Research Methodology

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Background

- Diploma in Computer Science from University of Kaiserslautern 1988
- Dr. rer. nat. from University of Kaiserslautern in 1995
- Professional Experience
  - German Research Center for Artificial Intelligence
  - Insiders Information Management
  - FHNW since 2000 (former FHSO)
  - Current position: Dean of MSc in Business Information Systems
- Research Activities
  - Researcher for more ab out 25 years
  - Published in various journals and international conferences
  - Reviewer of Journals and member of programm committees
  - Supervisor of students

My Relationship to University of Camerino

1 Introduction

1.1 Motivation

Why are we here?

- We want your studies to end at the right place ..

Thanks to Prof. Alta van der Merwe

Why are we here?

- We want to understand what we are busy with ..

Thanks to Prof. Alta van der Merwe

Why are we here?

- We want to end with a well-constructed thesis ..

Thanks to Prof. Alta van der Merwe

Why are we here?

- We don’t want to do unnecessary work due to bad planning ..

Thanks to Prof. Alta van der Merwe

Why are we here?

- We don’t want any surprises after the examination process ..

Thanks to Prof. Alta van der Merwe

In writing a good thesis

- You should prove that you are able to:
  - Complete a good research-based work and present it in a well-structured and well-written manner in a reasonable time.
  - The thesis is an accreditation process to prove to your university that you can do it.
  - Victory is walking out with a degree in your hand!

  - Writing a good thesis is a *skill* that can be learned

Thanks to Prof. Alta van der Merwe

Things to remember ..

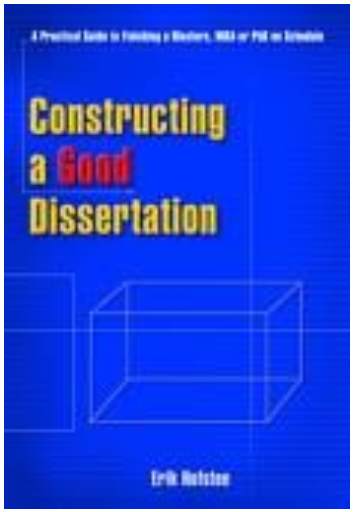
- Few people will ever read your work ..
- Three factors that are predictive whether or not you will complete your thesis:
  - ♦ If it is your **goal** and focus on that – you will complete.
  - ♦ You need to know your **process**. What to do, how to do it, and when to do it.
  - ♦ You need discipline. **Many many** hours!

Thanks to Prof. Alta van der Merwe

Acknowledgement

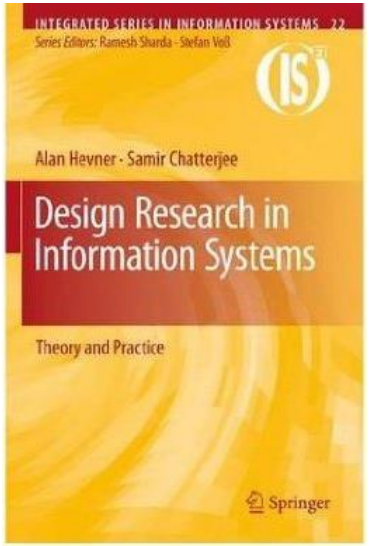
- This course is based on a course on «Practice-Oriented Research Project» that I teach together with Dr. Hans Friedrich Witschel in the Master of Science Business Information Systems at FHNW University of Applied Sciences and Arts Northwestern Switzerland
- It also uses material from a similar course taught by Prof. Thomas Hanne.
- I am also thankful to Prof. Alta van der Merwe from University of Pretoria for her valuable input.

Literature



Hofstee, E. (2006). *Constructing a Good Dissertation*. Johannesburg, South Africa: EPE. Retrieved from http://www.exactica.co.za/

Hevner, A. R., & Chatterjee, S. (2010). *Design Research in Information Systems*. *Media*. New York Dordrecht Heidelberg London: Springer.



Oates, B. J. (2005). *Researching Information Systems and Computing*. Sage Pubn Inc.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students* (5th Edition). Pearson Education.

A Guide for Novice Researchers

- Levy, Y., & Ellis, T. J. (2006). A Systems Approach to Conduct an Effective Literature Review in Support of Information Systems Research. Informing Science Journal, 9.
- Ellis, T. J., & Levy, Y. (2008). Framework of Problem-Based Research : A Guide for Novice Researchers on the Development of a Research-Worthy Problem. Informing Science: The International Journal of an Emerging Transdiscipline, 11, 17–33.
- Ellis, T. J., & Levy, Y. (2009). Towards a Guide for Novice Researchers on Research Methodology : Review and Proposed Methods. Issues in Informing Science and Information Technology, 6, 323–337.
- Ellis, T. J., & Levy, Y. (2010). A Guide for Novice Researchers : Design and Development Research Methods. In Proceedings of Informing Science & IT Education Conference (InSITE) (pp. 107–118).
- Ellis, T. J., & Levy, Y. (2012). Data Sources for Scholarly Research : Towards a Guide for Novice Researchers. In Proceedings of Informing Science & IT Education Conference (InSITE) (pp. 405–416).

Schedule

19 Maggio 2014	16:00 - 19:00
20 Maggio 2014	16:00 - 19:00
21 Maggio 2014	16:00 - 19:00

1.2 What is Research?

Some types of research

- exploratory research
  - introducing a new area of research that is poorly understood
  - goal: finding theories, explanations, …
- testing-out research
  - testing some theory, possibly under particular circumstances
  - goal: validating / falsifying a theory
- problem-solving research
  - theory is applied to some real-world situation
  - goal: solving a (general) problem
- synthetic research
  - generate knowledge from different sources within a research field
  - new concepts, frameworks, etc. for a research field
  - goal: a better understanding of a research field

adapted from Thomas Hanne

Design and Development Research

- In Information Systems Research we often design something
- Design and Development Research is the «disciplined investigation conducted in the context of the development of a product or program for the purpose of improving either the thing being developed or the developer» (Hasan 2003)
- In Information Systems: «Design science … creates and evaluates IT [Information Technology] artifacts intended to solve identified organizational problems» (Hevner et al 2004)
- Two important aspects:
  - the design and development research results in production of some form of **artifact**
  - the process is indeed **research, not product development**

Is the following research?

- The university faced the problem that students are cheating when doing home assignments. You write a system that compares students' contributions and checks whether two assignments are copies of each other. You want to publish your unique approach to compare texts.
- Is this research?

Is the following research?

- You are running a shop for do-it-yourself products. To decide how many products you have to order from the supplier, when you are running out of stock for some products, you compare the sales of the last weeks with the products you still have on stock and also take into account the delivery periods for the products.
- Is this research?

Is the following research?

- Your mother bakes the best cakes in the world. She uses a recipe that she got from her grandmother. To be able to bake a bigger cake, she experimented with the combination of ingredients and found that if she wanted a cake that is double the size she'd need to double all the ingredients except for the eggs, where she should take 5 instead of 4.
- Is this research?

thanks to Alta van der Merwe for this example!

Example

- You need something to carry home the goods from your weekly shopping on Saturday morning

How to carry?







Research is guided by a specific research problem, question or hypothesis

- Research needs a clear goal or articulation
- You need a bag
  - with which you can carry different things like vegetable and bottles
  - with which you can carry heavy things
  - which is small enough to take with you into the shops
- You decide to build your own bag because there is no bag that satisfies all your requirements (design-oriented research)

Research is based on existing knowledge and accepts certain critical assumptions

- You have to consider characteristics like
  - loading capacity
  - materials must not break from weight
  - a bag needs handles
  - there are different carrying options (with hand, over shoulder, on back, rolling …)

Research follows a methodology

- Using theory you find that there is no bag that suits your requirements
- You construct your own bag
  - What does the design look like (data gathering)?
- You make a plan
  - Where am I going to buy the material?
  - What tools do I need?
  - Where am I going to build it?

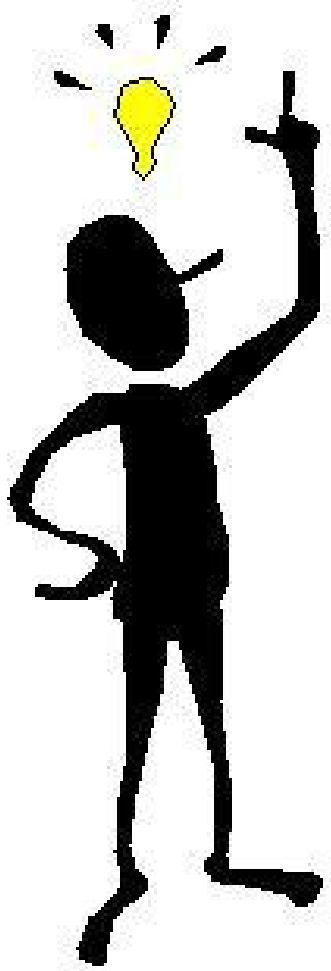
The result

- A bag with wheels, usable also as backpack:

Is this now research? Unfortunately not yet!

Research Result

- New insights
- Generalisable results



AHA effect!

Research and building a bag

	Designing a bag	**Write a piece of software**
Problem	Carrying shopping goods	Cheating of students …
Question	How should a bag be constructed to cover heavy goods	What are the similarity characteristics of assignments
What do we know?	Theory on loading capacity, material, carrying, …	Existing approaches for text comparison and classification
What do we want to do? How?	Plan!	Plan!
What did we do?	Build the bag …	Build the software …
Is it working?	Testing	Testing
Why is it worth something?	Best suited for a specific category of shopping …	General approach for text similarity

What is Research?

- **Write a definition of research …**
  - Starts with a problem
  - Clear goal or articulation
  - Research question or hypothesis
  - Sub-problems
  - Critical assumptions
  - Plan or procedure, methodology
  - Produce data
  - Contribution

Research adds New and Relevant Knowledge

- Research must collect and analyze new information and/or data that will enhance the body of knowledge
- Research contributes to the solution of a documented problem
- Some ways in which original research contributions can be made to the body of knowledge:
  - Establishing causal relationships by conducting a causal-comparative study
  - Evaluating the efficacy of an approach by conducting an experimental or quasi-experimental study.
  - Exploring in depth the positive and negative aspects of an approach in a descriptive study.
  - Establishing a method for creating a product that could at least potentially reduce the impact of the documented problem through a developmental study.
  - Developing a predictive model

Criteria for Research

- **Originality:** Finding out (discovering, working out, …) something what we don't know
- **Significance:** What we want to find out must be sufficiently interesting for others
  - There must be new insights that are of **general** interest (significance)
  - Usually, there is a research community dealing with similar research topics
- **Validity/Evidence:** Others must be convinced that the research (applied methodology, research results) is valid

adapted from Thomas Hanne

What main activities do usually make up research?

- gathering of information
  - everyday understanding of research (e.g. research on prices, …)
  - gathering of literature on a research topic
- analysis and interpretation of information
  - discovery of the meaning of the information
  - finding explanations
  - looking for relationships
  - making comparisons
  - making predictions
  - generalization of the information
  - stating new theories

adapted from Thomas Hanne

What is not research?

Research is not …

… just information gathering

- ♦ presentation of data without analysis
- ♦ finding and repeating information, theories, …

… a literature survey

… rearranging facts

… finding out something individually unknown

… writing a computer program

… stating of theories, principles without any justification (data supporting it, further explanations, …)

adapted from Thomas Hanne

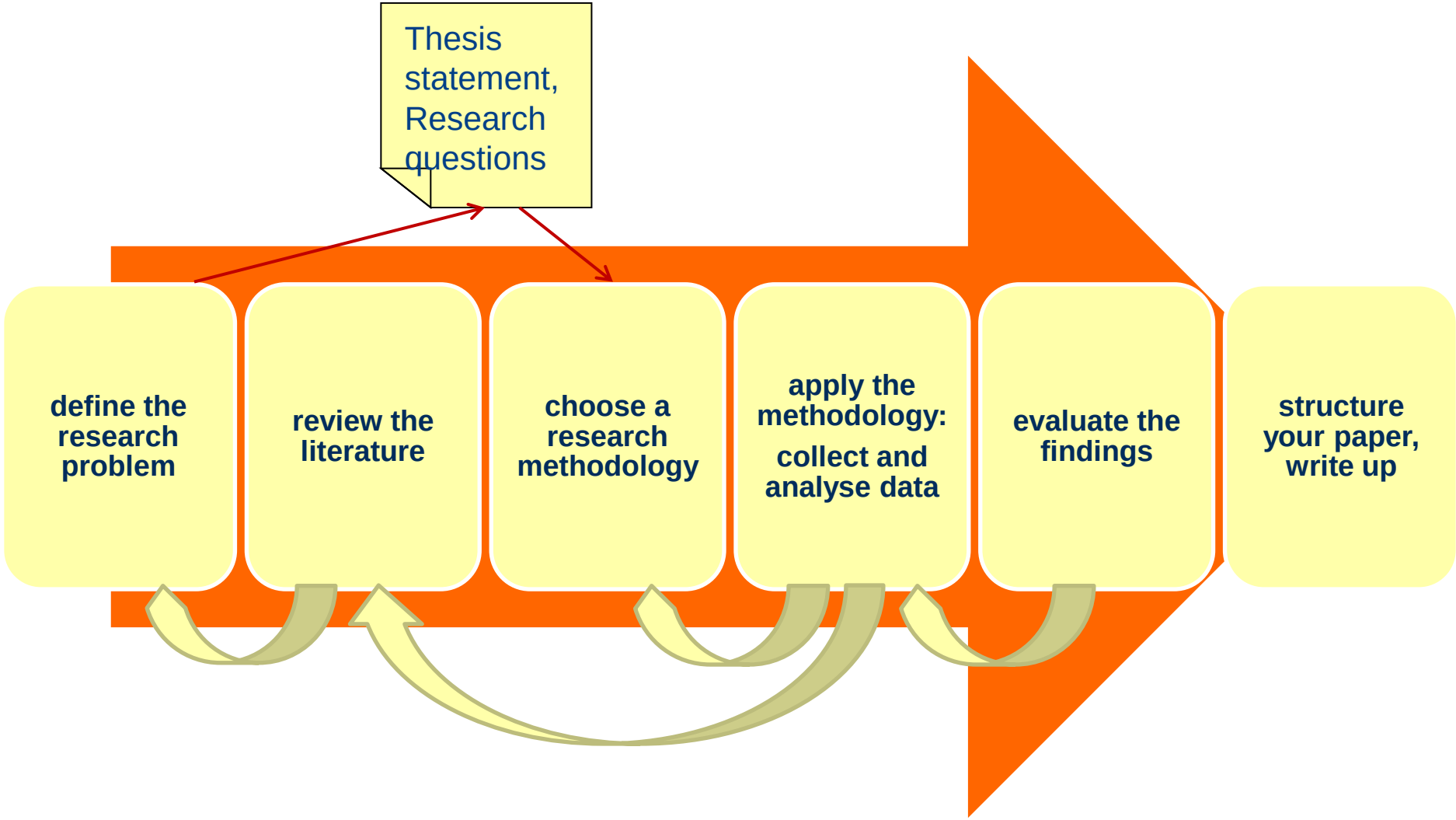
1.3 The Research Process

The Academic Method

- Academic researchers are in the business of explaining the unexplained.
- You will at the most basic level have to:
  - Identify a research problem
  - Develop a thesis about it (make a guess about the solution or take a stand about something)
  - Find out what other academics have written
  - Figure out a way to find out if your thesis is correct
  - Apply that to your thesis
  - Analyse your results
  - Come to a conclusion.

Research Process

The research process is meant as a guidance for you

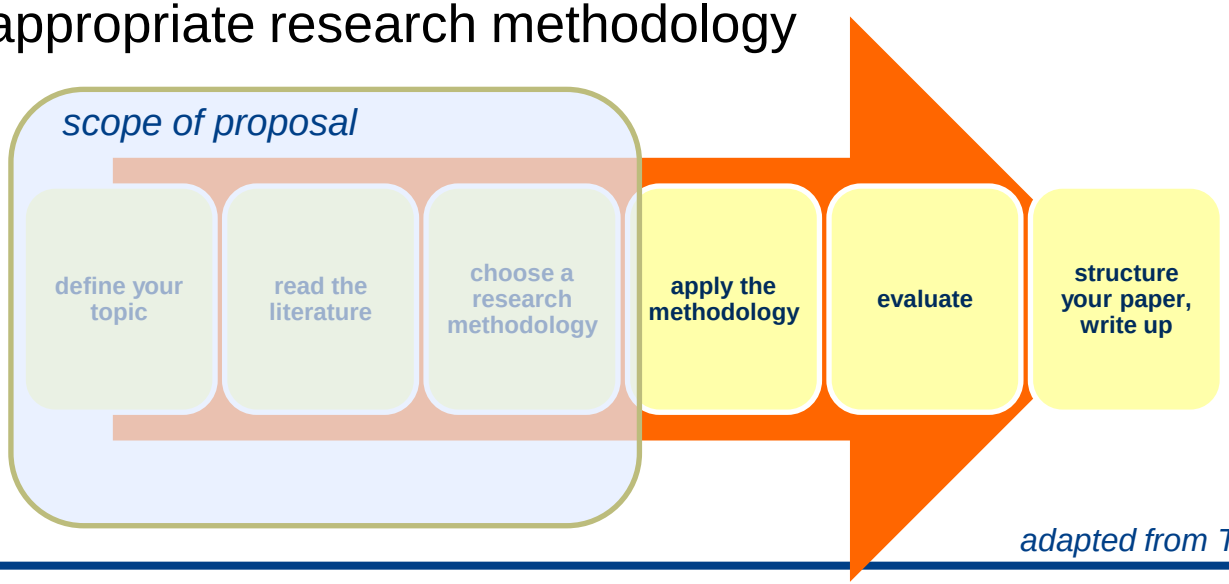


Research Process and the Structure of your Thesis

	Designing a bag	Write a piece of software	Structure of a research paper
Problem	Carrying shopping goods	Cheating of students …	Introduction
Question	How should a bag be constructed to cover heavy goods	What are the similarity characteristics of assignments	
What do we know?	Theory on loading capacity, material, carrying, …	Existing approaches for text comparison and classification	Literature Review
What do we want to do? How?	Plan!	Plan!	Research Methodology
What did we do?	Build the bag …	Build the software …	<Body of work>
Is it working?	Testing	Testing	Evaluation
Why is it worth something?	Best suited for a specific category of shopping …	General approach for text similarity	Conclusion

The research proposal – what it contains

1. problem statement / research question including research goals
   - ♦ should not be too broad
   - ♦ should usually cover research field, specific boundaries
2. short literature review (identification of relevant related research)
3. justification of research (e.g. need for research as stated in the literature, significance of the problem)
4. choice of the appropriate research methodology



adapted from Thomas Hanne