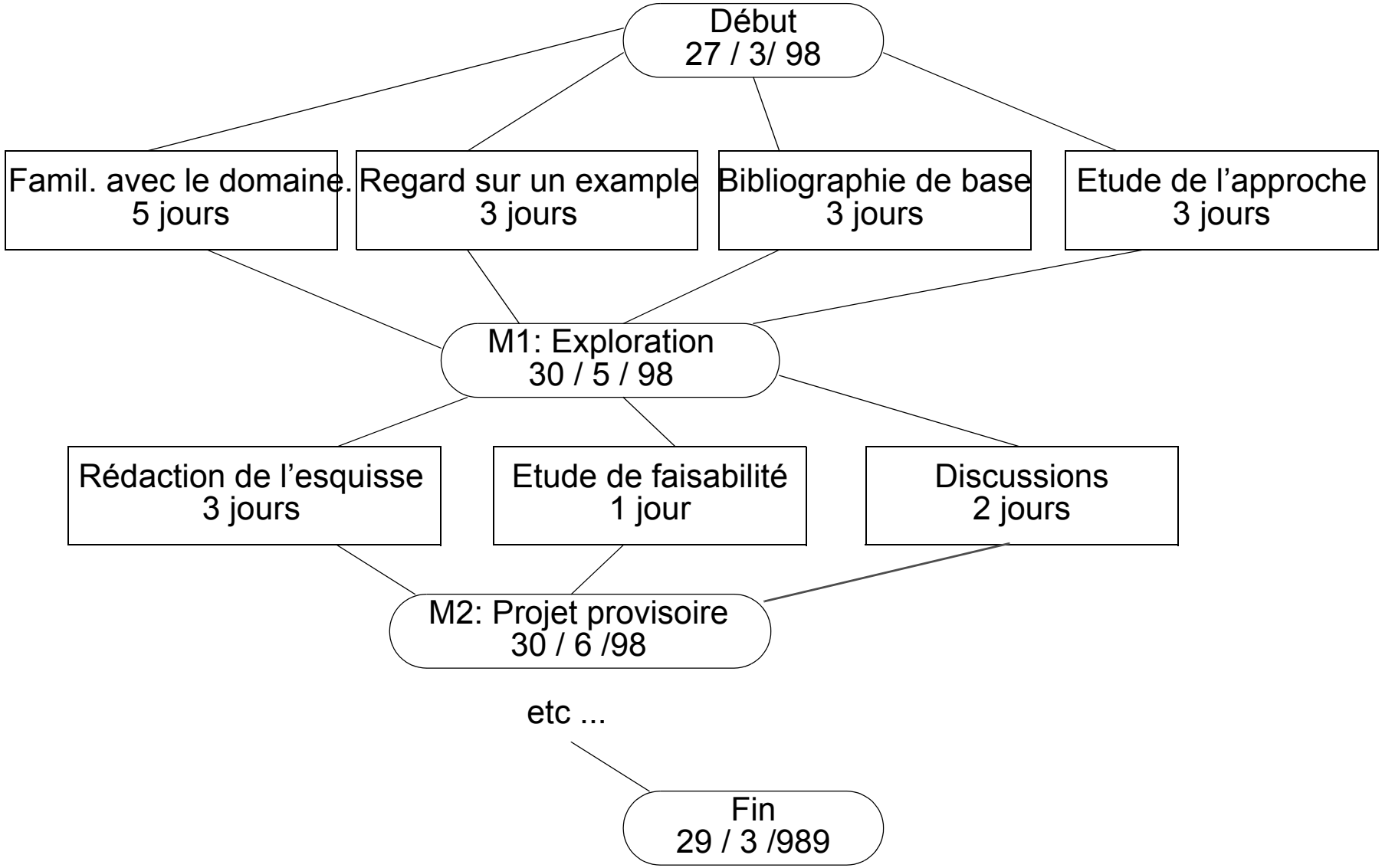
Les plus connus:

- PERT (Program Evaluation and Review Technique)
- CPM (Critical Path Method)

Un graphique simple:

- Chaque projet est un réseau de tâches [rectangles]
- Certaines tâches dépendent d'autres tâches
- Pour chaque tâche on estime la durée, parfois on estime 3 chiffres:
  le minimum , le maximum et le temps le plus probable.
- Chaque "milestone", c.a.d. groupe de tâches dépendantes achevés doit être daté [ovals]
- Avant de dessiner il est parfois plus simple de résumer la situation dans un tableau.
- Dessinez à la main ou avec un logiciel de dessin

Exemple 2-1: Graphique “Pert” (à ne pas recopier tel quel !)



2.2 Les diagrammes de barres (Bar Charts)

Le plus connu: Le Gantt Chart

Une proposition simple

Inscriptions:

- sur l'axe horizontale:
  - le temps (jours, demi-semaines, semaines, mois selon la taille du projet
- sur l'axe verticale:
  - les "workpackages" (WP)
  - On peut différencier pour chaque WP: intensité, participants, etc.
  - les "milestones"

Construction du diagramme avec des moyens simples:

- avec des "___xxxx____" dans un éditeur
- avec des tableaux (Excel, HTML, Word, etc.)
- avec un outil de dessin
- à la main en utilisant un calendrier de planning
  (on peut en bricoler un avec un traitement de texte)

Exemple 2-2: Simple diagramme de barres avec un tableau

WP's et milestones	26/5	29/5	2/6	5/6								
Exploration du domaine	xxxxxxxxx											
Première étude de 1-2 cas		XXXxxx										
Projet provisoire			M									
Rédaction du rapport				x	xxx					XXXXXXXXX		

3. Contrôle (Controlling)

Par qui ?

- Dans l'industrie c'est le chef (ou encore le groupe) qui le fait,
- ici vous êtes responsable principal !
- Si vous faites un plan, donnez-le au rapporteur (ou intégrez-le dans la proposition)

Monitoring du progrès:

- comparaison entre plan et réalité tous les mois
- identification des raisons de déviation et actions correctrices
  - vos problèmes ne vont pas s'arranger seuls (!!)

Gestion des crises:

- demandez de l'aide au directeur
- négociez une redimension de votre projet si nécessaire
- adaptez l'approche si (vraiment) nécessaire
- Note: Des crises sont presques inévitables, mais un bon plan de recherche diminue les risques et limite les dégats ....

4. Estimation de la durée d'un projet typique

Eléments de calcul:

tâches	par élément	total
• Chercher un sujet et faire le plan de recherche		1 mois
• littérature et début de rédaction		1 mois
• contacter les sites (cas par cas)	1/2 journée	1 mois
• visite d'un site	1 journée	
• codage et exploitation primaire d'une visite	2-3 jours	1 mois
• analyses synthétiques / visualisations globales		
• rédaction du rapport (1ère version)		1 mois
• révisions		1 mois
• Total		6 mois


vous êtes trop optimistes !!


N'analysez pas trop de cas / sous-cas pour un travail de licence ou de diplôme !
... ou alors utilisez une démarche quantitative

Stress management and writer's block

(version 0.1, 1/4/05 - fix: translation)

Code: thesis-stress

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Menu

1. Conseils généraux

1.1 Faites un bon plan de recherche

Il vous donne un sentiment de sécurité

Permet un travail modulaire

- aussi de vous attaquer à certaines questions plus faciles.

Redimensionnez votre travail vers le bas si c'est possible.

- un mémoire n'est pas une thèse!

1.2 Organisez votre temps

Avant de s'attaquer à une tâche spécifique, identifiez les points les plus importants dans votre tête:

- "Que dois-je faire maintenant?", ensuite essayez d'accomplir cette tâche.

Essayez de travailler régulièrement et de faire un plan d'activité pour chaque semaine ou mois

A. Concentration

☞ Observez vos pensées

- Si elles contiennent trop d'idées non productives (hors contexte) chassez-les.
- En échange, videz-vous la tête après le travail.

☞ Une seule tâche à la fois !

- Cela ne veut pas dire qu'il faut se lancer toujours dans une tâche très précise.
- Faire du brainstorming, explorer la littérature, etc. sont des tâches utiles. Simplement, il ne faut pas vouloir faire trop en même temps.

☞ Produisez quelque chose qui sert !

- .....pour le reste de votre recherche.

☞ Ne perdez rien

- Si vous faites du brainstorming, faites-le sur papier par example.

2 heures de bon boulot => 2 heures de loisirs

4 heures de mauvais boulot => STRESS

1.3 Exercices physiques anti-stress

Pendant le travail....

- faites de petits breaks de 5 minutes en vous promenant (même dans l'appartement)
- Etirez-vous et/ou respirez très profondément de temps en temps

Il est inutile de vous dire que vous devez déstresser!

On déstresse:

- soit en résolvant le problème
- soit en s'engageant une autre activité.

... si jamais mangez plutôt des vitamines ..... que des anti-dépresseurs etc.

car le stress vient du fait que vous ne produisez pas !

Enthousiastes !
... à éviter aussi: le "burn out"

2. Le Writer's Block

- est l'incapacité presque totale de commencer à rédiger
- Il existe plusieurs causes et plusieurs remèdes contre ce mal, à vous de choisir !

2.1 Faites tout pour réduire le stress

☞ **L'important est de faire quelque chose (même si c'est pas très bon).**

1. Discutez!
   - .....sur votre "blocage", sur votre recherche, sur le plan de mémoire, ..
   - Parler est plus simple que d'écrire et ça génére des idées!
2. Commencez par rédiger "n'importe quoi".
   - Le résultat ne sera pas forcément convaincant, mais c'est un départ!
3. Travaillez peu tous les jours, mais régulièrement.
   - "peu tous les jours" produira beaucoup au bout d'un mois ou deux.
   - Une variante: Prenez un dé et écrivez le nombre de pages qui correspond à la moitié du chiffre. Cela ajoute un côte ludique et une variation

2.2 Maîtrisez la non-maîtrise de certains sujets

On présuppose que vous possédez:

- un bon plan de mémoire
- un bon "research design"

☞ **Si ça n'est pas le cas, refaire la planification du travail de recherche**

La non-maîtrise d'un sujet particulier:

Si le sujet choisi est vraiment trop difficile ... il n'y a rien à faire, mais ce n'est pas toujours le cas.

- lisez un dictionnaire spécialisé, un manuel, une introduction, un travail qui porte sur le même sujet
- discutez avec un expert
- Intégrez, rédigez et ne prenez pas juste des notes!

Si vous trouvez quelqu'un qui connaît la matière allez le voir avec un problème précis comme la rédaction d'un chapitre:

1. Formulez vos question par écrit !
2. Discutez du contenu et prenez des notes.
3. Ensuite, mettez-vous toute de suite à rédiger.

2.3 Diviser et/ou contourner, et conquérir

- Il s'agit de faire quelque chose que vous savez faire et de profiter du résultat.
- Imaginez que votre travail est une carte vierge et qu'il s'agit de remplir des îlots.
- Une fois que ces îlots sont là, vous pouvez remplir le reste plus facilement, comme dans un puzzle difficile.

1. Il faut essayer d'isoler des tâches que l'on maîtrise.
   - Dans ce cas on prend un élément du plan de mémoire (qui normalement ne prend pas plus d'une ou deux heures à rédiger) et on essaye de le "torcher". Ça marche encore mieux si on le fait en présence d'une personne, par example un(e) ami(e), un assistant, etc.
2. Note: n'écrivez pas de sections inutiles
   - "A quoi sert le truc dans la section et pour le travail".
   - N'écrivez que ce qui est absolument nécessaire !
3. Evitez de penser à l'ensemble (parfois)
   - Concentrez-vous sur la seule sous-section ou le seul paragraphe.
   - (Notez ailleurs les idées qui vous viennent en tête, mais revenez tout-de-suite sur le paragraphe en question)
4. Prenez une feuille de papier et faites du brainstorming

- Utiliser un médium différent: parlez dans sur une cassette, faites des dessins, etc.

2.4 Faites-vous plaisir et libérez votre esprit

☞ Donnez-vous des cadeaux pour chaque 3-4 pages écrites.

☞ Détendez-vous !

- exercez une activité qui détend et cela juste avant d'écrire ....
- Ca libère l'esprit des activités précédentes et souvent des idées peuvent surgir que l'on peut mettre sur papier dans la suite.

☞ Parlez de vos problèmes à quelqu'un!

- Avoir ce problème n'est pas une honte, la plupart des gens l'ont!!

☞ Imaginez que vous écrivez pour quelqu'un

- ... et imaginez le plaisir que l'autre va avoir de lire/voir le texte.

☞ Ecrire un autre texte.

- Il s'agit ici de vous prouver que vous savez écrire.
- Ecrivez par example une longue lettre à quelqu'un à qui vous n'écrivez jamais

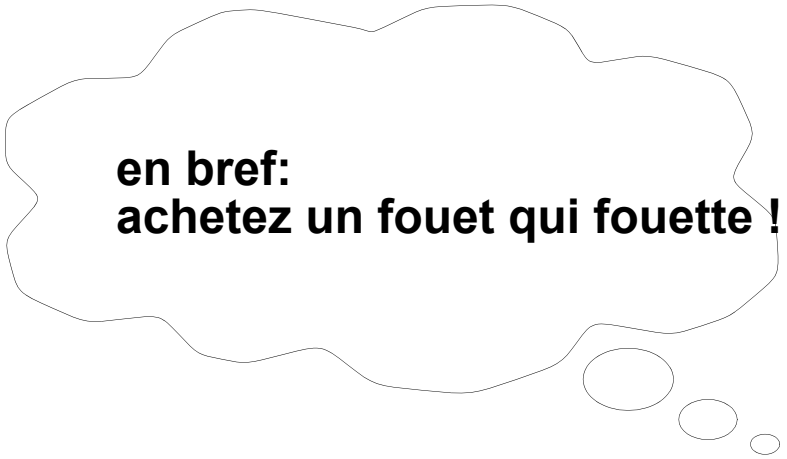
2.5 Prenez des engagements auprès quelqu'un

☞ **Promettez un chapitre à votre directeur tous les mois.**

- Marche seulement si votre blocus n'est pas total sinon vous perdez votre crédibilité!

☞ **Demandez du "coaching"**

- Parfois certains directeurs de thèse ou assistants acceptent qu'un étudiant viennent dans leur bureau ou à côte pour "se débloquer".
- Il peut venir vous voir toutes les 15 minutes et "pousser"/aider un peu.



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