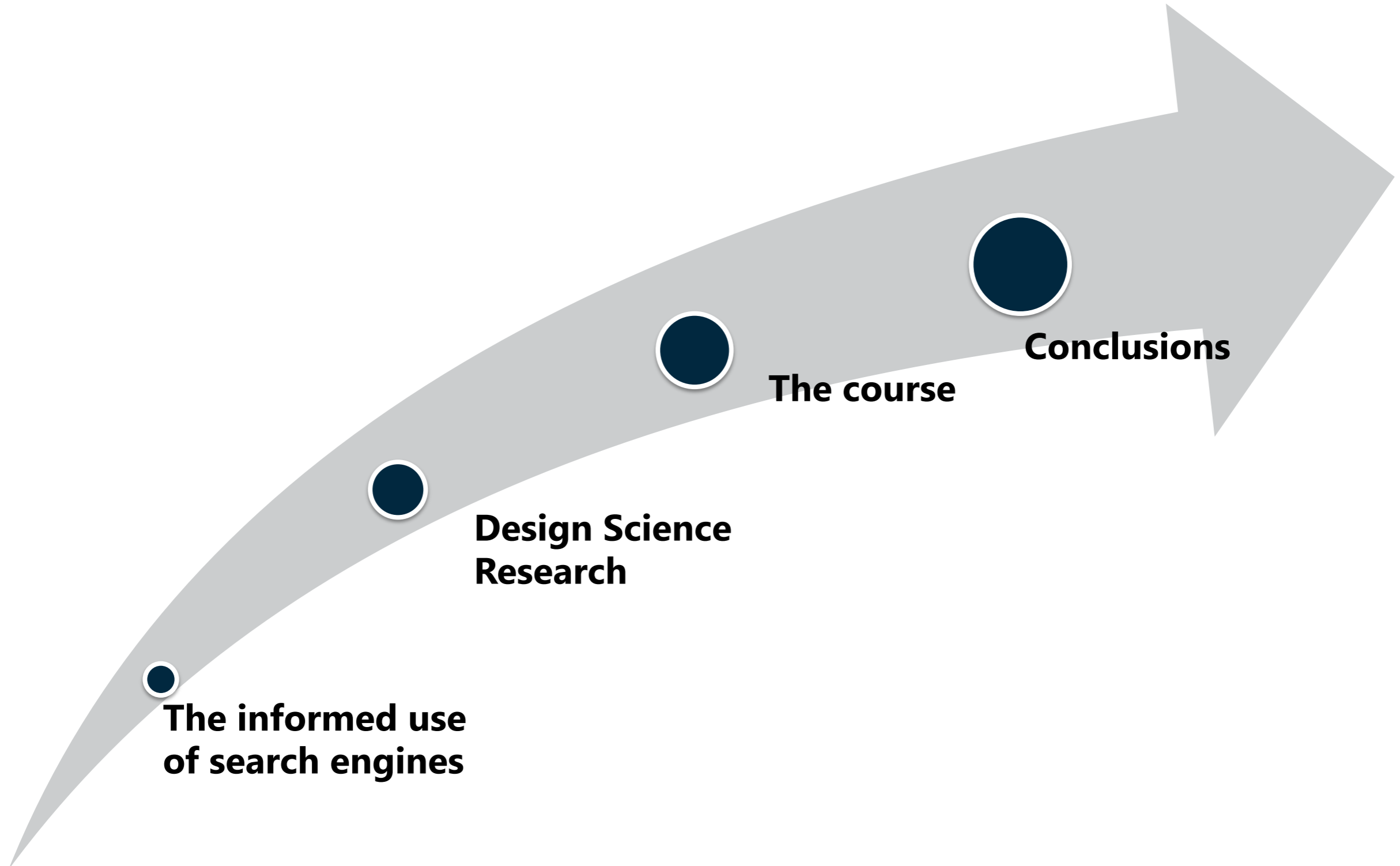




Design Science Research
for the development of a
University Course
on the informed use of
Search Engines

Prof. Dr. Melanie Platz



The informed use of Search Engines

Search Engine Literacy in Primary School

Primary school children mostly use search engines like Google (KIM, 2020; Feil, Gieger & Grobbing, 2013) without knowing or questioning how they work (Le Deuff, 2017).



Lisa, grade 1, words with „G“



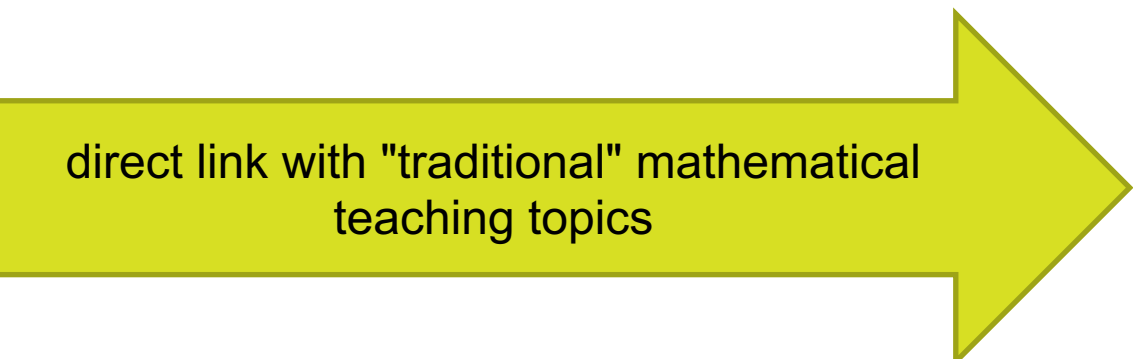
Developing and acquiring the skills needed to live in a digital world goes far beyond the necessary basic knowledge of information technology and affects **all subjects**. Therefore, they **cannot be assigned to an isolated learning area**.



KMK, 2016, p. 12



Bildung in der digitalen Welt
Strategie der
Kultusministerkonferenz



direct link with "traditional" mathematical teaching topics



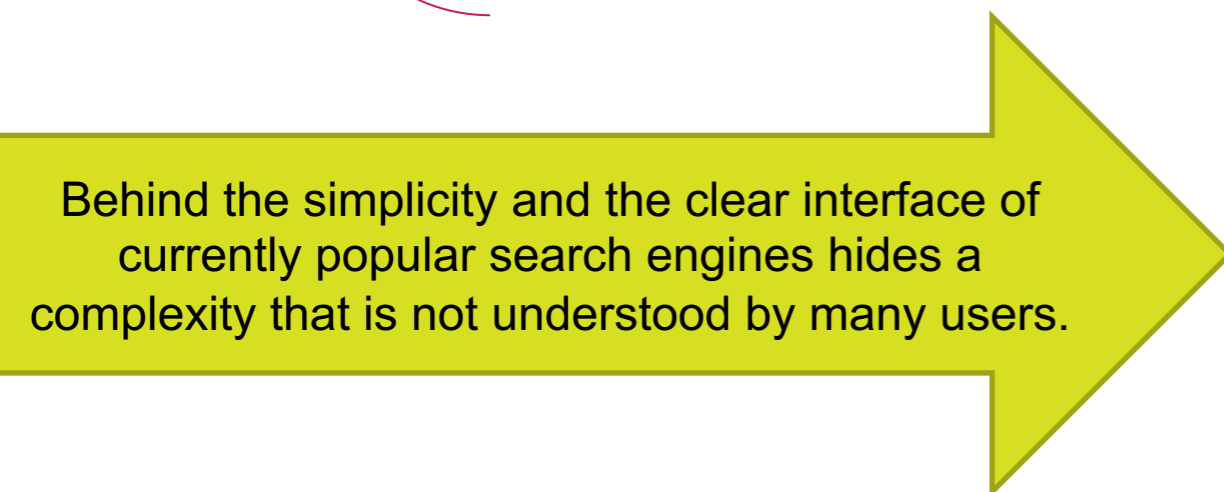


In concrete terms, this means that teachers must be able to use digital media in their respective subject lessons in a **professional and didactically meaningful way** and to **reflect on their content** in accordance with the educational mandate.

KMK, 2016, p. 24



Bildung in der digitalen Welt
Strategie der
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Google



Information Literacy

Information literacy is the ability to understand when information is needed, to seek information efficiently, and evaluate and use information appropriately. It also includes integrating new information with prior knowledge and using it legally, economically, socially, and ethically correct to achieve goals.

Search Literacy

Search literacy is a specific aspect of information literacy. It relates directly to the process of obtaining information and refers to the ability to find and access the desired information to satisfy information needs efficiently and effectively.

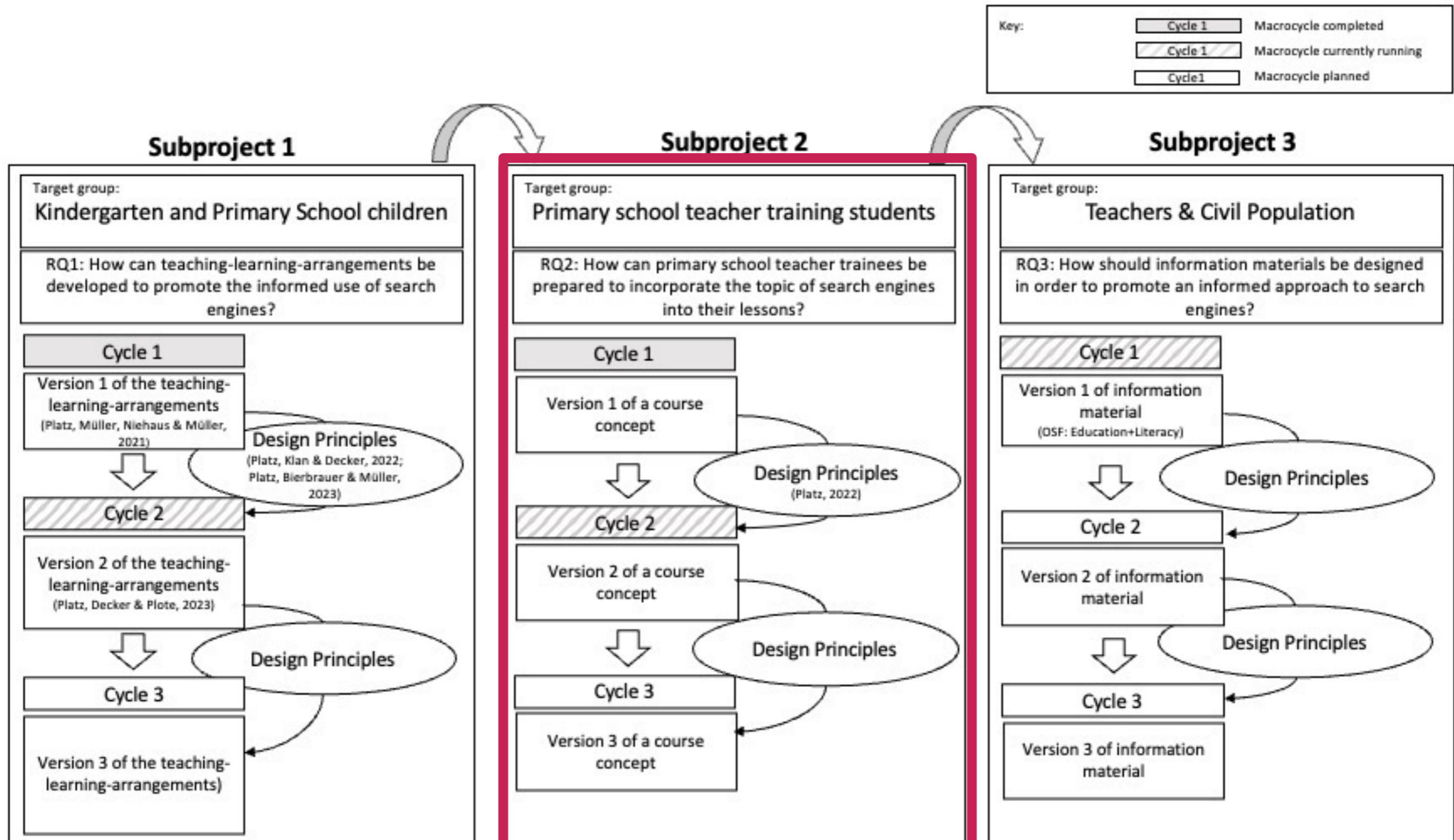
Search Engine Literacy

Achieving accurate search results requires **search engine literacy**, which is the knowledge of how search engines work and the following: findability, linguistic functions, query language, and ranking.

e.g, Platz, Klan, Decker (2022)

- How can **teaching-learning arrangements** be developed to promote the informed use of search engines?
- How can **primary school teacher trainees** be prepared to incorporate the topic of search engines into their lessons?
- How should **information materials** be designed to promote an informed approach to search engines?

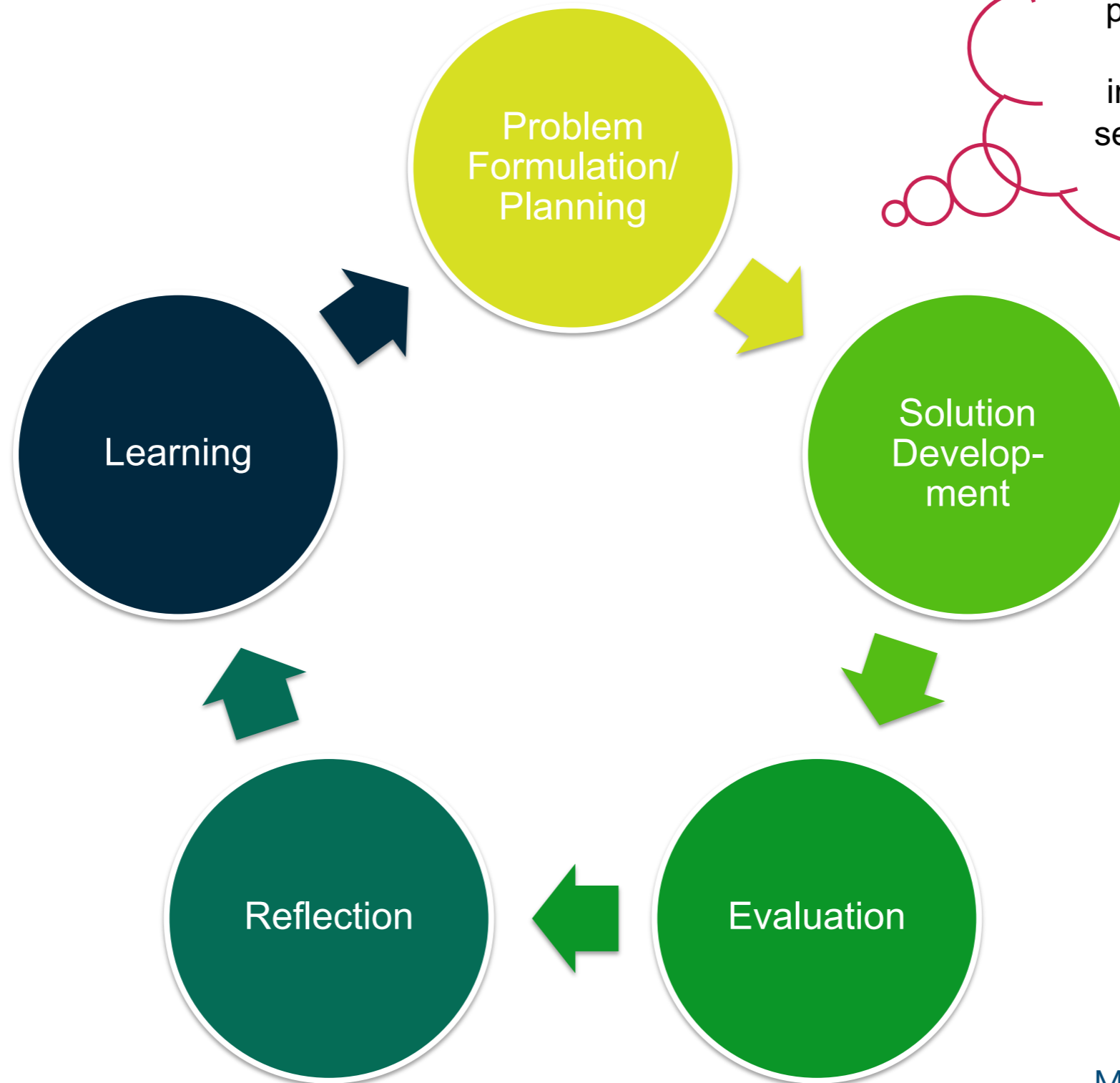
Process, status, and planning of the project



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Design Science Research

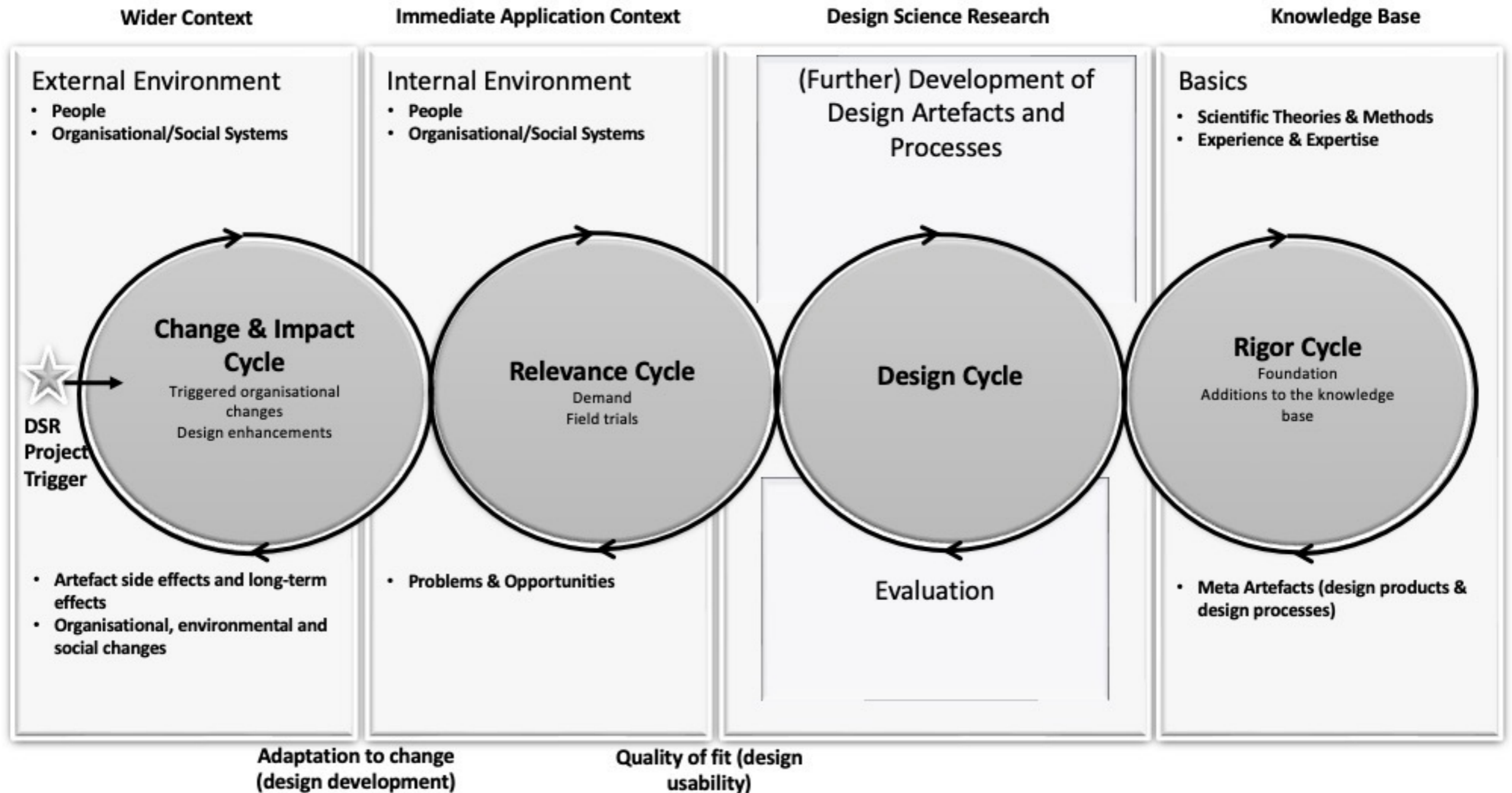
Design Science Research



Goal: developing a university course to prepare primary school teacher trainees to incorporate the topic of search engines into their lessons.

Mullarkey & Hevner (2019)

Design Science Research: The Four-Cycle View



Drechsler & Hevner (2016)

The Course

Module Handbook

Informatische Bildung in der Primarstufe					IBMaDiPri
Studiensem.	Regelstudiensem.	Turnus	Dauer	SWS	ECTS
2-7	7	WiSe/SoSe	1 Sem.	2	4

Modulverantwortliche/-r	Prof. Dr. Melanie Platz	
Dozent/inn/en	Prof. Dr. Melanie Platz und Mitarbeiter/-innen oder Lehrbeauftragte der Fachdidaktik	
Zuordnung zum Curriculum	Pflichtmodul LP (Lehramt Primarstufe)	
Lehrveranstaltungen / SWS	Seminar: z.B. Algorithmen (Coding); Sprachen & Automaten (Roboter & Co.); Informatik, Mensch und Gesellschaft (Kryptologie); ... (mit UP-Versuch im Praktikum)	2 SWS (4 CP)
Zulassungsvoraussetzung(en)	keine	
Leistungskontrollen / Prüfungsleistungen	Klausur oder mündliche Prüfung oder Hausarbeit oder Portfolio; benotet Welche der genannten Prüfungsleistungen zu erbringen ist, legt der/die Seminarleiter/-in fest und gibt sie mit der Veranstaltungsankündigung bekannt.	
Arbeitsaufwand	Workload insgesamt:	120 Stunden
	Präsenz:	30 Stunden
	Vor-/Nachbereitung:	30 Stunden
	Planung, Gestaltung, Durchführung, Dokumentation und Reflexion eines empirischen Projekts:	60 Stunden
Modulnote	Durch Klausur oder mündliche Prüfung oder Hausarbeit oder Portfolio (benotet).	
Lernziele / Kompetenzen	Die Studierenden	
	<ul style="list-style-type: none"> - erwerben Grundkenntnisse im Bereich Informatische Bildung. - erwerben Grundkenntnisse in der Nutzung von digitalen Medien für mathematische Lehr-Lernprozesse in der Grundschule. - eruieren mathematikdidaktisch sinnvolle Einsatzmöglichkeiten digitaler Medien, erstellen didaktische Konzepte und reflektieren diese kritisch. 	
Inhalte	<ul style="list-style-type: none"> - Inhalte der Informatischen Bildung in der Primarstufe aus mathematikdidaktischer Perspektive (z.B. Algorithmen (Coding); Sprachen & Automaten (Roboter & Co.); Informatik, Mensch und Gesellschaft (Kryptologie); ...) - Gestaltung von substanziellen Lernumgebungen mit Einsatz digitaler Medien - Einsatz digitaler Medien in der Unterrichtspraxis 	

Weitere Informationen

Praxisbezug:

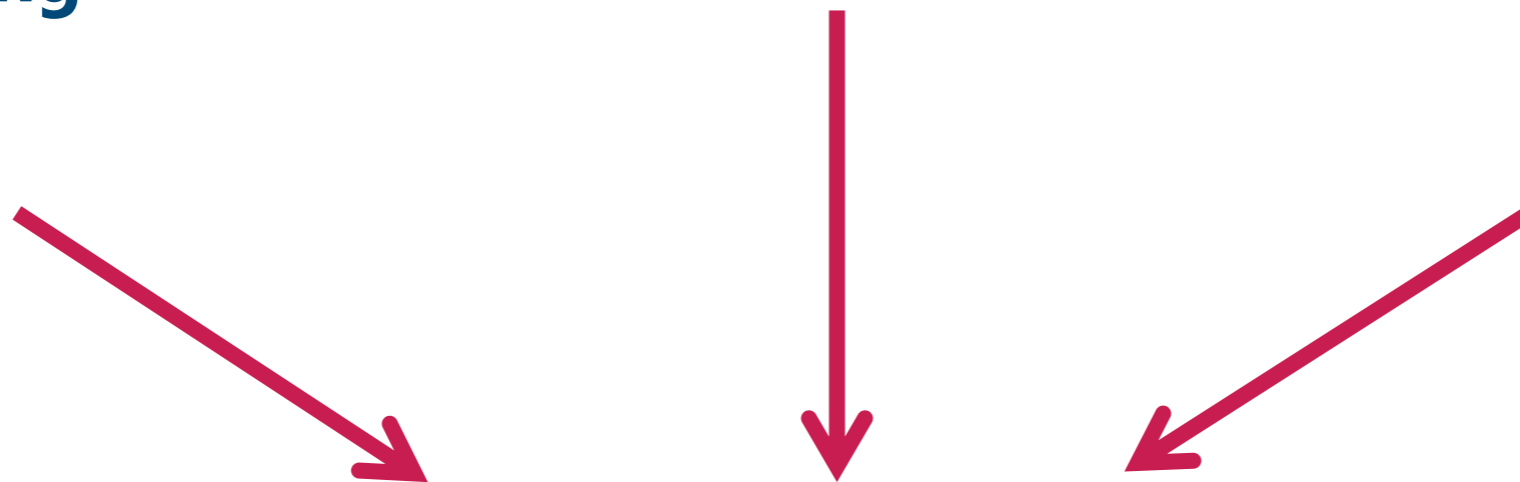
- Selbständige Planung und Durchführung einer substanziellen Lernumgebung mit Einsatz digitaler Medien im Rahmen eines UP-Versuchs im Praktikum
- Analyse und Reflexion der Erprobung

Goals of the course

Knowledge of the
basic ideas of
maths teaching

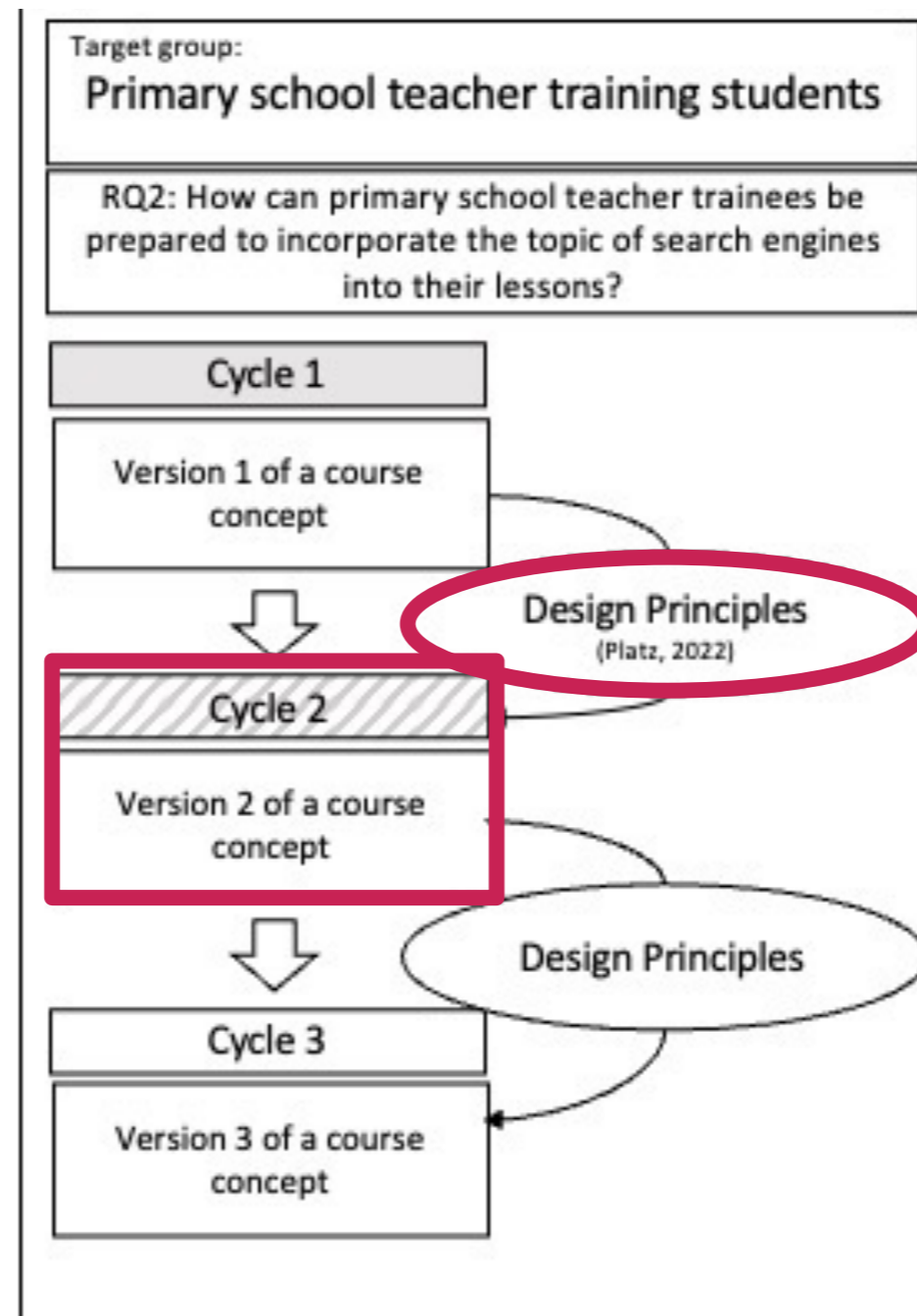
Acquisition of an overview of
**computer science
education**, especially in the
area of **Internet search**.

Acquire an overview of
digital media and
their potential



Independent and critical evaluation of digital
media offerings and development of **meaningful
ideas** for classroom use

Design Principles



If you want to design a course for teacher training students on the development of teaching-learning arrangements to promote the informed use of search engines, then you are best advised to:

- Include course elements to create awareness of and concern for the risks of internet searches.
- Give the students an already developed teaching-learning arrangement that they can optimize (e.g., those from CS Unplugged)
- Provide the (prospective) teachers with a model to support them in lesson planning. One crucial part is the theoretically sound understanding of a concept (originally on the topic of 'algorithms' (Etzold et al., 2019) transferred to 'search engines' and expanded to include a reflection (Platz, Klan & Decker, 2022).
- Let the students become active participants in and designers of the course.

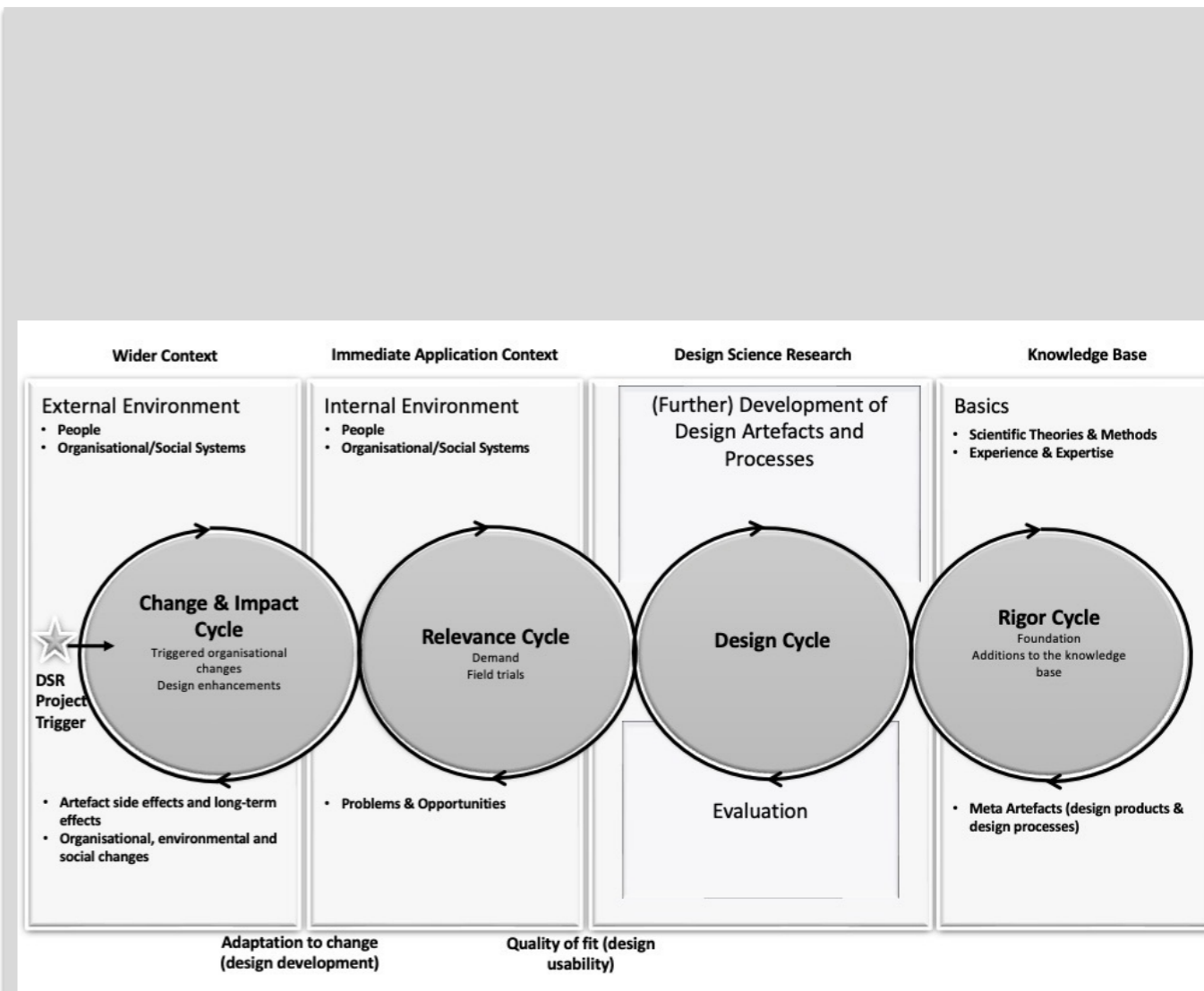
Course Structure

- Include course elements to create Awareness of and concern for the risks of internet searches.
- Give the students an already developed teaching-learning arrangement that they can optimize (e.g., those from CS Unplugged).
- Provide the (prospective) teachers with a model to support them in lesson planning. One crucial part is the theoretically sound understanding of a concept (originally on the topic of 'algorithms' transferred to 'search engines' and expanded to include a reflection).
- Let the students become active participants in and designers of the course.

Session	Topic
1	Organizational matters & introduction: Computer Science Education in Primary School
2	Search better and safer on the Internet
3	CS Unplugged
4	Search Engines in Mathematics Education
5, 6	Teaching-Learning-Arrangements in Mathematics in Primary School
7	Analysis of existing Teaching-Learning-Arrangements to promote the informed use of search engines
8, 9, 10, 11	Development of teaching-learning arrangements to promote the informed use of search engines as further development of CS Unplugged units
12, 13, 14	Testing with the course participants and further development
15	Reflection & Conclusion, Term Paper & Wikiversity

Course Structure

Sessi on	Topic	Mainly addressed cycle
1	Organizational matters & introduction: Computer Science Education in Primary School	Relevance Cycle
2	Search better and safer on the Internet	Relevance Cycle
3	CS Unplugged	Rigor Cycle
4	Search Engines in Mathematics Education	Rigor Cycle
5, 6	Teaching-Learning-Arrangements in Mathematics in Primary School	Rigor Cycle
7	Analysis of existing Teaching-Learning-Arrangements to promote the informed use of search engines	Rigor Cycle
8, 9, 10, 11	Development of teaching-learning arrangements to promote the informed use of search engines as further development of CS Unplugged units	Design Cycle
12, 13, 14	Testing with the course participants and further development	Design Cycle
15	Reflection & Conclusion, Term Paper & Wikiversity	Rigor Cycle



Drechsler & Hevner (2016)

Conclusions

Guidelines for the evaluation of DSR projects

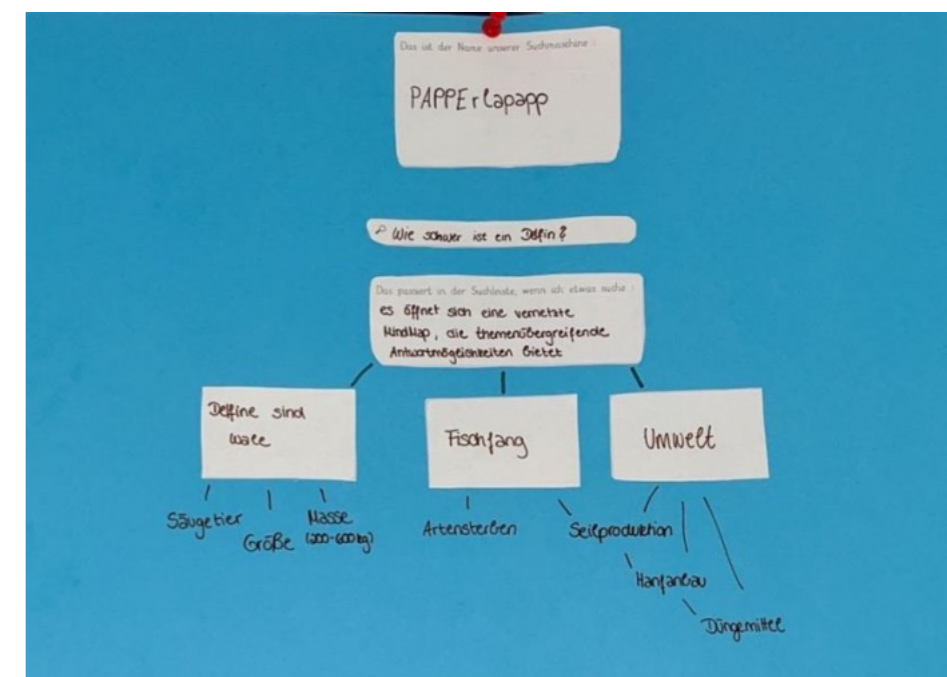
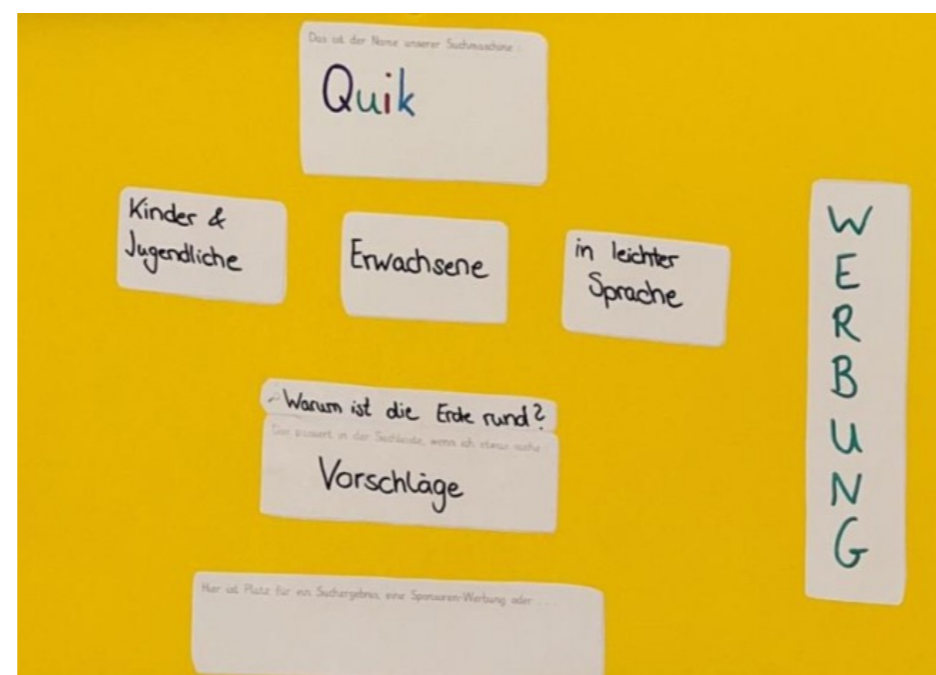
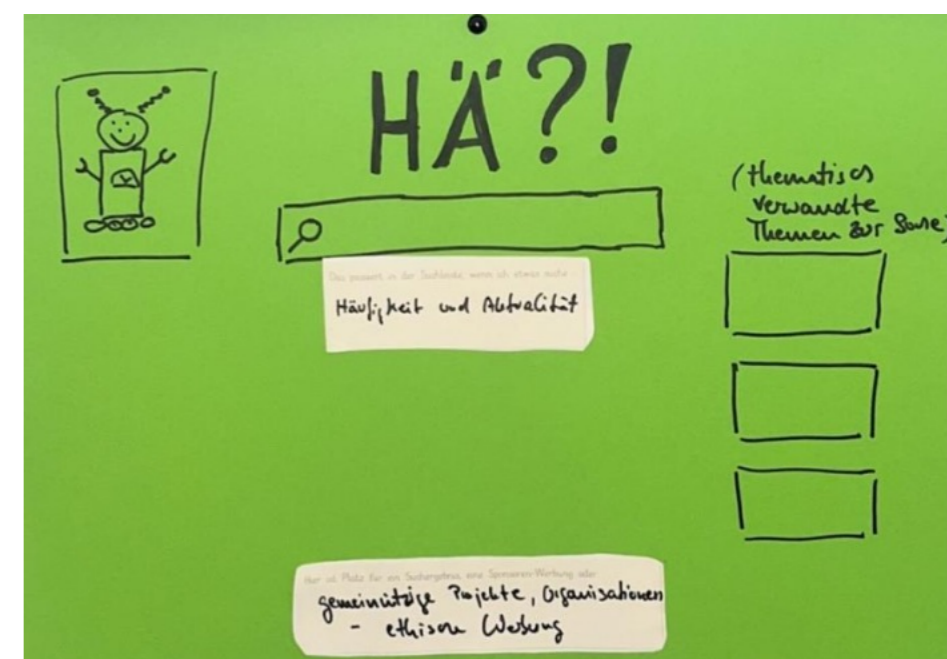
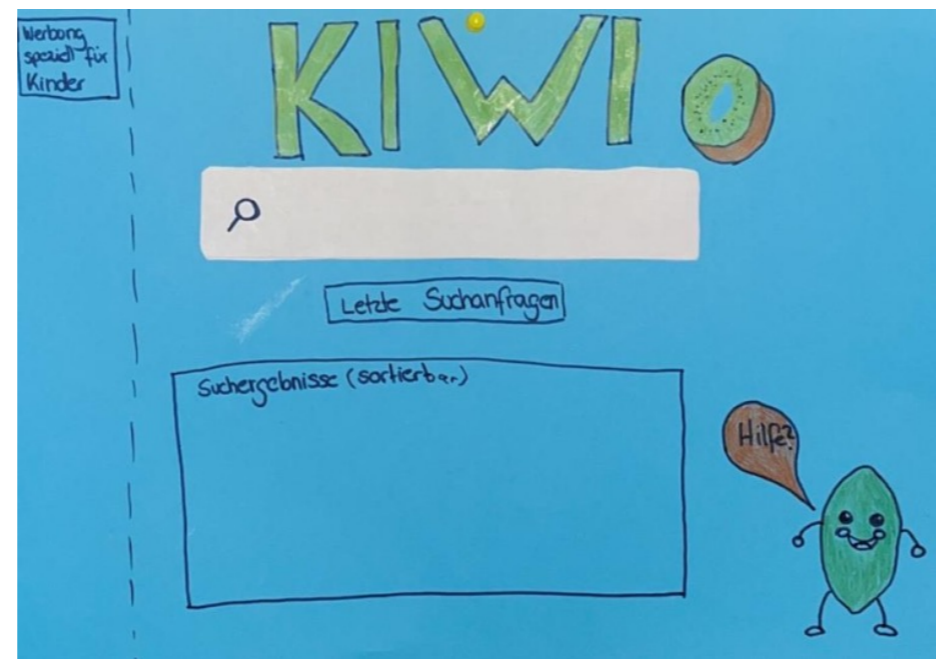
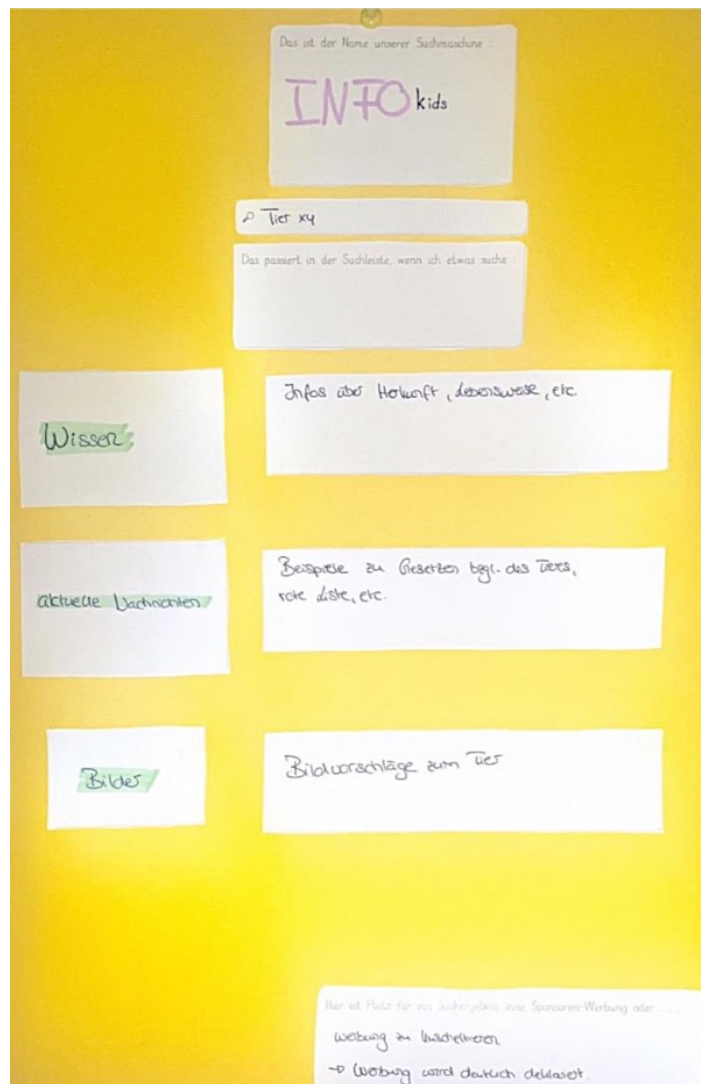
Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Hevner et al. (2004)

Guidelines for the evaluation of DSR projects

- 1 Design as an Artifact/ Consistency (construct validity)/ Practicality – Expected:** The artifact 'concept of the seminar computer science education in primary school' is a **method** (March & Smith, 1995), i.e., a series of steps to counter the difficulties of integrating the informed use of search engines into the primary classroom.
- 2 Problem Relevance/ Relevance (content validity)/ Practicality – Actual/ Effectiveness – Expected:** Scientific findings were used to design the artifact. The seminar concept can be employed in the primary school teaching degree program, and it is hoped that the students can be given a sense of confidence in dealing with and feel the relevance of dealing with search engines in primary education so that they can integrate it into their **future teaching**.
- 3 Design Evaluation/ Effectiveness – Actual:** The usefulness, quality, and effectiveness of the artifact were checked, among other things, by the student contributions in the **term paper** and by **teaching evaluations**. On this basis, changes were made to the seminar concept. However, whether the seminar impacts the students' future teaching behavior has not yet been investigated.
- 4 Research Contributions:** This paper presents the seminar concept of computer science education in primary school, which **other universities** can adopt (in whole or in part) (possibly in an adapted form).
- 5 Research Rigor:** To assess the artifact, the student contributions in the term paper were evaluated, and teaching evaluations were considered. Within the framework of the macrocycle, **qualitative evaluation methods** will also be used, and a possibility of the actual effects on the students' subsequent teaching behavior is to be developed. (For the construction of the artifact, see guideline 2).
- 6 Design as a Search Process:** The teaching-learning arrangements are developed so that they can be used directly in school. The students publish their developments in a fact sheet format (Platz, 2020) as **OER at Wikiversity**: https://de.wikiversity.org/wiki/OpenSource4School/Lernumgebungen_zur_Informatischen_Bildung_im_Mathematik_unterricht_der_Primarstufe#Search_Engine_Literacy
- 7 Communication of Research: This presentations** shares the seminar concept with a scientific audience. Challenges were presented in Platz (2022).

Search Engine Redesign



Course „Informatische Bildung in der Primarstufe“, SoSe 2024, Saarland University

Thank you
for your attention!



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