

Open Educational Resources (OER) for Teaching Thematic Mapping



Cartography M.Sc.



Technische
Universität
München



TECHNISCHE
UNIVERSITÄT
WIEN



TECHNISCHE
UNIVERSITÄT
DRESDEN



UNIVERSITY OF TWENTE.

Motivation and Problem Statement

INTRODUCTION

The technique or the technology of making maps

Research Focus

Focus on the thematic mapping teaching given to university students

Education in University

Creating OER prototype based on the knowledge of how the educators usually teach

Prototype of OER

Thematic mapping

OER as a tool

Thematic mapping as a hard skill

Teaching thematic mapping requires more exercise, so OER can be a potential tool

RESEARCH IDENTIFICATION

Research Objectives

Identifying the syllabus of teaching method in university for teaching thematic cartography

See how we can implement the syllabus as an open educational resource (Building a prototype)

Determining the potential and relevance of open educational resources for teaching thematic cartography

Research Questions

RQ1A - How is the syllabus for teaching thematic cartography defined and delivered to the students in university?

RQ1B - How is the thematic cartography teaching syllabus different for bachelor's and master's students?

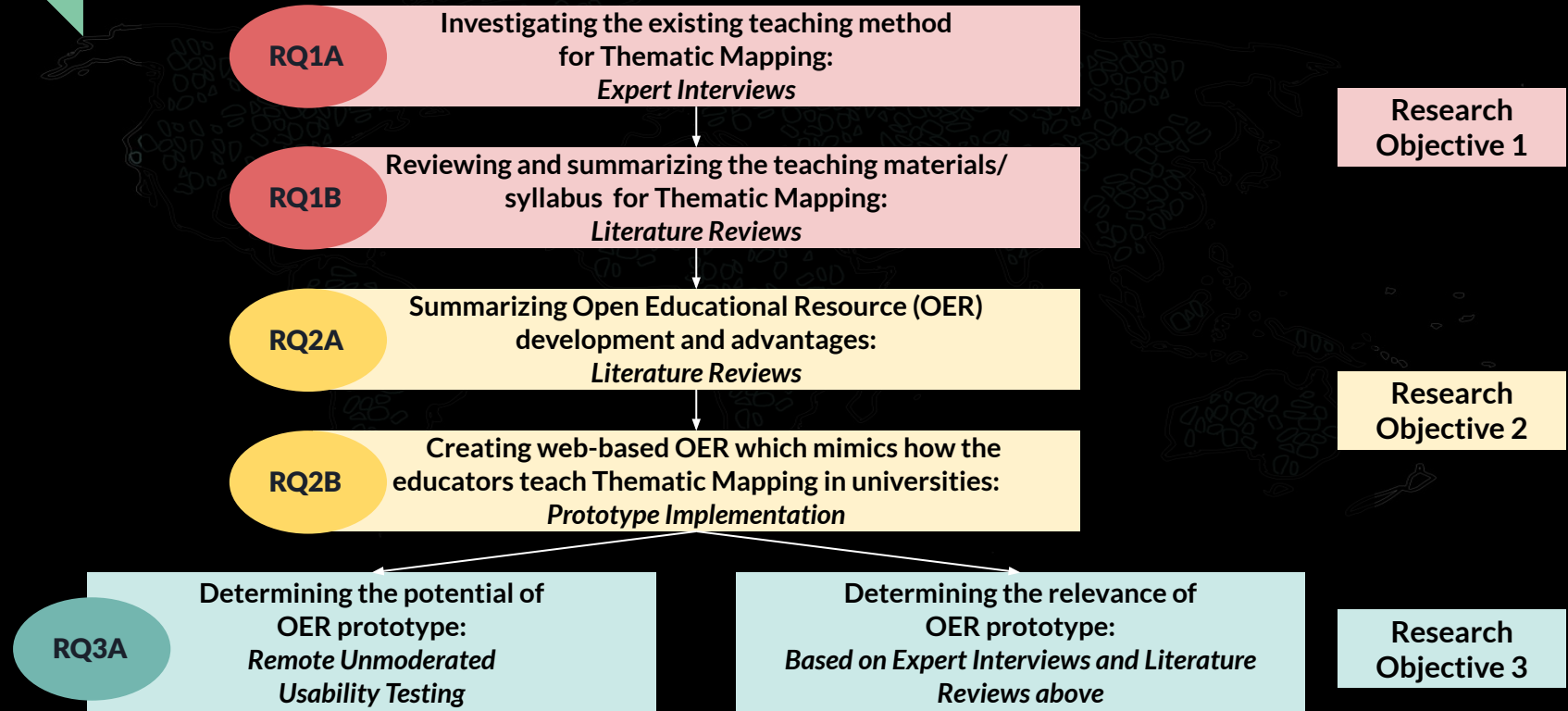
RQ2A - What are Open Educational Resources (OER)? What is the advantage of it? How is the development of OER recently?

RQ2B - How can the thematic cartography teaching syllabus be implemented in Open Educational Resources?

RQ3A - How high is the potential and the relevance of OER for teaching thematic cartography?

METHODOLOGY -

How to answer the Research Questions



METHOD -

Research Question 1 A (RQ1A)

RQ1A

Investigating the existing teaching method
for Thematic Mapping:
Expert Interviews

Expert interviews

- to get the information about *how they teach* thematic cartography/thematic mapping and *how they arranged* the syllabus or teaching materials from the educators
- *semi-structured interview*

RESULT - RQ1A

RQ1A

Expert Interviews (Shortest) Summary

1	The most important things in the class	Theory behind and application of techniques
2	Organization of the course	Lecture and exercise classes. The teachers prefer to have active learning.
3	Online teaching vs in-class teaching	In-class teaching is preferable, but online teaching is possible by increasing student engagement

METHOD - Research Question 1 B (RQ1B)

RQ1B

Reviewing and summarizing the teaching materials/
syllabus for Thematic Mapping:
Literature Reviews

Literature Reviews

→ to compare how the thematic cartography *teaching syllabus* **different** for bachelor's and master's students

RESULT - RQ1B

Syllabus comparison

RQ1B

4 Bachelor's teaching materials

No significant difference between both

2 Master's teaching materials

METHOD - Research Question 2 A (RQ2A)

RQ2A

Summarizing Open Educational Resource (OER)
development and advantages:
Literature Reviews

Literature Reviews to answer this research question, I managed to answer these questions below:


1. *What are Open Educational Resources (OER)?*
2. *What is the advantage of it?*
3. *How is the development of OER recently?*

RESULT - RQ2A

Open Educational Resources

RQ2A

Development




**University Consortium for
GEOGRAPHIC INFORMATION SCIENCE
GIS&T Body of Knowledge**

[GITTA Home](#)

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- [GITTA Access](#)
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 - [Module Overview](#)
 - [Download IMS/SCORM](#)
 - [Bugtracker](#)
 - [GIS Software](#)
- [GITTA Association](#)
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GITTA/CartouChe news:



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CARTOGRAPHY PLAYGROUND

Spatial data:

Attribute data:

Map title:

The nature of the data

Qualitative

Nominal

Perception properties

Associative

Colour

Form

Texture

Orientation

History & Cart


Visual variables

Ca

This fdfd fdsf is the Cartography Playground, a simple and interactive website for explaining cartographic algorithms, problems and other matters. It is aimed at students of cartography who want to refresh and deepen their knowledge.

Cartography Playground is build as part of a masterthesis at the [Chair of Cartography](#) at the [Technical University of Munich](#).

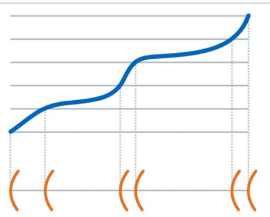
Please use an up to date, modern browser like Firefox or Chrome with JavaScript enabled and SVG support to make sure all playgrounds work as intended.



Douglas-Peucker algorithm

Play with the algorithms parameter to reduce a piecewise linear curve.

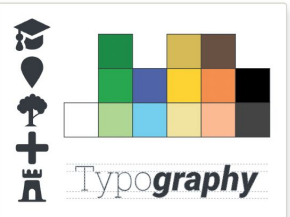
[DOUGLAS-PEUCKER ALGORITHM](#)



Contour lines to profile

Learn how to extract height profiles from Contour lines - the representation for elevation in topographic maps.

[CONTOUR LINES TO PROFILE](#)



Map design

Learn and fiddle around with some general design principles for map design - especially color and font.

[MAP DESIGN](#)

METHOD -

Research Question 2 B (RQ2B)

RQ2B

Creating web-based OER which mimics how the educators teach Thematic Mapping in universities:
Prototype Implementation

Prototype Implementation utilized:

1. HTML
2. CSS
3. JavaScript
4. Vega-Lite
5. Bootstrap

RESULT - RQ2B

Prototype (Web-based OER)

RQ2B



**BUT
NOT
THIS
TEMPE**

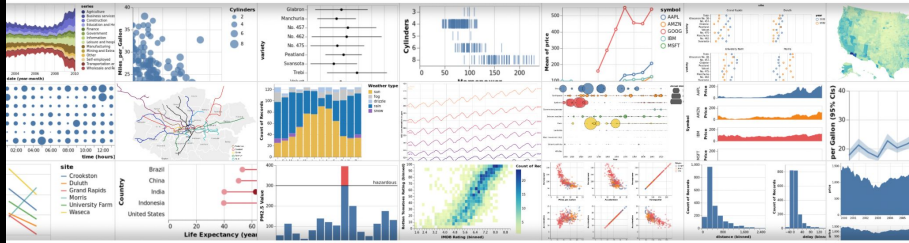
Thempe

THEmatic Mapping Practice and Explanation

vega.github.io/vega-lite/

Vega-Lite Examples Tutorials Documentation Usage Ecosystem GitHub Try Online

Vega-Lite – A Grammar of Interactive Graphics



Vega-Lite is a high-level grammar of interactive graphics. It provides a concise, declarative JSON syntax to create an expressive range of visualizations for data analysis and presentation.




RQ2B

getbootstrap.com

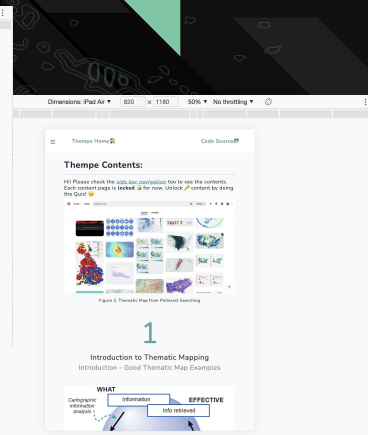
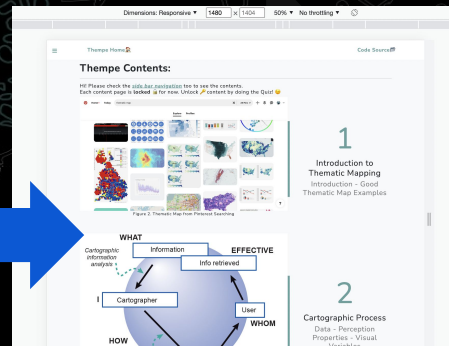
Docs Examples Icons Themes Blog

New in v5.2 CSS variables, responsive offcanvas, new utilities, and more!



Build fast, responsive sites with Bootstrap

Powerful, extensible, and feature-packed frontend toolkit. Build and customize with Sass, utilize prebuilt grid system and components, and bring projects to life with powerful JavaScript plugins.



×

☰

Thempe Home🏠

1 - Introduction🔒

2 - Cartographic Process🔒

3 - Map Type🔒

learn about each map type

3.1 - Choropleth Map🔒

3.2 - Proportional Symbol Map🔒

3.3 - Flow Map🔒

4 - Map Elements🔒

Hi!!!

you can unlock the locked pages by doing the Quiz on each page

The

An Open Educational Resource

More About The

TAKE ME TO

Match the visual variables with perception properties

Selective

Associative

Ordered

Quantitative

CHECK YOUR ANSWERS

Size

• ■ ■

Color value

■ ■ ■

Orientation

⬆ ⬇ ⬅

Texture

📖 🧱 🗑

Color Hue

● ● ●

Position

🌐 🌐 🌐

Shape

● ■ ◆

Create a Choropleth Map

create freely, change your data and color scheme to see the difference affected by both

TEACHER WITH MINIMUM REQUIRED QUALIFICATIONS

CHOOSE COLOR SCHEME

✓ SEQUENTIAL SINGLE-HUE: BROWNS

SEQUENTIAL SINGLE-HUE: RED

SEQUENTIAL MULTI-HUE: VIRIDIS

SEQUENTIAL MULTI-HUE: TURBO

DIVERGING SCHEMES: PURPLE-GREEN

DIVERGING SCHEMES: RED-GREY

latest_val

13

4 QUALITY EDUCATION

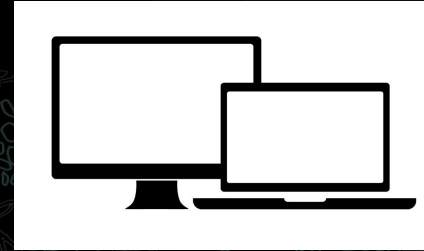
15



SCAN ME

<https://zulfanaa.github.io/thempe/>

Developed for:



Best to open it on these browsers:



METHOD -

Research Question 3 A (RQ3A)

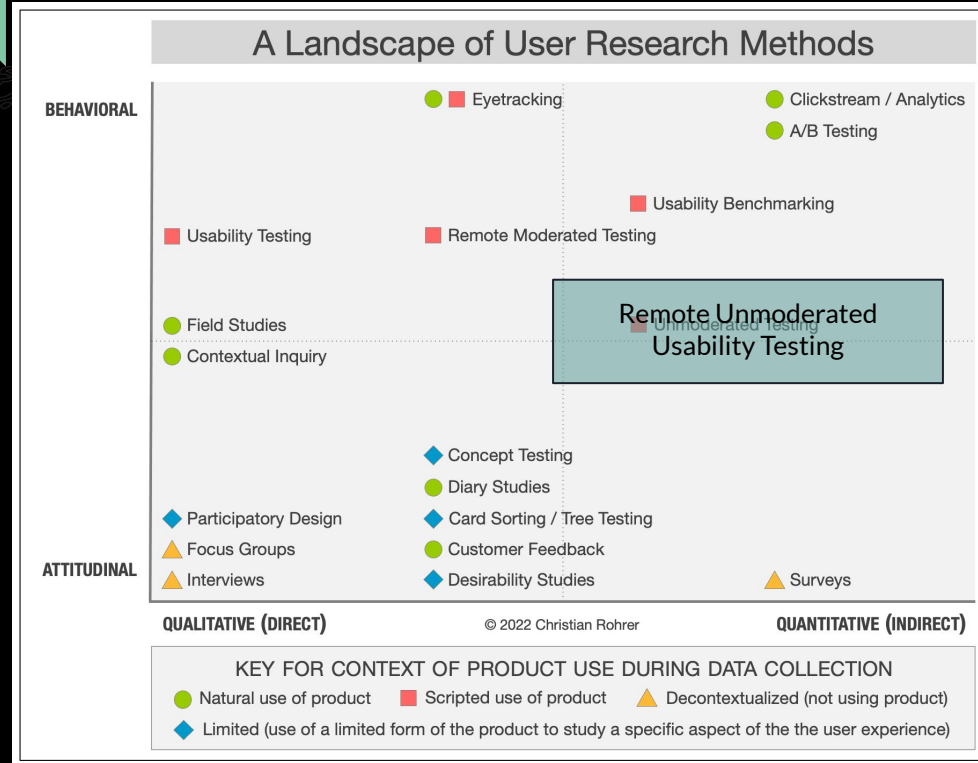
RQ3A

Determining the potential of OER prototype:
Remote Unmoderated Usability Testing

The idea of user testing sticks on 3 terms based on ISO 9241-11:

1. **Effectiveness:**
→ to test the understanding of users regarding the materials
2. **Efficiency:**
→ to test how Thempe's features work
3. **Satisfaction:**
→ to see what users think about Thempe

User Research - How it was implemented



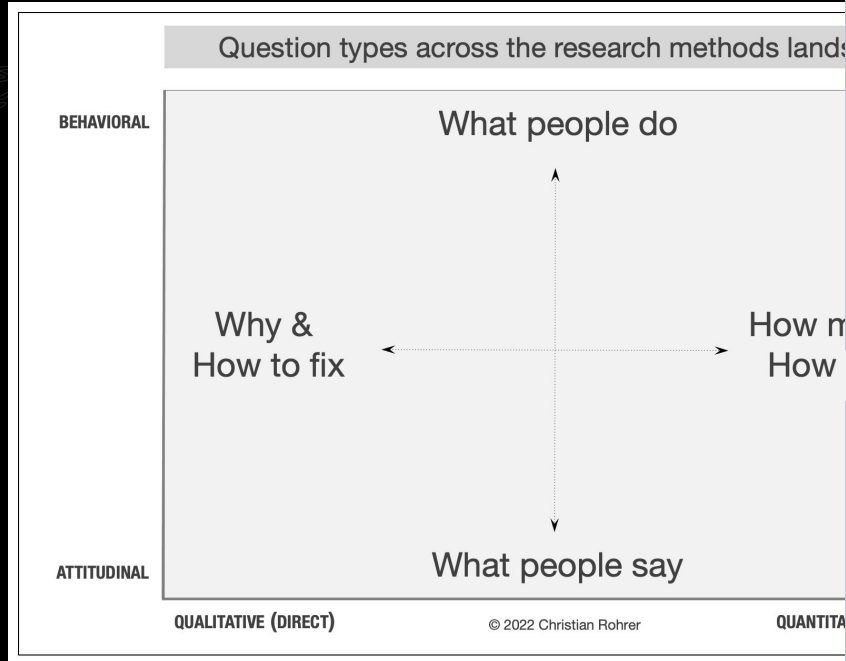
Behavioral:
what people *do*

Attitudinal:
what people *say*

Qualitative:
why or *how* to fix a problem

Quantitative:
how many and *how much*

Question Types - In questionnaires



Pretest - Thempe

Quiz related to Thematic Mapping/Thematic Cartography

Please do answer the questions, and do not be afraid of getting the wrong choice. This is not an exam.

What is the purpose of a thematic map?*

- ☐ to tell the audience about a specific geographical area
- ☐ to show a beautiful representation of information
- ☐ to visualize only geographic phenomenon distribution
- ☐ to represent one or more geographic phenomena, the location, and the attribute
- ☐ to show detailed statistical data

RQ3A

Post-test - Thempe

Questions Regarding to The Post-test

The questions of post-test are easy*

Strongly disagree Disagree Neutral Agree Strongly agree

I am confident with my answers*

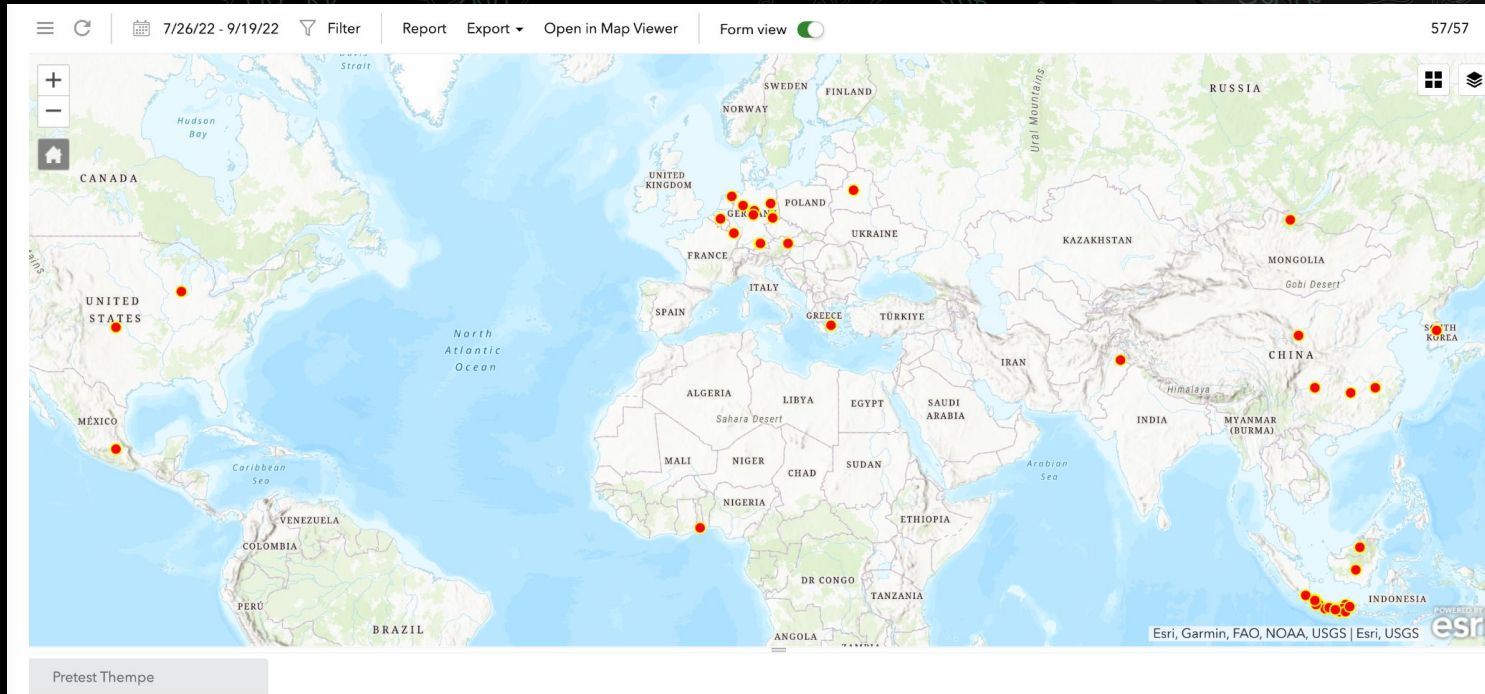
Strongly disagree Disagree Neutral Agree Strongly agree

RESULT - RQ3A

Usability Testing

RQ3A

Participants



RESULT - RQ3A

Usability Testing

RQ3A

Student Participants

Student's Study Program

Remote Sensing and GIS

2.9%

Regional Development

8.6%

Geography

5.7%

Geodesy and Geomatics

2.9%

Geodesy and Geoinformation

2.9%

Geodesy

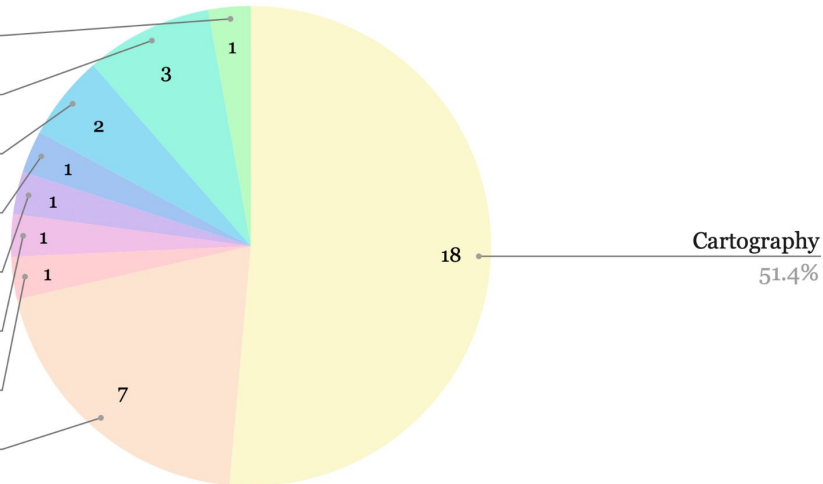
2.9%

Cartography PhD student

2.9%

Cartography and Remote

20.0%



Known students' universities:

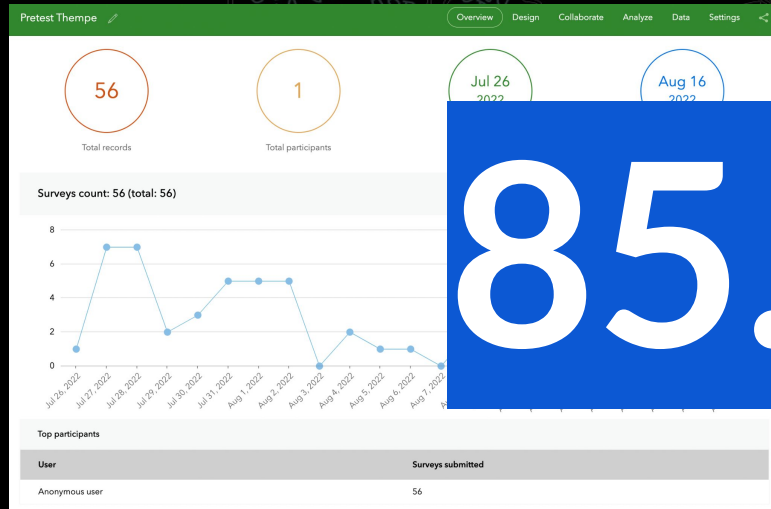
1. TU Wien
2. TU Dresden
3. TU Munich
4. ITC - University of Twente
5. University of Wisconsin-Madison
6. Gadjah Mada University
7. KU Leuven
8. Lund University

FINDINGS - RQ3A

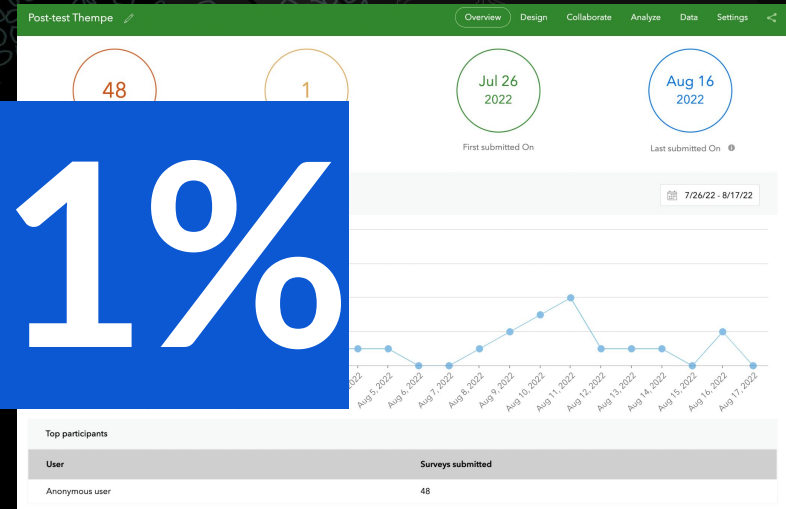
The potential of THEMPE

RQ3A

Effectiveness - Completeness



85.71%



FINDINGS - RQ3A

The potential of THEMPE

RQ3A

Effectiveness - Correctness

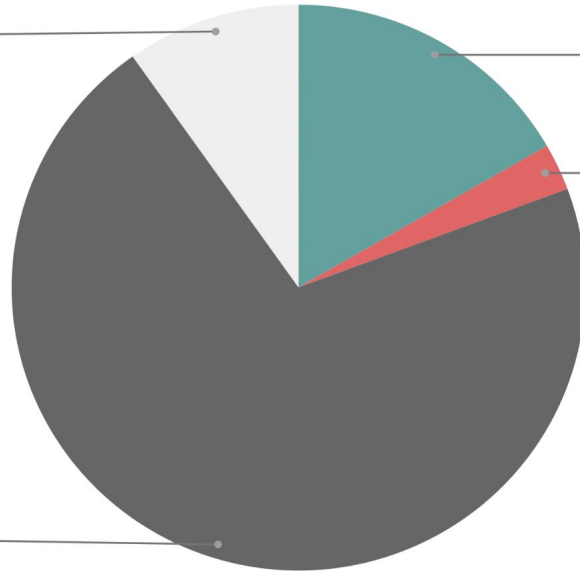
Count of Correct Answers

Wrong in Pretest and Post-test
9.8%

Correct in Post-test
16.7%

Correct in Pretest
2.7%

Correct in Pretest and Post-test
70.8%



FINDINGS - RQ3A

RQ3A

The potential of THEMPE

Effectiveness - Where THEMPE helps

What visual variable are the best for representing Population Density data on a thematic map?

Wrong in Pretest and Post-test

23.9%

Correct in Post-test

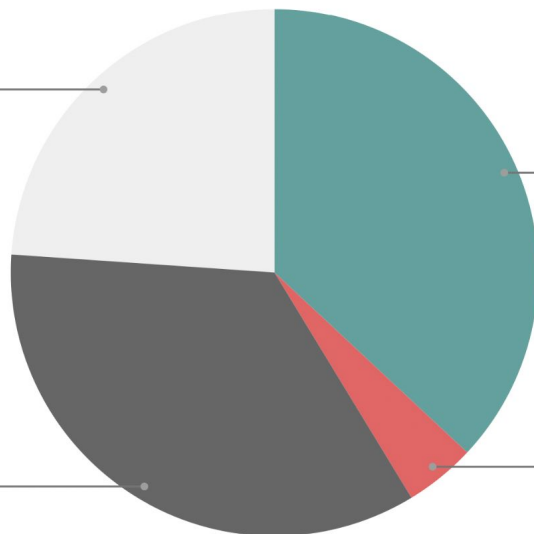
37.0%

Correct in Pretest and Post-test

34.8%

Correct in Pretest

4.3%



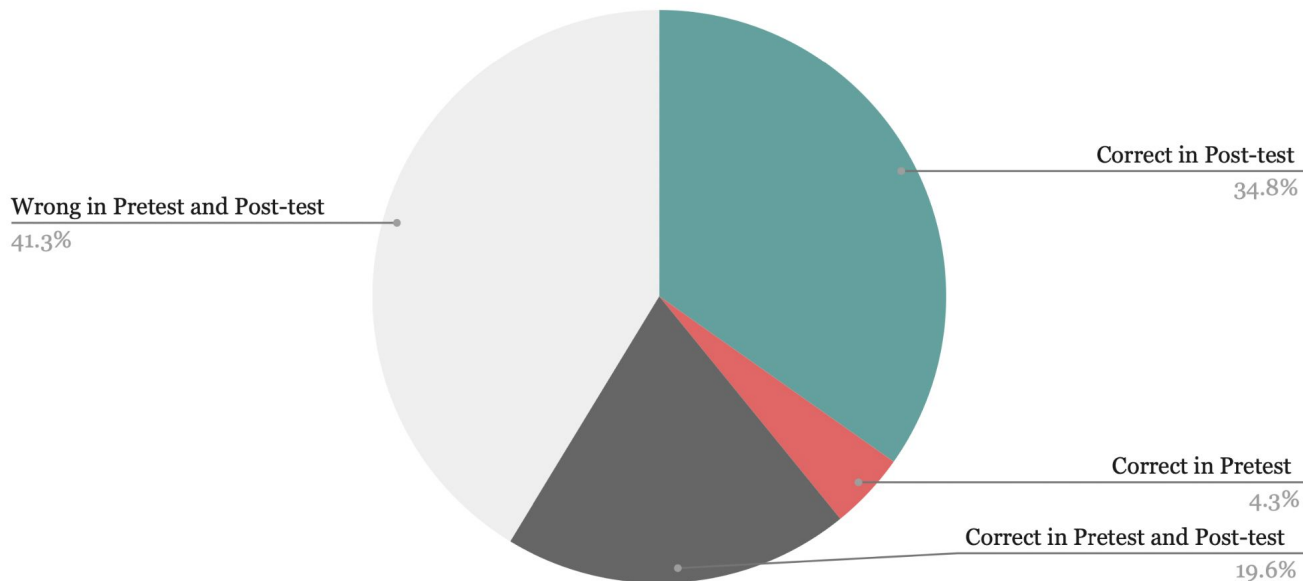
FINDINGS - RQ3A

RQ3A

The potential of THEMPE

Effectiveness - Where THEMPE does not help

Which visual variables can be used to visualize data with a Flow Map?



FINDINGS - RQ3A

RQ3A

The potential of THEMPE

Effectiveness - Participants confidence

I am confident with my answers for post-test

Neutral

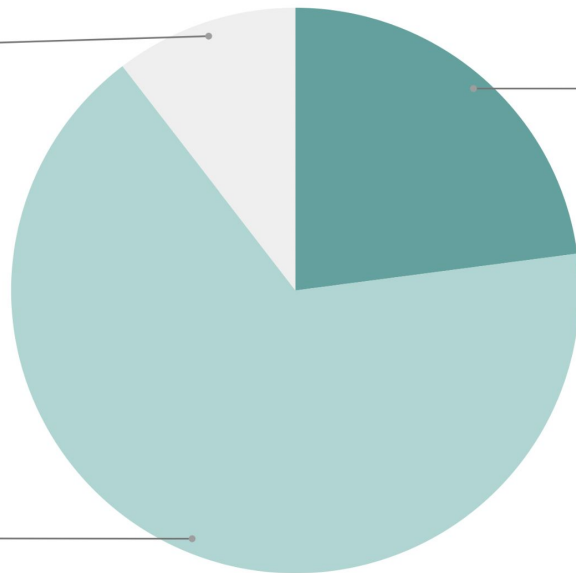
10.4%

Strongly Agree

22.9%

Agree

66.7%



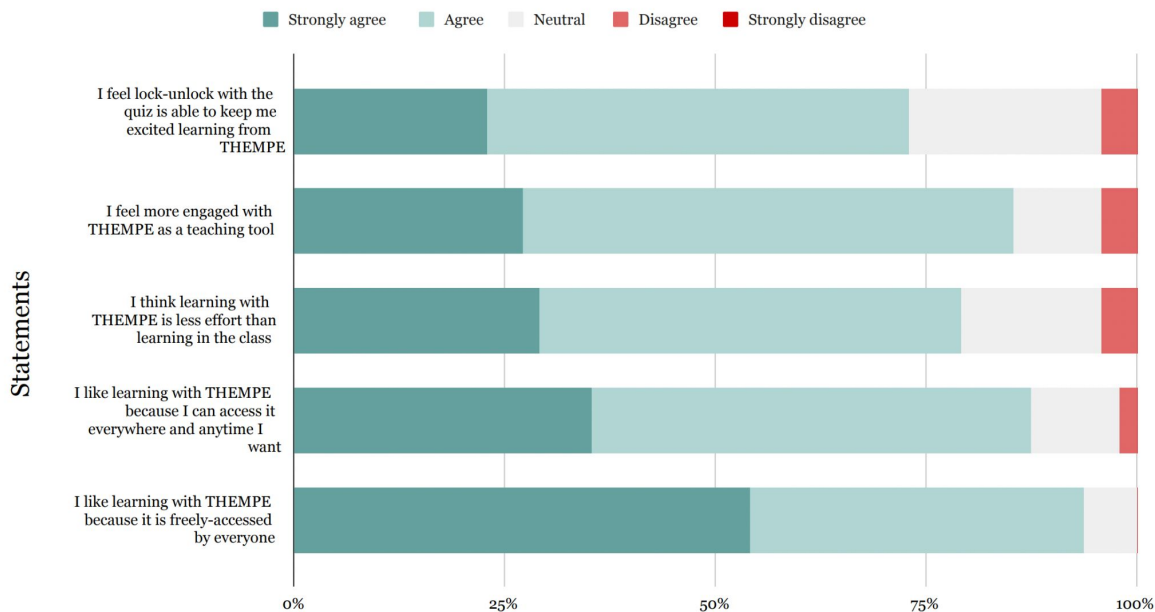
FINDINGS - RQ3A

RQ3A

The potential of THEMPE

Efficiency - OER features and advantages

THEMPE features and advantages



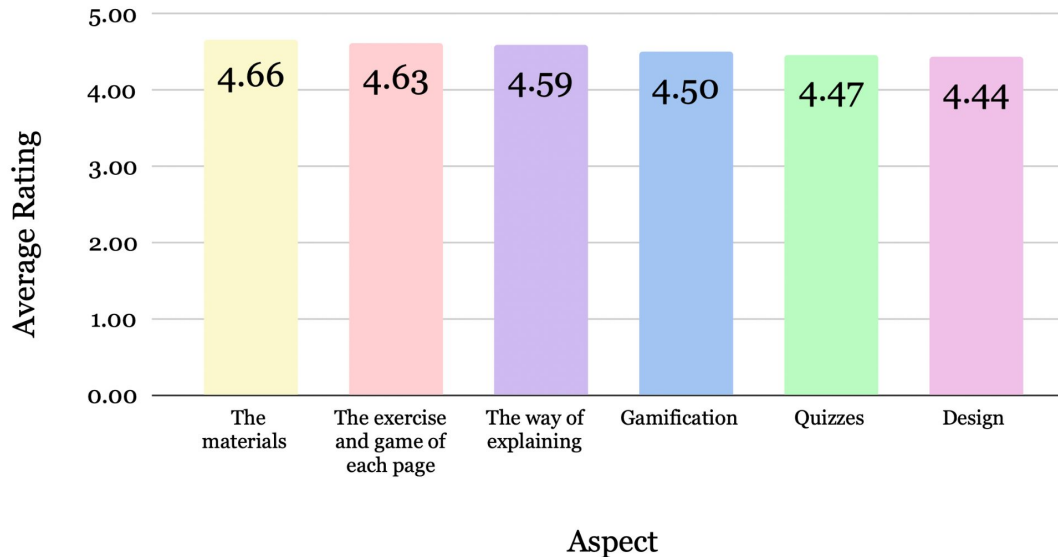
FINDINGS - RQ3A

RQ3A

The potential of THEMPE

Satisfaction - Average Ratings

Average Rating for Each Aspect



FINDINGS - RQ3A

The potential of THEMPE

Satisfaction - What users said

*"Very innovative and attractive design with **rich materials**. I love it! Thank you for your hard work. **Very exciting!** I would say I love it all."*

*"The interactive gamified aspects are **fun and engaging**."*

*"i like that there's **some games** that we can play, it **help me to understand easier** also **remember little things!**"*

*"the way of explaining thematic cartography is more **easy and fun** than usual cartography class!"*

METHOD - RQ3A

The relevance of THEMPE

RQ3A

Determining the relevance of
OER prototype:
*Based on Expert Interviews and
Literature Reviews results*

Expert
interviews

THEMPE

Syllabus/
teaching
materials
review

RESULT - RQ3A

RQ3A

The relevance of THEMPE

Expert interviews

<u>Questions</u>	<u>Answers</u>	<u>How it is implemented</u>
The most essential in the class	Practices and exercises after the lectures	Exercise part added in every page of THEMPE
The main learning objectives	Understand how to make a thematic map based on its principles	The contents of THEMPE are arranged based on a certain learning path
The tools for supporting the teaching	Various GIS and design softwares	There is a part telling the students what possible softwares for mapping in THEMPE

RESULT - RQ3A

RQ3A

The relevance of THEMPE

Expert interviews

<u>Interviewee</u>	<u>Expectations</u>	<u>How it is implemented</u>
Interviewee 2	OER can explain the data scale , the characteristics of visual variables , the thematic map types they can choose and the elements of the map layout	The contents of THEMPE start from Cartographic Process up to Map Elements
Interviewee 3 and 6	OER has a learning path and available for everyone to contribute	THEMPE has its learning path and provides code source for people to contribute
Interviewee 4	OER can be gamified to keep students interested	THEMPE is slightly gamified and has lock-unlock

RESULT -

RQ3A

The relevance of THEMPE

Syllabus review

Legend:

textbox

Included in OER

textbox

*Not included in OER***Cartography***Topographic Mapping**Thematic Mapping*

Data type introduction

Data acquisition

Data preprocessing

Cartographic
Communication

Perception Properties

Visual Variables

Visualization

Generalization

Coordinate System

Projection

*Thematic Map Types*Proportional Symbol
Map

Choropleth Map

Flow Map

Cartogram

Web Mapping

Isoline - Isarithmic map

Dot Density Map

Time series mapping

3D Mapping

Dasymetric Map

Animation Map

Map Elements

Map Layout

CONCLUSION - Back to Research Questions

RQ1A

How is the syllabus for teaching thematic cartography defined and delivered to the students in university?



**Lectures +
Practices**

RQ1B

How is the thematic cartography teaching syllabus different for bachelor's and master's students?



**There is no
significant
difference**

RQ2A

What are Open Educational Resources (OER)?
What is the advantage of it?
How is the development of OER recently?



**OER has
numerous
advantages
and promising
development**

RQ2B

How can the thematic cartography teaching syllabus be implemented in Open Educational Resources?



**THEMPE was
built to mimic
how
educators
teach**

RQ3A

How high is the potential and the relevance of OER for teaching thematic cartography?



**THEMPE has
high potential
and relevance
to teach
thematic
mapping**

FUTURE WORK - What to improve from THEMPE

Based on users' feedback

*"It would be great if Thempe could be accessed in **multiple languages** besides English so it could widen the participant's interest"*

*"maybe with **some video animation** will make the thempe more perfect"*

*"maybe we can **add another thematic material** or another theme for the map, but it need more data"*

*" Maybe you can make a kind of **checkpoint or a button to reset the material** so that when we want to repeat the material we don't have to fill out the quiz again."*

FUTURE WORK - Future OER possibilities

Other Cartography Topics

Start from syllabus
and teaching materials
with more topics
related to cartography

Implement them to OER

Considering the
feedback about what
to improve in THEMPE

Add Gamification

Make it more gamified



THANK YOU ✨

Questions and comments are
very much appreciated 😊