



University of Maribor

Faculty of Electrical Engineering
and Computer Science

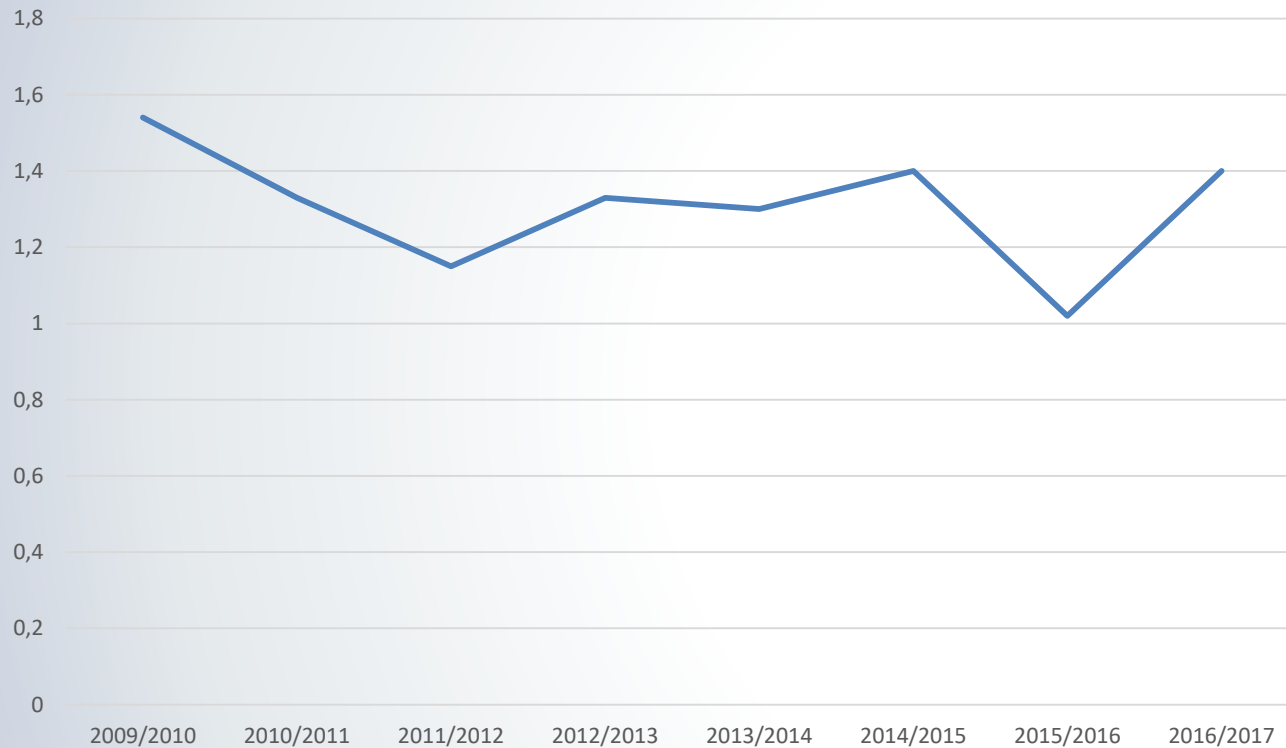
Guided development of scientific research tasks - experiences of students' completion of studies in Institute of informatics, Maribor (2019)

Maja Pušnik, Boštjan Šumak

University of Maribor, Faculty of Electrical Engineering and Computer Science

DAAD 2019

DAAD presentation from 2018



Students survey:
Business process optimization

Motivated to evaluate, what CAN GO wrong and control it!

	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Average grade	65%	68%	79%	81%	82%

A year later...

Introduced changes

- CHANGE #1
Introduction of real-life motivation for optimization
- CHANGE #2
Challenging the use of existing approaches
- CHANGE #3
Introduced new methods/approaches



- All students finished their obligations in January
- The average grade in 2018/2019 was 77%
- Changes introduce success for more students, however the average grade is lower.

PUŠNIK, Maja, WELZER-DRUŽOVEC, Tatjana, HERIČKO, Marjan, ŠUMAK, Boštjan. Approaches and tools for business process optimization support : a survey based evaluation. V: *EJC 2019 : the 29th International conference on information modelling and knowledge bases*, 29th International conference on information modelling and knowledge bases, 3-7 June, 2019, Lappeenranta, Finland. [S. l.]: s. n. 2019, str. 330-340, ilustr.

Motivation for evaluation of other subjects: Empirical research methods

Master thesis is the final result, students have to accomplish before finishing their studies, to receive the title: Masters of Informatics and Technologies of Communication.

The last semester of the 2nd level Bologna Studies includes the subject **Empirical research methods**

The students have a theory course of research methods overview and gain theoretical and practical experience on chosen projects.

The goal of the research

- The objective of this research was to examine, if the success of the students increased after **guided step-by-step** development of research thesis, supported by:
 - assistant
 - professor
 - mentor

SUBJECT OVERVIEW

- Overview of survey and result statistics
- Presentation of the subjects
- Identified challenges
- Conclusion and future work

General students surveys

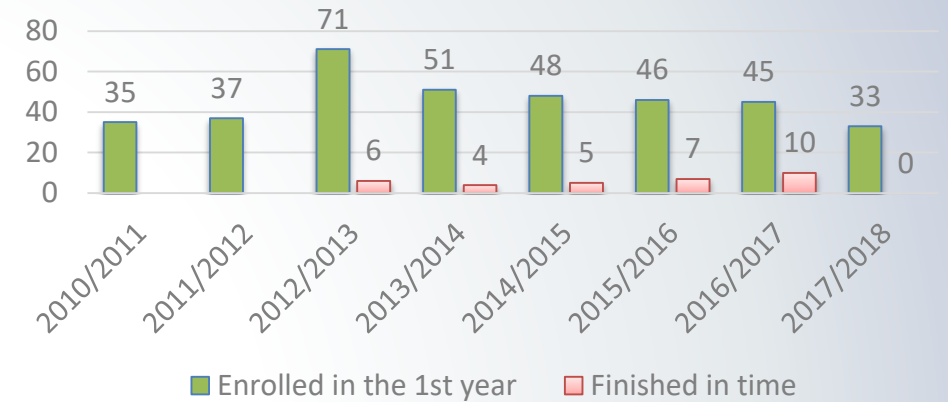
	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	
Student survey (FERI) – average grade [-2,2]	1,13	1,15	1,11	1,12	1,14	1,16		1,23	
Student survey (UM) – average grade [-2,2]				1,23	1,27	1,3		1,33	

2016/2017 – results not representable due to technical issues

2018/2019– final results not yet available

General success of students at Institute of Informatics (FERI)

Number of students vs. number of
finished masters



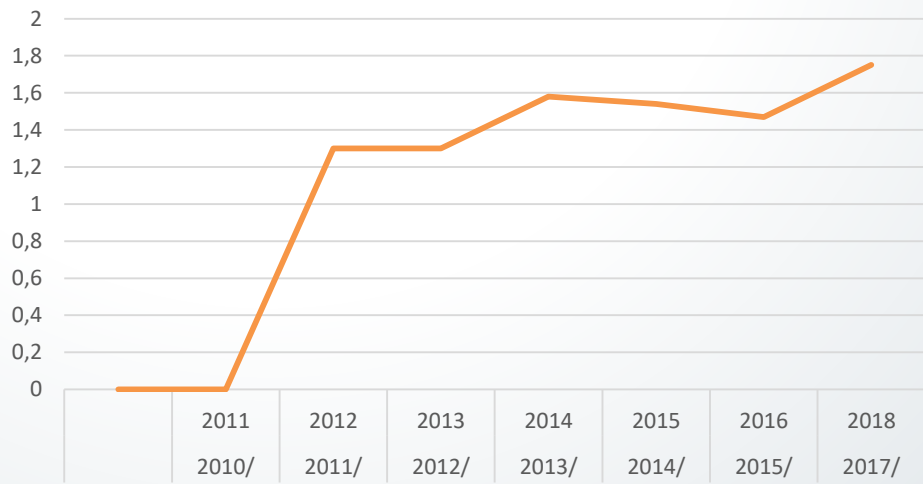
	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019
Enrolled in the 1st year	35	37	71	51	48	46	45	33	Not yet provided
Finished their studies in time	No data provided	No data provided	6	4	5	7	10	10	Not yet provided
Success rate			8%	8%	10%	15%	22%	31%	

[Student Affairs Office]

ASSISTANT	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2017/ 2018
Empirical research methods		1,3	1,3	1,58	1,54	1,47	1,75
Convergence and system integration		0,67	1,15	1,47	1,25	1,01	1,19
Convergence and system integration		1,44	1,86	0,94	0,94	1,60	NP
Operational research		1,46	1,26		1,89	1,38	1,88
Business process optimization		1,34	1,41	1,38	1,28	0,61	1,64
Basics of the web technologies		0,93	0,84	0,85	1,13	1,08	1,27
Development of information services		1,38	1,59	1,22		1,33	1,31
Development of information services		1,19	1,66	2,00	1,50	0,80	1,45
Practicum I		1,47			1,32		
Tools for application development				1,30			

Students surveys – subjects evaluation

Empirical research methods



How satisfied are students with:

Lectures

YEAR	To little	Suitable	Too Much
2013/2014	7,1	85,7	7,1
2014/2015	8,7	91,3	0
2015/2016	6,70	93,30	0,00
2017/2018	0,00	100,00	0,00

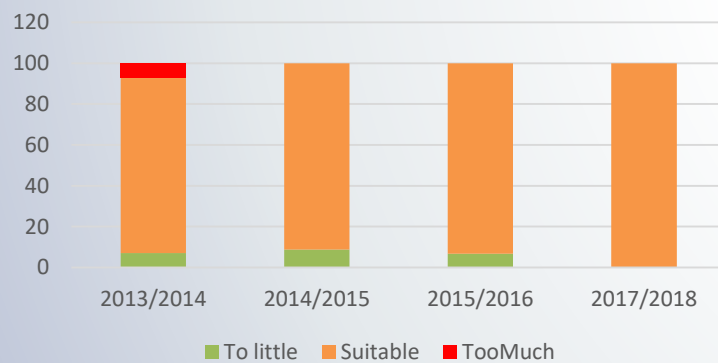
Labs

YEAR	To little	Suitable	Too Much
2013/2014	10,7	82,1	7,1
2014/2015	4,3	95,7	0
2015/2016	6,70	86,70	6,70
2017/2018	0,00	95,20	4,80

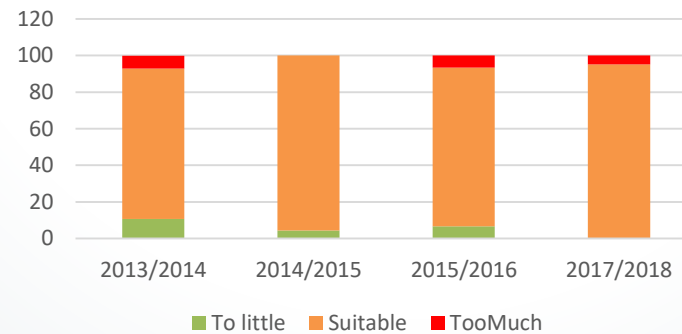
Individual work

YEAR	To little	Suitable	Too Much
2013/2014	0	81,5	18,5
2014/2015	4,3	87	8,7
2015/2016	0,00	100,00	0,00
2017/2018	9,50	85,70	4,80

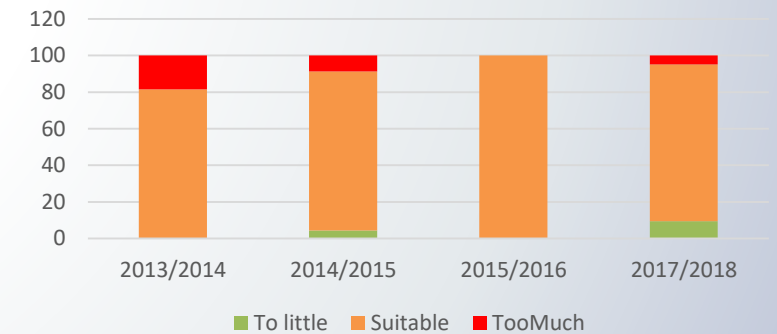
Satisfaction with lectures



Satisfaction with labs



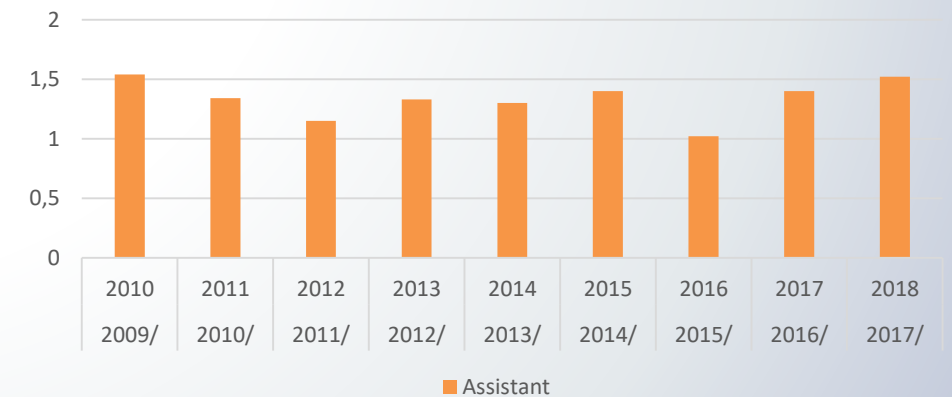
Individual work



Assistant survey results

2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018
1,54	1,34	1,15	1,33	1,3	1,4	1,02	1,4	1,52

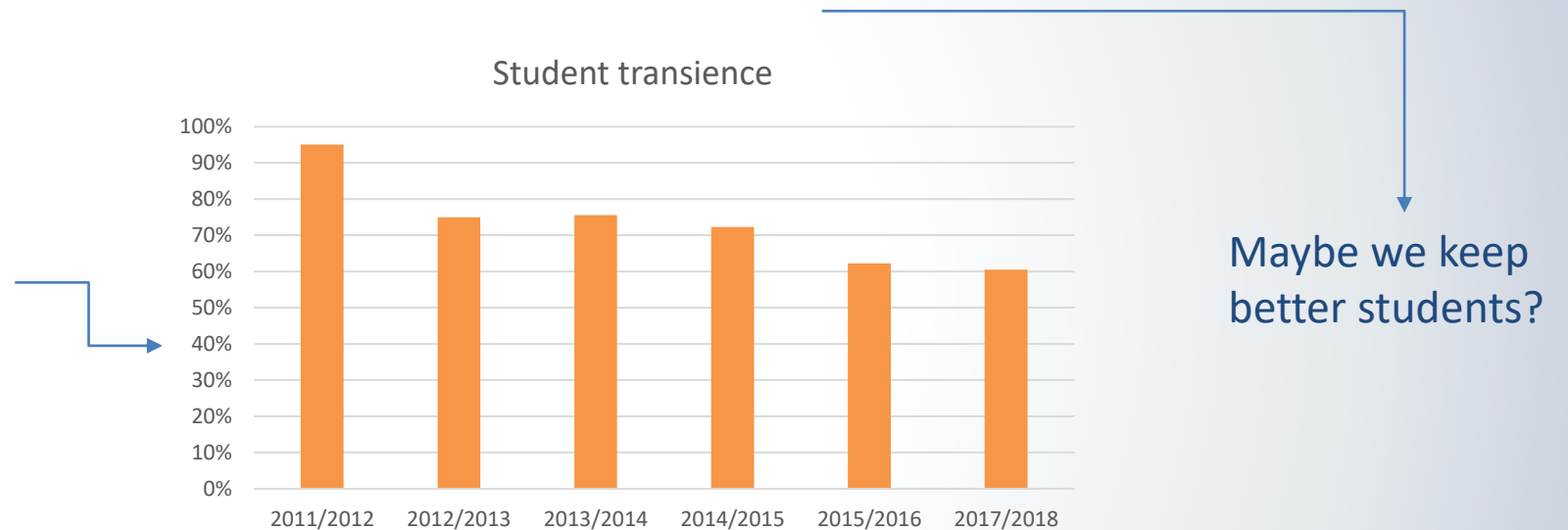
Student's evaluation of assistants for
Empirical research models



Results seem to be improving....

How many students successfully finish their obligations?

2011/2012	95%
2012/2013	75%
2013/2014	76%
2014/2015	72%
2015/2016	62%
2017/2018	61%

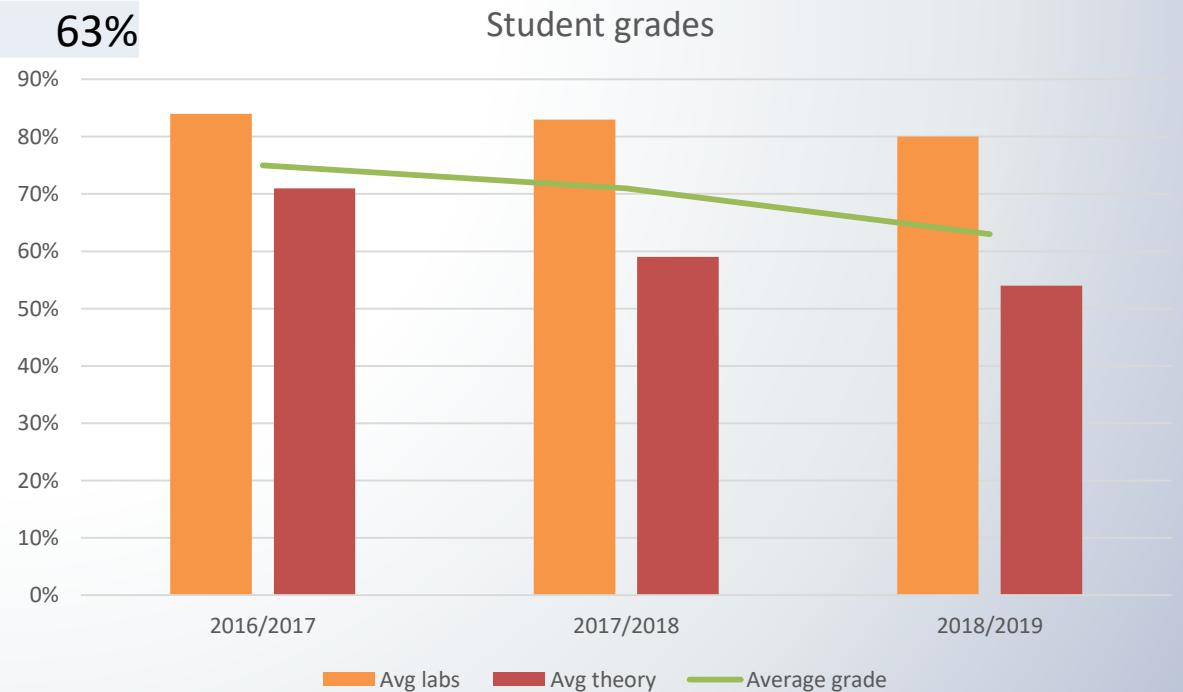


ALARM #1 Although student surveys regarding assistants, professor and subject contents in general are improving, the student success is dropping and the number of students, which do not finish their obligations on time, is rising!

The student grades 2016-2019

	2016/2017	2017/2018	2018/2019
Number of students	46	40	24
Number of failed	19	23	3
Percentage failed	41%	58%	13%
Average labs grade	84%	83%	80%
Average theory grade	71%	59%	54%
Average final grade	75%	71%	63%

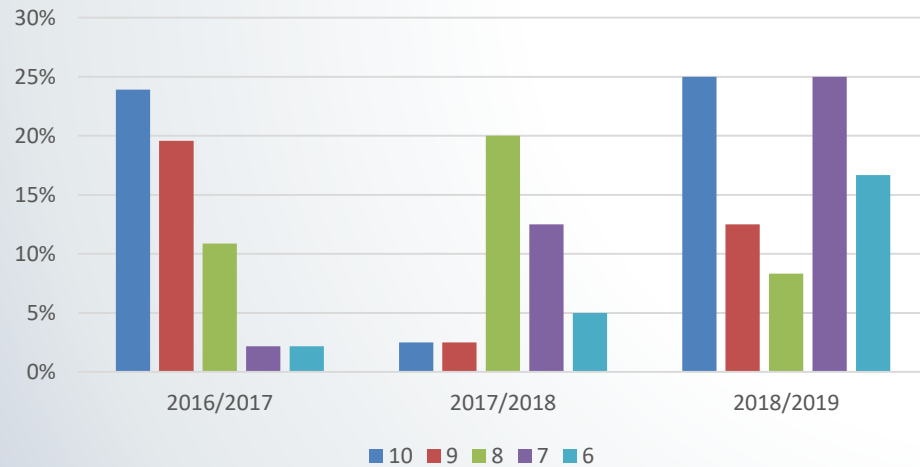
Maybe there are many good and many less good students?



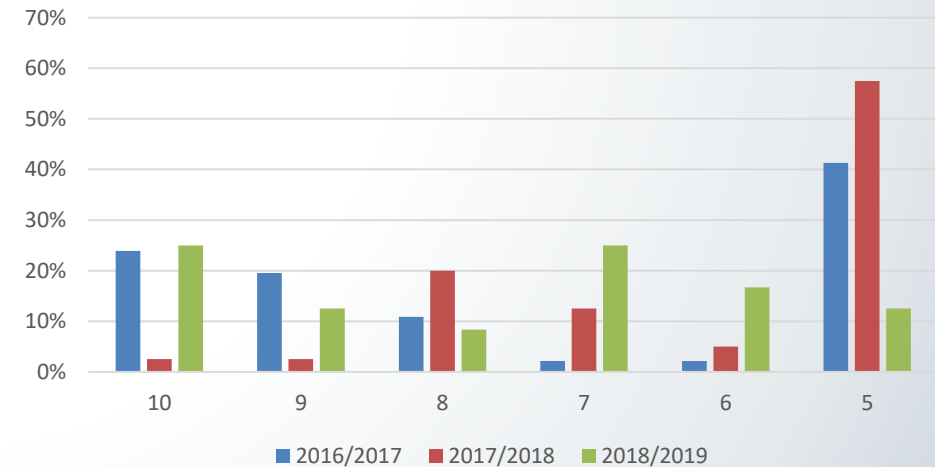
The distribution of grades

	2016/2017	2017/2018	2018/2019
10	24%	3%	25%
9	20%	3%	13%
8	11%	20%	8%
7	2%	13%	25%
6	2%	5%	17%
5	41%	58%	13%

Grades distribution



Grades distribution through years



ALARM #2 The number of low/average grades is rising!

How to improve student's interest and grades

1. Transparent schedule
2. Well explained expectations
3. Week-to-week overview of their work
4. Introduction of several small examples

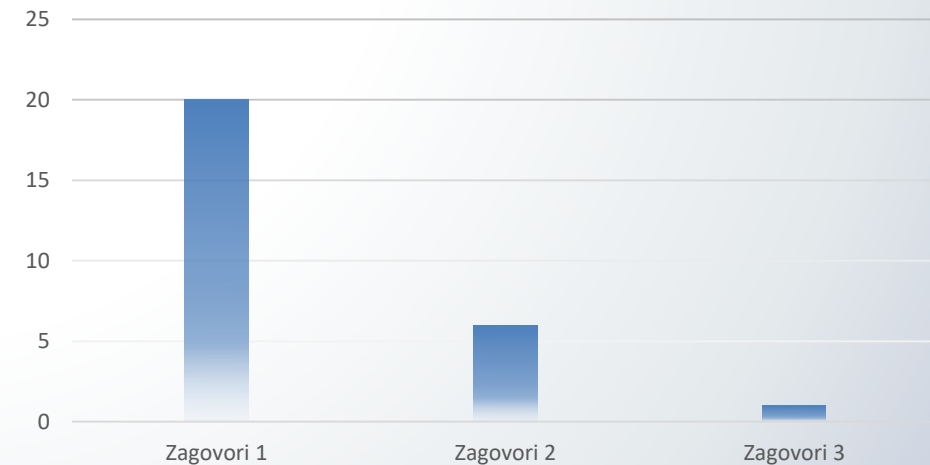
CHANGE #1: presentation of statistical chances to be successful based on attendance and work on exercises

- Attendance is required
- Weekly show of progress to assistant (debate)
- Exercise work is largely independent

LABS ATTENDANCE



PRESENTATIONS



CHANGE #2: Structured reporting and public presentation

- Includes
 - Submission of documentation (30-50 pages) – based on FERI template for diploma work proposal submission
 - Public presentation (approx. 15 minutes)
 - Questions and debates among students

CHANGE #3: Transparency of contents and expectations

1. Definition of problem area and research questions
2. Designing a theoretical model
3. Systematic literature review
4. Design and simulation of an experiment
5. Planning, simulation and implementation of a survey
6. Design, simulation and execution of a case study
7. Analysis of the results
8. Presentation of the assignment and submission of documentation

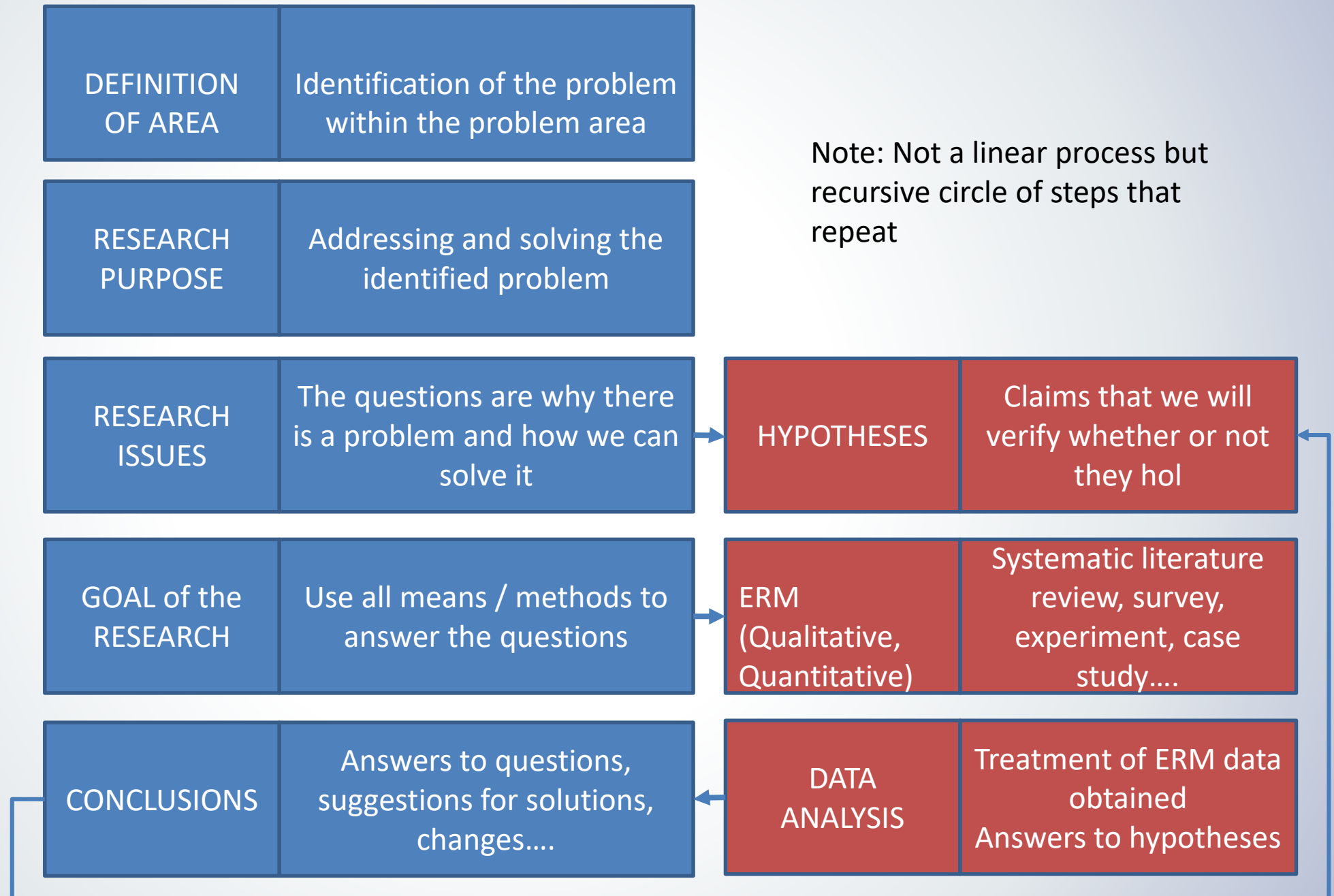
Task 1: Definition of problem area and research questions

Choosing the right topic

1. Choosing a mentor (**as soon as possible**)
2. Familiarity with the problem area (**literature**, interview with a mentor)
3. Long-term interest in working in this field (topic should be of interest to the candidate)
4. Avoiding overly ambitious and difficult topics (**missing appropriate literature**)
5. Approach objectively, without emotions or assumptions about what the results will be
6. Choosing a topic that has the potential of **original contribution**

RESEARCH = own ambitions + mentor requirements + practical circumstances

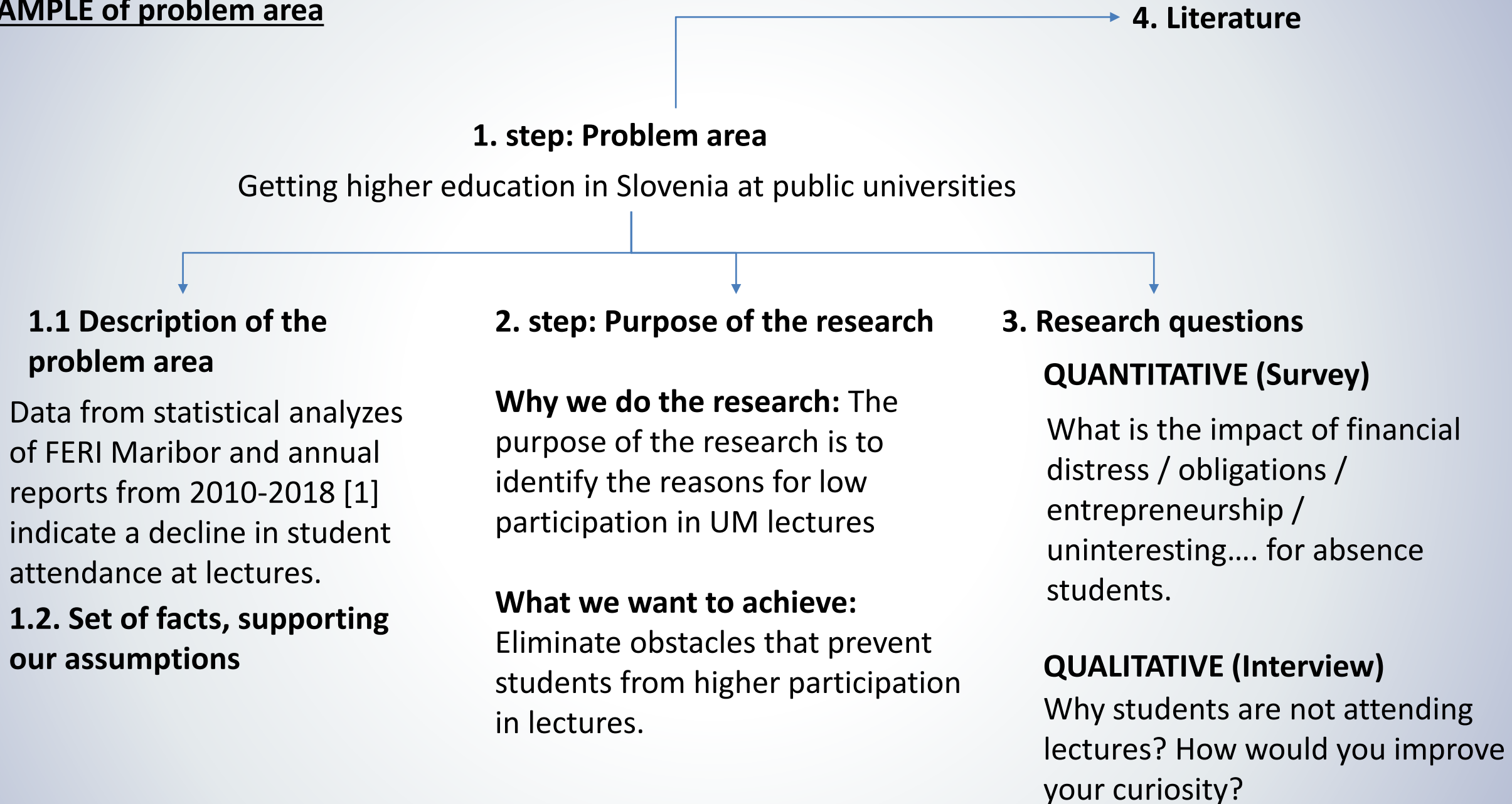
Presentation of basic steps



Practical approach to research questions

1. Will the student be able to answer them?
 2. What variables can be extracted (dependent, independent)?
 3. Are some of them latent and what indicators can measure them?
- Common dependent variables:
 - Usefulness
 - Performance
 - Complexity
 - Quality
 - Difficulty

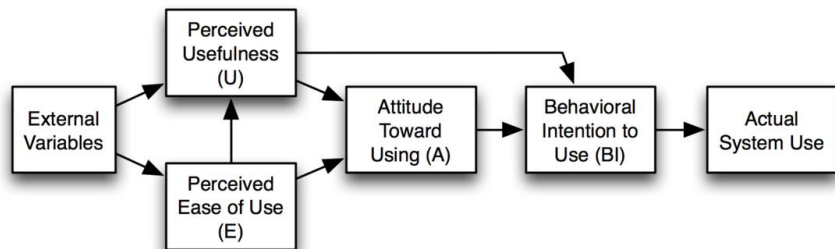
EXAMPLE of problem area



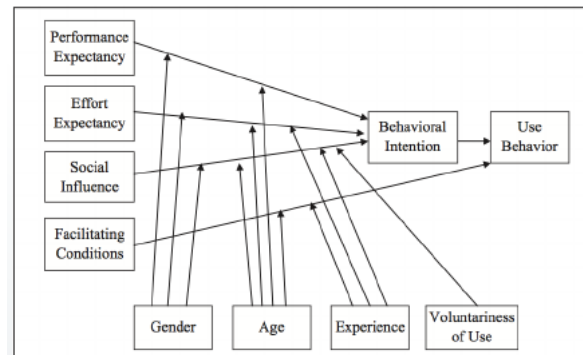
Task 2: Definition of the theoretical model

- Linking independent and dependent variables to causal relationships.
- Definition of causal hypotheses
 - "Independent variable affects dependent variable"

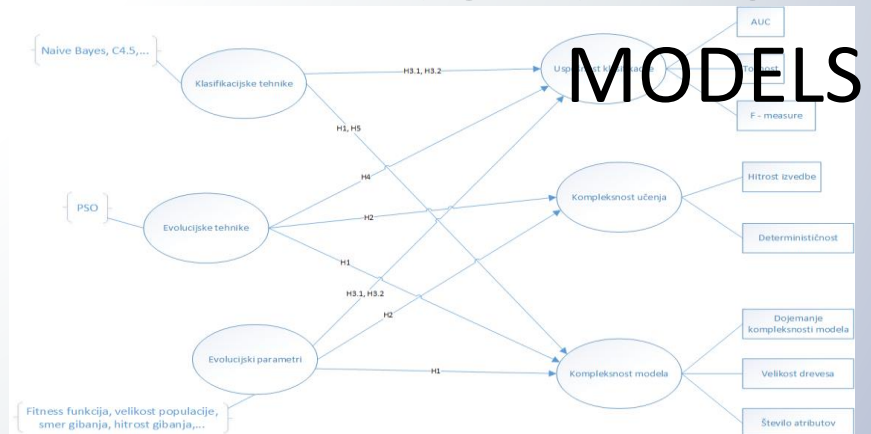
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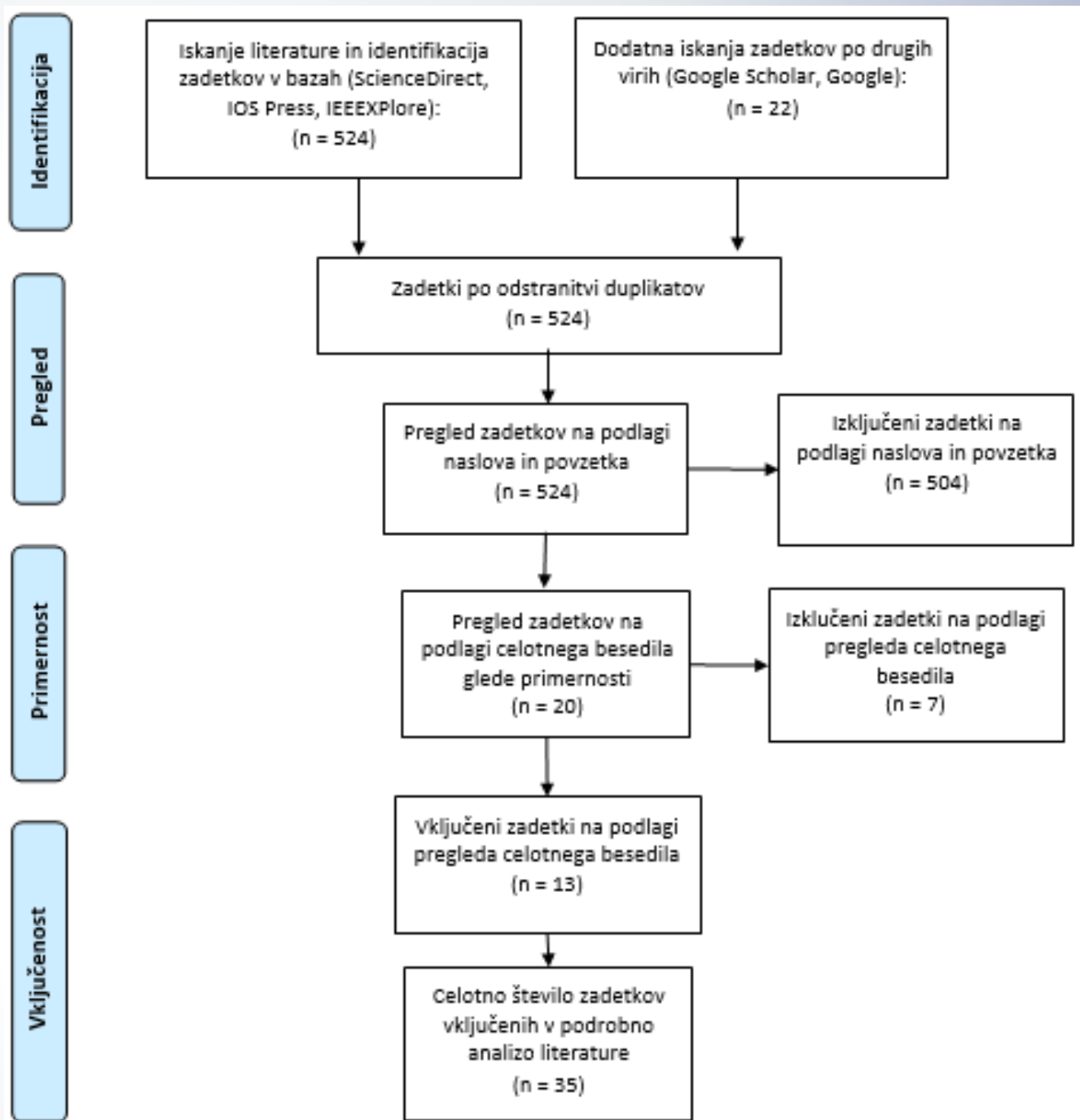
PROBLEM BASED CONCEPTUAL MODELS



Task 3: Systematic literature review!

- When looking for a basis for research work
- Clearly define what contribution to the existing knowledge constitutes the proposal of the thesis *.
 - defining shortcomings in the existing literature
 - definition of further research activity.
- Protocol or. implementation strategy of SLR
 - Planning
 - Performance
 - Reporting

Search evaluation and inclusion!



Task 4 to 6: Choosing the right method and testing at least 3 basic methods

- Experiment
- Survey or Interview
- Case study
- Combination of the above

Task 7: Data presentation

- Qualitative data
- Quantitative data

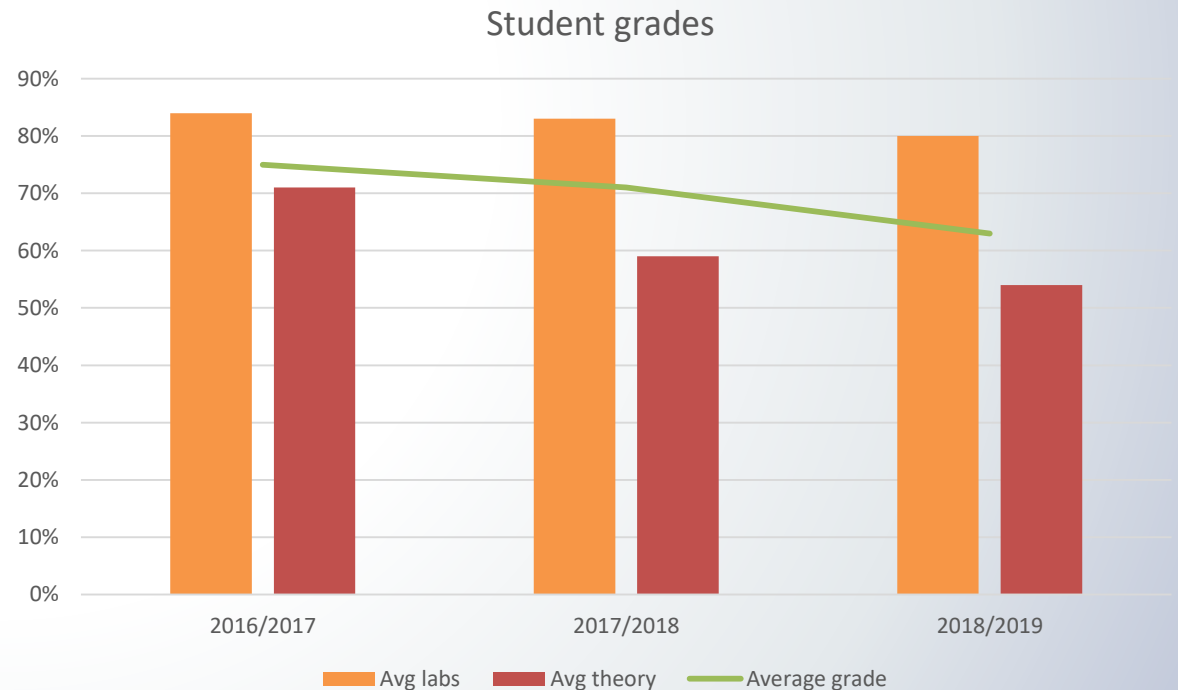
- SPSS
- EXCEL
- QDA
MINER
- Others

Individual task: In-depth overview of possible methods (theoretical overview in lectures)

- Inductive and deductive method
- Analysis and synthesis
- Abstraction and concretization
- Generalization and specialization
- Proving and challenging
- Classification
- Descriptor
- Compilation
- Comparative method
- Statistical method
- The mathematical method
- Modeling method
- The cybernetic method
- Experimental method
- The dialectical method
- Historical method
- Genetic method
- Systems theory as a research method
- Axiomatic method
- Ideal type method
- Empirical method
- Case study method
- Survey method
- Interview method
- Observation method
- Counting method
- Method of measurement
- Mosaic method

Existing problem

- If we try to focus on more students successfully (and on time) to finish their thesis, we loose interest of more engaged students (they get quickly contented with mediocre grades)
- If we focus on best students to achieve high level results, we loose the majority of others



Successful project examples

A preliminary study of the use of cellular automata

Using Markov Chains to Rank Websites: A Case Study on FERL

A preliminary study of the use of game theories to provide a positive user experience

Application of genetic algorithms in the field of business process optimization

Implementation of the shortest path finding methods for optimizing social networking

Development and evaluation of a mobile application prototype for reclamations of citizens in smart cities

A meta-analysis of the application of chaos theory in business

Conclusion

- To improve students grades, providing support and motivation to students while choosing the right subject/problem area is essential
- Focusing on support during research question development
- Support while choosing the right approach/empirical research method

Thank you for listening!

Questions, suggestions?

maja.pusnik@um.si

bostjan.sumak@um.si