Technische Hochschule Ingolstadt

DLR

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Didaktik der Primarstufe – Schwerpunkt Mathematik

Developing and promoting search engine literacy in primary education

Prof. Dr. Melanie Platz,
Dr. Friederike Klan &
Prof. Dr. Alexander Decker

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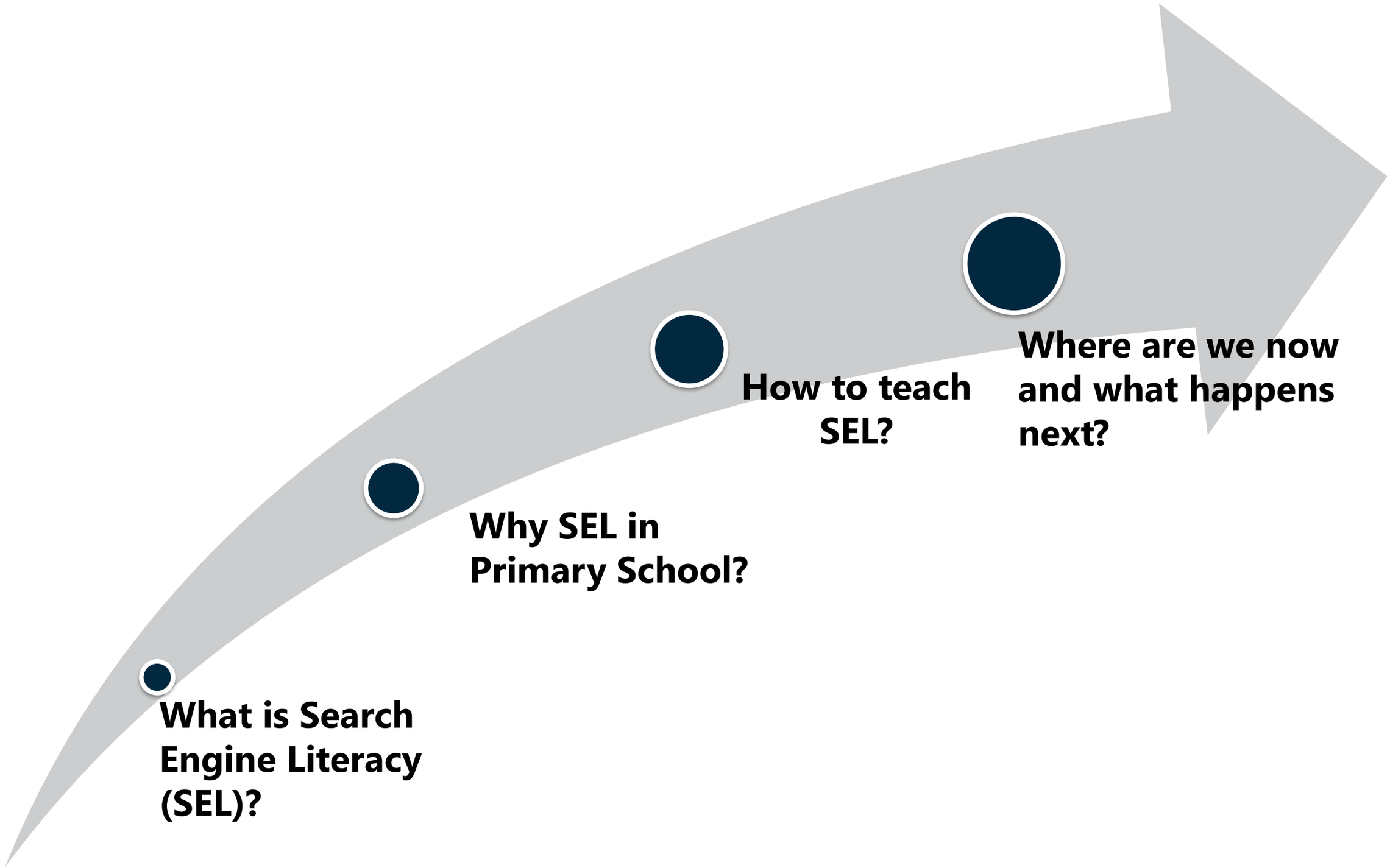
Where are we now and what happens next?
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Why SEL in Primary School?
What is Search Engine Literacy (SEL)?

What is Search Engine Literacy?

Search Engine Literacy

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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.

Project „PrimaSearch“ (Uni Saarland, TH Ingolstadt, DLR_School_Labs); cf. Fuhr (2014)

Why Search Engine Literacy in Primary School?

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“

Current Policies

> 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

direct link with "traditional" mathematical teaching topics

Current Policies

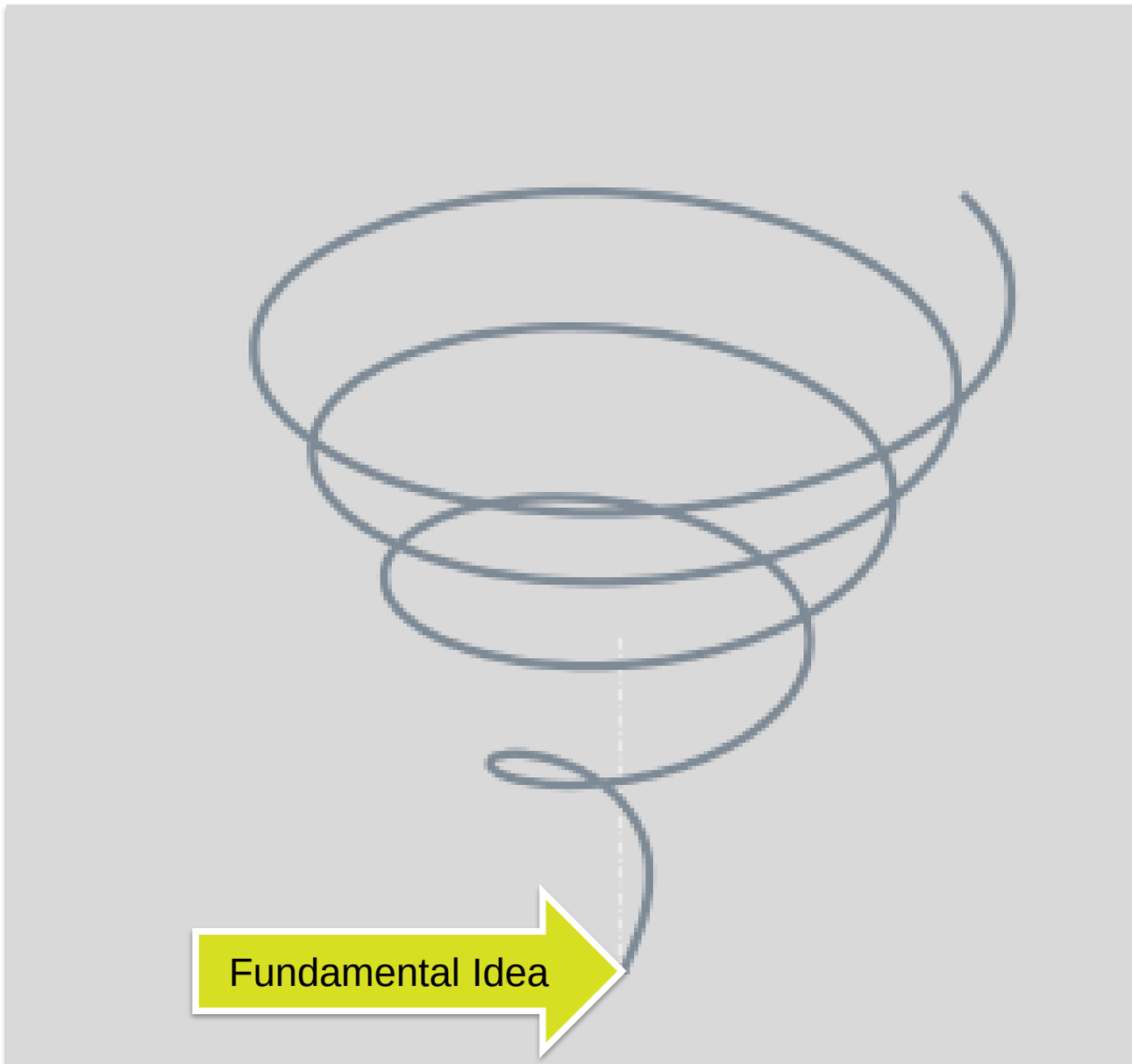
> In concrete terms, this means that teachers must be able to use digital media in their respective subject lessons in a **professional and didactically meaningful way** and to **reflect on their content** in accordance with the educational mandate.
>
> KMK, 2016, p. 24

Behind the simplicity and the clear interface of currently popular search engines hides a complexity that is not understood by many users.

How to teach Search Engine Literacy

Teaching Concept

Identification of **Fundamental Ideas** of **Search Engine Literacy** in direct relation with the **traditional curriculum**.



Platz, Müller, Niehaus & Müller (2021)

Teaching Concept

Representation level

How is information represented on the Internet and how do I therefore need to communicate with the search engine?

Search index as basis, searching

Algorithm level

How does a search engine work?

Filter & sorting algorithms, Crawling & Index

Evaluation level

Are my results trustworthy and usable? What information about me do third parties receive from my search entries?

Filter bubbles, critical handling

Risks & Opportunities

Project „PrimaSearch“ (Uni Saarland, TH Ingolstadt, DLR_School_Labs)

Teaching Strategy

Goal: to understand a concept in a theoretically sound way (topic "algorithms" (Etzold et al., 2019) transferred to "search engines" and extended by a reflection)

Initial example

First, an initial example is discussed intensively. This must be characteristic for the concept to be formed, i.e. the essence of the concept must be particularly well recognizable and tangible in it. It should not be a special case, but also not contain too many additional components that distract from the actual concept.

Initial abstraction

After the initial example has been discussed, the essence of the term is worked out and formulated as an initial abstraction. This can be, for example, a definition suitable for children. It is important that it is actually a general formulation. This means that references to the initial example can and should be made, but they do not play a role in the formulation of the abstraction itself.

Concreti-zations

Now the initial abstraction is applied to further examples, the concretizations. In doing so, the initial abstraction is worked with, reasons are given why it is applicable or why the examples contain certain properties, etc. Through this occupation, the essence of the concept is once again penetrated and better internalized.

Reflection

Consequences for dealing with search engines are drawn and "guidelines" for optimized search are formulated.

Example: Ranking

Text statistics are used to compare search queries and documents.

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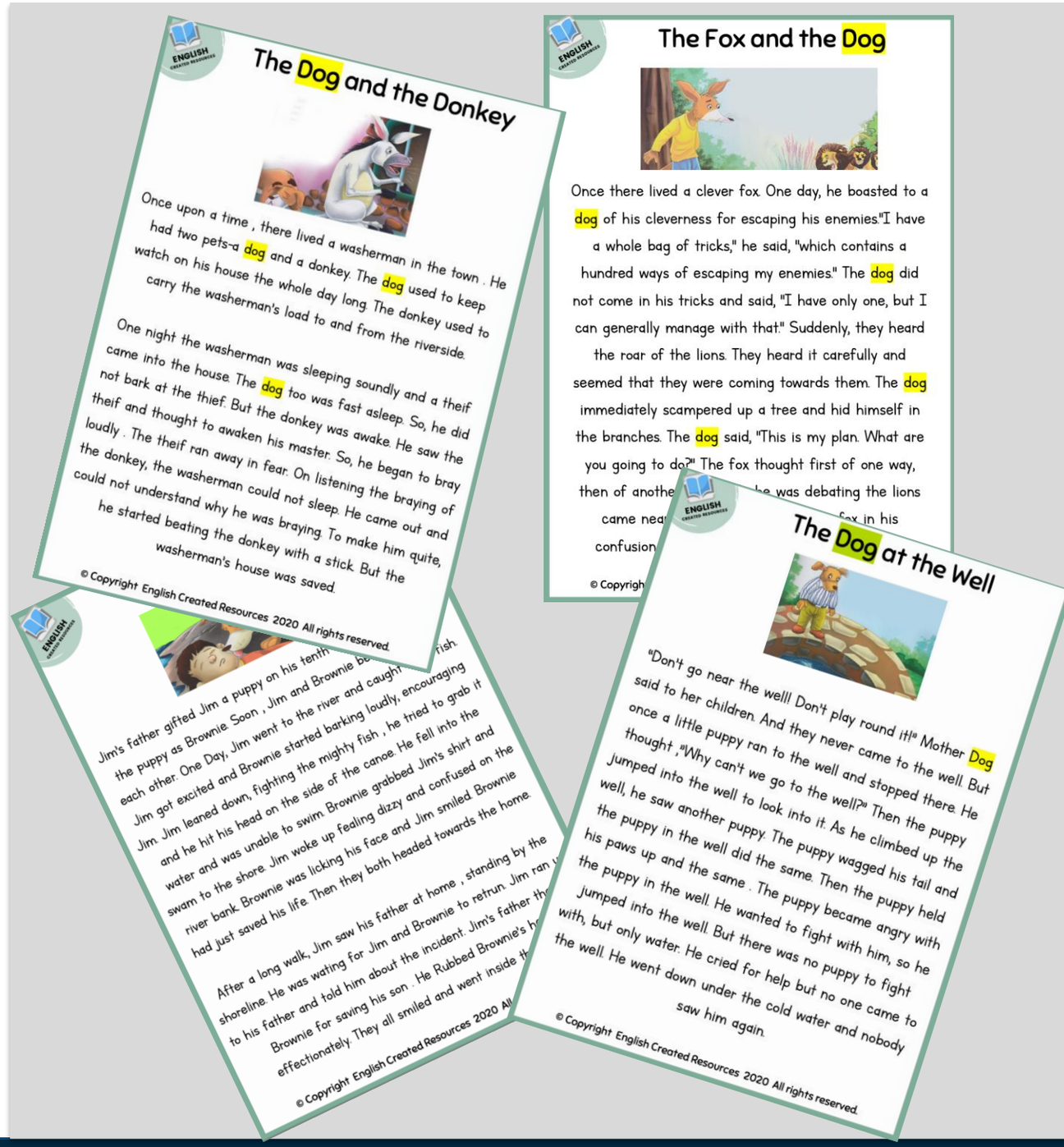
- frequency determination
- search of text sections of the same length for a specific search term
- e.g., „dog“



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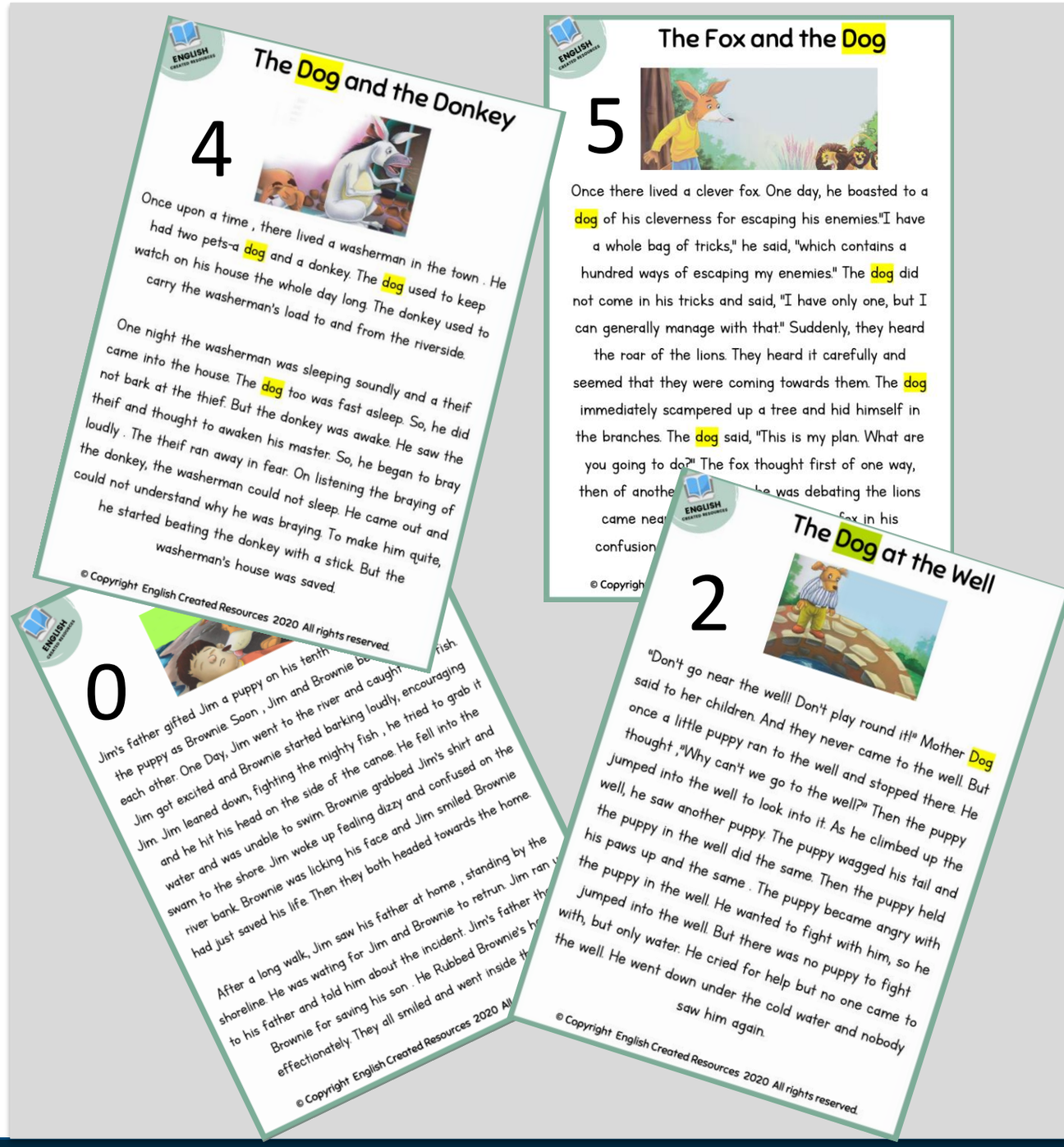

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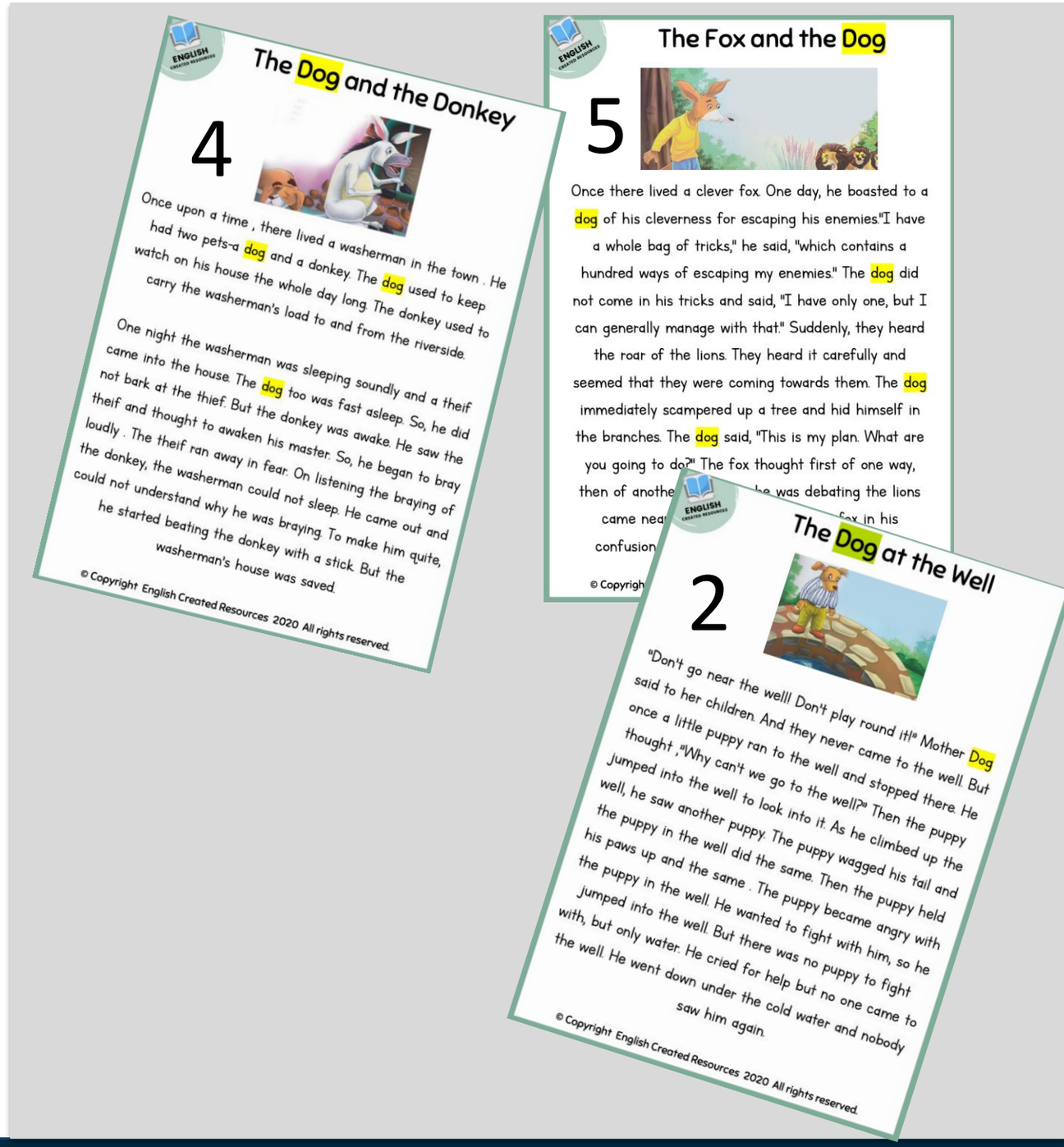

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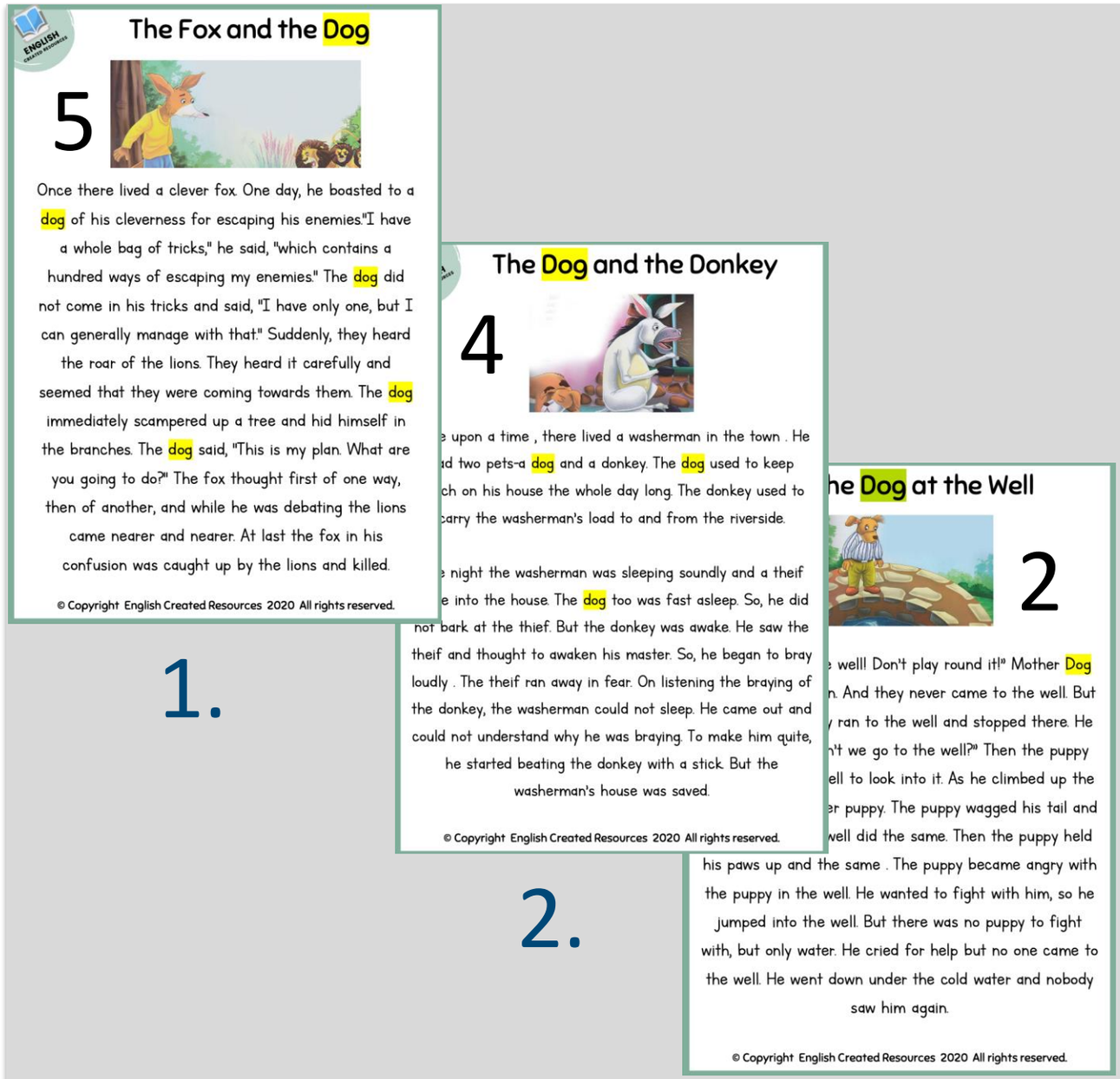

Initial Abstraction

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A ranking of search results for a search term can be created by first **excluding the texts**, mathematical objects, etc., that **do not contain the search term**. Afterward, the order in which the texts, mathematical objects, etc., are to be displayed can be determined using **frequency determination**. The text, mathematical object, etc., in which **the search term is found most often, comes first**, the text, mathematical object, etc., in which **the search term occurs second most often, comes second**, and so on.

Concretizations

Concreti-zations

Now the initial abstraction is applied to further examples, the concretizations. In doing so, the initial abstraction is worked with, reasons are given why it is applicable or why the examples contain certain properties, etc. Through this occupation, the essence of the concept is once again penetrated and better internalized.

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- On the set of numbers up to 20, "large, even" is searched for.
- On the set of geometric solids {cube, sphere, cone, triangular-based pyramid, cylinder} "face" is searched.

Reflection

Reflection

Consequences for dealing with search engines are drawn and "guidelines" for optimized search are formulated.

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Consideration of structural information

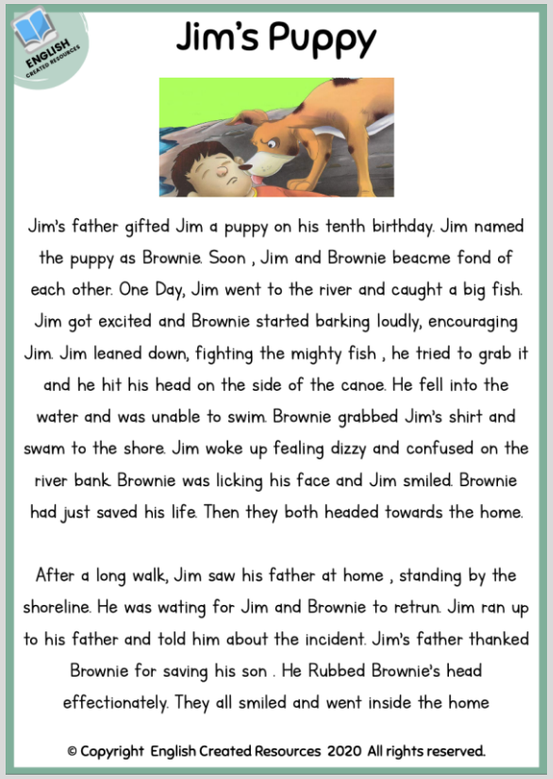
in documents:

What are "meaningful" search

results that help the searcher?

→the idea of quality control can be stimulated

- the **formulation** of the search query is essential
- **not only the first hits** should be considered but also subsequent ones since the ranking "is always only one of many possible algorithmic views of the contents of the World Wide Web" (Lewandowski, 2021, p. 93)



Jim's Puppy

Jim's father gifted Jim a puppy on his tenth birthday. Jim named the puppy as Brownie. Soon , Jim and Brownie beacme fond of each other. One Day, Jim went to the river and caught a big fish. Jim got excited and Brownie started barking loudly, encouraging Jim. Jim leaned down, fighting the mighty fish , he tried to grab it and he hit his head on the side of the canoe. He fell into the water and was unable to swim. Brownie grabbed Jim's shirt and swam to the shore. Jim woke up fealing dizzy and confused on the river bank. Brownie was licking his face and Jim smiled. Brownie had just saved his life. Then they both headed towards the home.

After a long walk, Jim saw his father at home , standing by the shoreline. He was wating for Jim and Brownie to retrun. Jim ran up to his father and told him about the incident. Jim's father thanked Brownie for saving his son . He Rubbed Brownie's head effectionately. They all smiled and went inside the home

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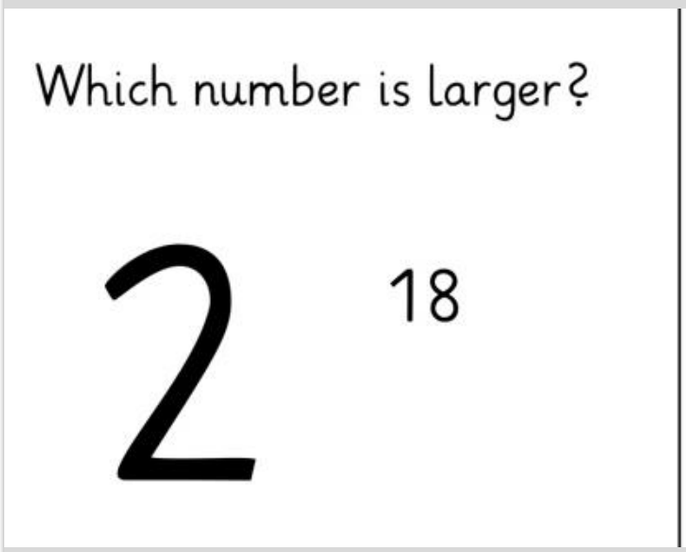
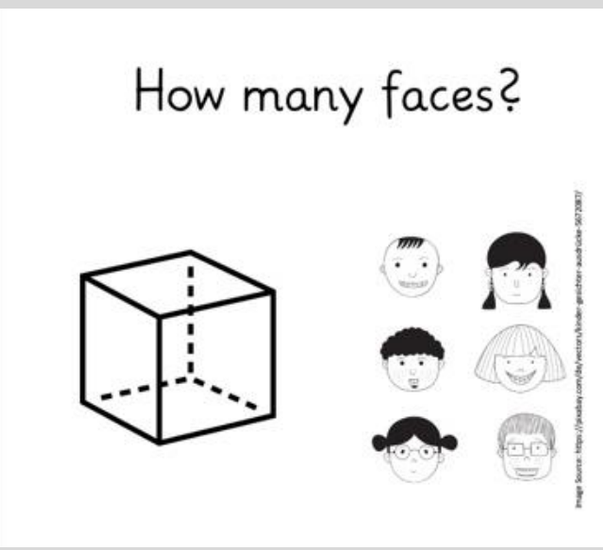


Which number is larger?

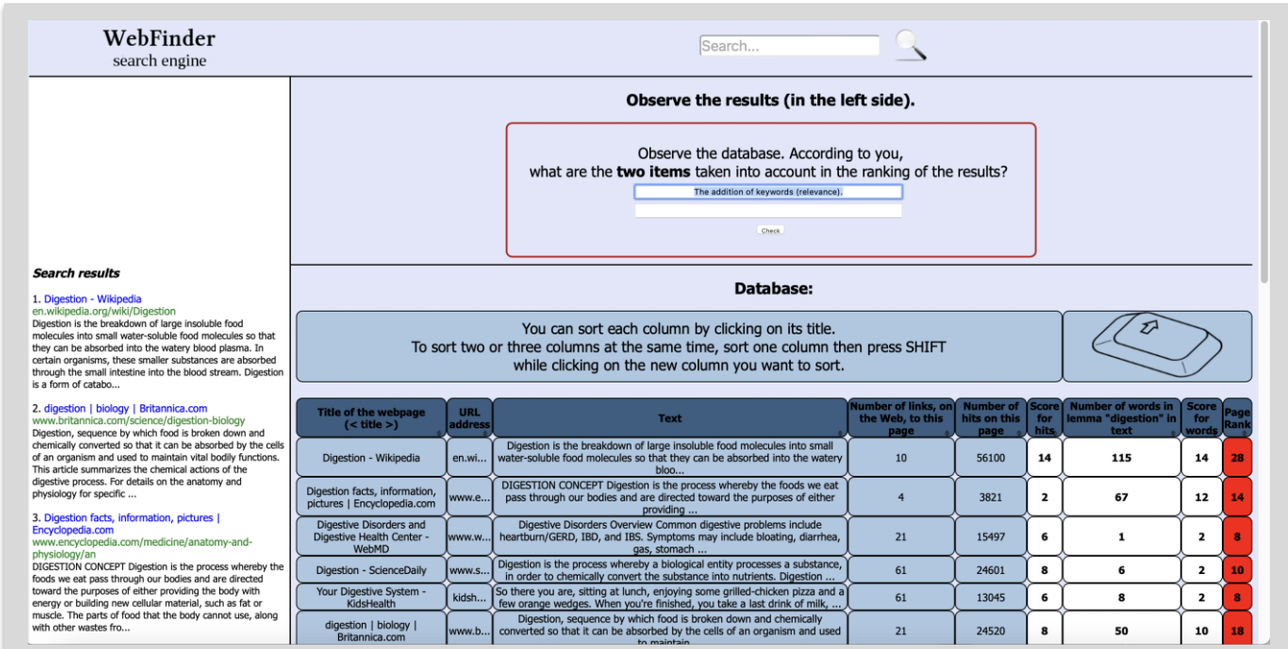
2 18



How many faces?

Not reinventing the wheel

Based on this idea, **existing** concepts of SEL can be **transferred** to the primary school level.



Le Deuff (2017); https://iddocs.fr/webfinder/index.php

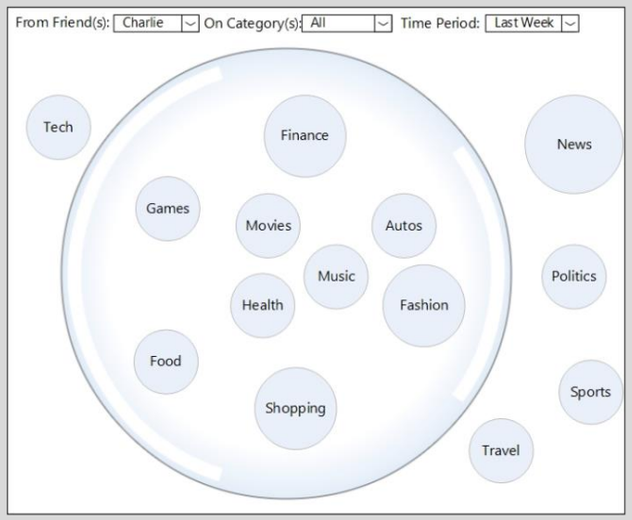


Figure 1. Anna's "category view" of her filter bubble related to Charlie's posts

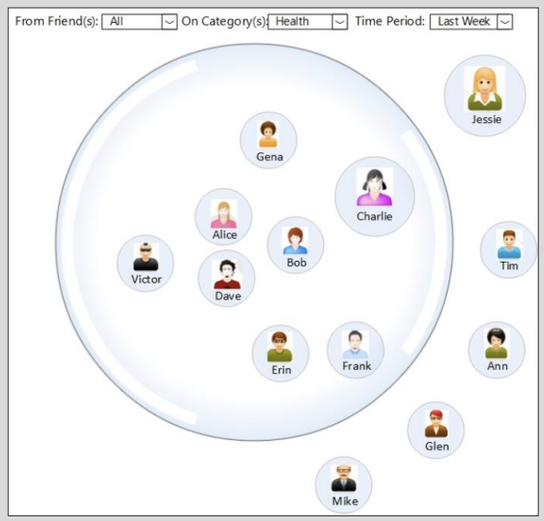


Figure 2. Anna's "friends view" of her filter bubble related to a certain category of posts ("health")

Nagulendra & Vassileva (2014)

Teaching Concept

2. Block

Developing search strategies (2nd Big6 stage) through problem solving.
"How do I get the best search results?" "Which strategy fits when?"

Problem Solving
& arguing

Derivation of "guidelines" for optimized search
"What do I need to consider when using search engines?" "Why is it important?"

Relate and reflect,
arguing

1. Block

Topic: Functionality of search engines
"How does a search engine work?"

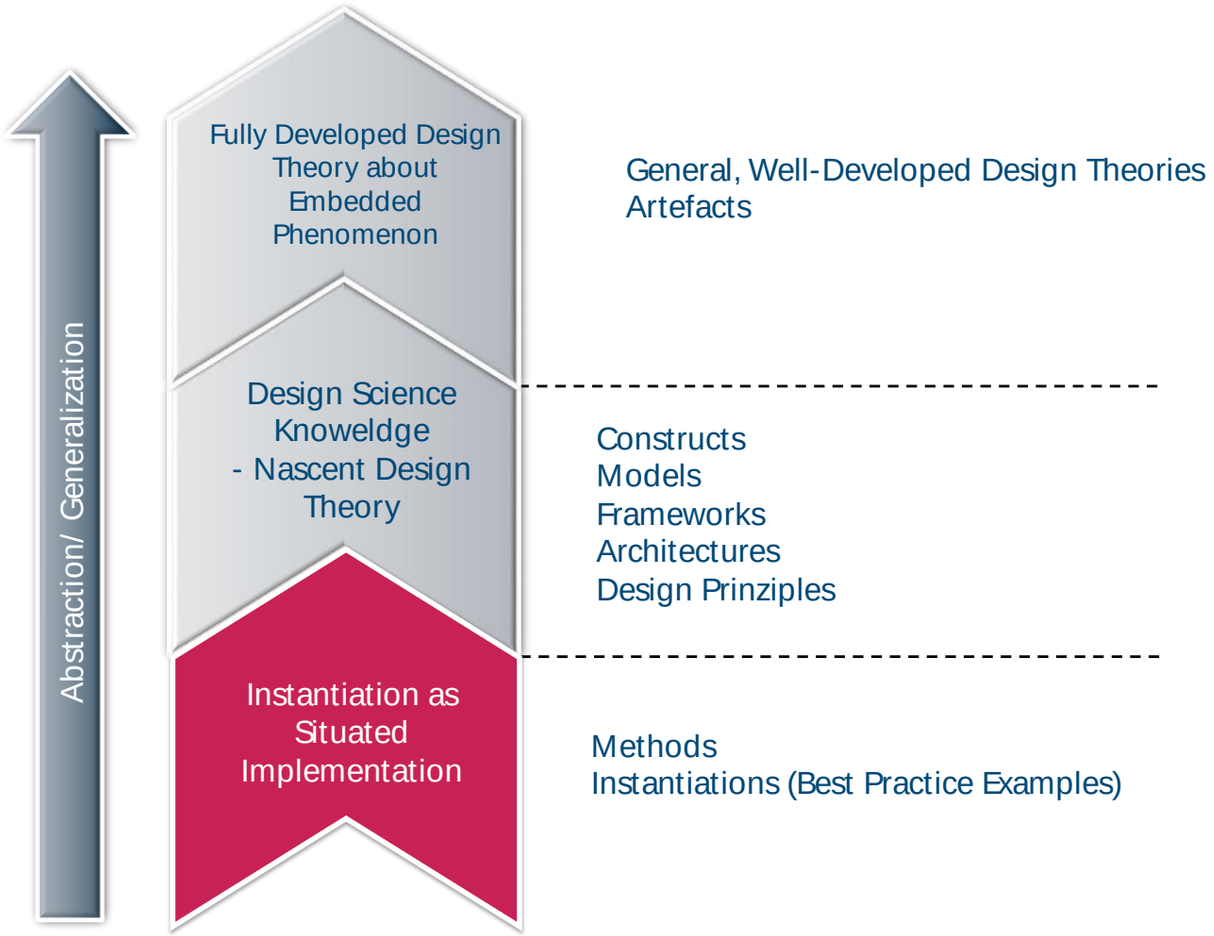
KMK Competencies in the digital world

Traditional Curricula (e.g. Mathematics & Science;
KMK Bildungsstandards & GDSU Perspektivrahmen)

Project „PrimaSearch“ (Uni Saarland, TH Ingolstadt, DLR_School_Labs)

Where are we now and what happens next?

Current developments

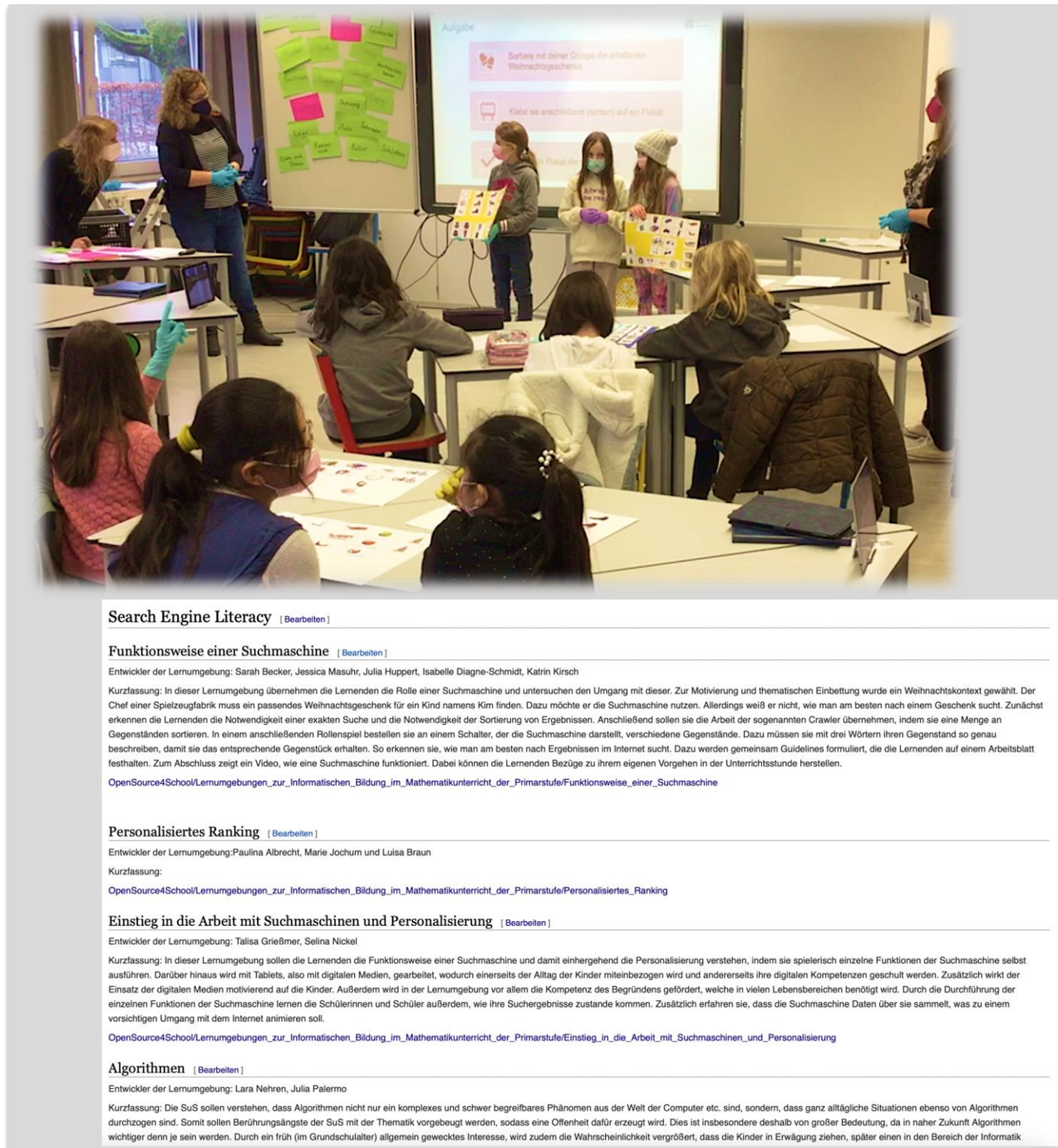


Cf. Purao (2002); Vaishnavi et al. (2019)

OER

https://de.wikiversity.org/wiki/OpenSource4School/Lernumgebungen_zur_Informatischen_Bildung_im_Mathematikunterricht_der_Primarstufe#Search_Engine_Literacy

Platz (2020)



Search Engine Literacy [Bearbeiten]

Funktionsweise einer Suchmaschine [Bearbeiten]

Entwickler der Lernumgebung: Sarah Becker, Jessica Masuhr, Julia Huppert, Isabelle Diagne-Schmidt, Katrin Kirsch

Kurzfassung: In dieser Lernumgebung übernehmen die Lernenden die Rolle einer Suchmaschine und untersuchen den Umgang mit dieser. Zur Motivierung und thematischen Einbettung wurde ein Weihnachtskontext gewählt. Der Chef einer Spielzeugfabrik muss ein passendes Weihnachtsgeschenk für ein Kind namens Kim finden. Dazu möchte er die Suchmaschine nutzen. Allerdings weiß er nicht, wie man am besten nach einem Geschenk sucht. Zunächst erkennen die Lernenden die Notwendigkeit einer exakten Suche und die Notwendigkeit der Sortierung von Ergebnissen. Anschließend sollen sie die Arbeit der sogenannten Crawler übernehmen, indem sie eine Menge an Gegenständen sortieren. In einem anschließenden Rollenspiel bestellen sie an einem Schalter, der die Suchmaschine darstellt, verschiedene Gegenstände. Dazu müssen sie mit drei Wörtern ihren Gegenstand so genau beschreiben, damit sie das entsprechende Gegenstück erhalten. So erkennen sie, wie man am besten nach Ergebnissen im Internet sucht. Dazu werden gemeinsam Guidelines formuliert, die die Lernenden auf einem Arbeitsblatt festhalten. Zum Abschluss zeigt ein Video, wie eine Suchmaschine funktioniert. Dabei können die Lernenden Bezüge zu ihrem eigenen Vorgehen in der Unterrichtsstunde herstellen.

OpenSource4School/Lernumgebungen_zur_Informatischen_Bildung_im_Mathematikunterricht_der_Primarstufe/Funktionsweise_einer_Suchmaschine

Personalisiertes Ranking [Bearbeiten]

Entwickler der Lernumgebung:Paulina Albrecht, Marie Jochum und Luisa Braun

Kurzfassung:

OpenSource4School/Lernumgebungen_zur_Informatischen_Bildung_im_Mathematikunterricht_der_Primarstufe/Personalisiertes_Ranking

Einstieg in die Arbeit mit Suchmaschinen und Personalisierung [Bearbeiten]

Entwickler der Lernumgebung: Talisa Grießmer, Selina Nickel

Kurzfassung: In dieser Lernumgebung sollen die Lernenden die Funktionsweise einer Suchmaschine und damit einhergehend die Personalisierung verstehen, indem sie spielerisch einzelne Funktionen der Suchmaschine selbst ausführen. Darüber hinaus wird mit Tablets, also mit digitalen Medien, gearbeitet, wodurch einerseits der Alltag der Kinder miteinbezogen wird und andererseits ihre digitalen Kompetenzen geschult werden. Zusätzlich wirkt der Einsatz der digitalen Medien motivierend auf die Kinder. Außerdem wird in der Lernumgebung vor allem die Kompetenz des Begründens gefördert, welche in vielen Lebensbereichen benötigt wird. Durch die Durchführung der einzelnen Funktionen der Suchmaschine lernen die Schülerinnen und Schüler außerdem, wie ihre Suchergebnisse zustande kommen. Zusätzlich erfahren sie, dass die Suchmaschine Daten über sie sammelt, was zu einem vorsichtigen Umgang mit dem Internet animieren soll.

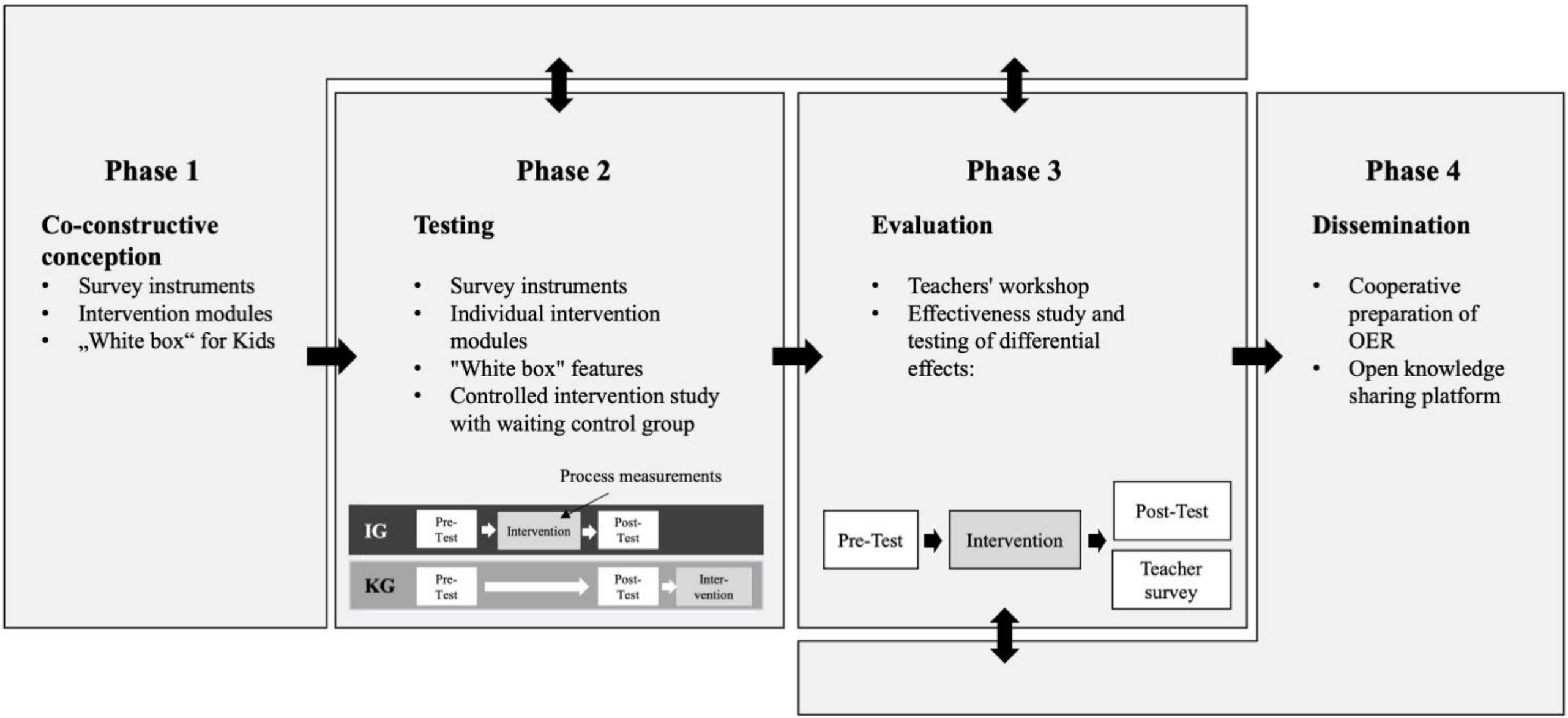
OpenSource4School/Lernumgebungen_zur_Informatischen_Bildung_im_Mathematikunterricht_der_Primarstufe/Einstieg_in_die_Arbeit_mit_Suchmaschinen_und_Personalisierung

Algorithmen [Bearbeiten]

Entwickler der Lernumgebung: Lara Nehren, Julia Palermo

Kurzfassung: Die SuS sollen verstehen, dass Algorithmen nicht nur ein komplexes und schwer begreifbares Phänomen aus der Welt der Computer etc. sind, sondern, dass ganz alltägliche Situationen ebenso von Algorithmen durchzogen sind. Somit sollen Berührungsängste der SuS mit der Thematik vorgebeugt werden, sodass eine Offenheit dafür erzeugt wird. Dies ist insbesondere deshalb von großer Bedeutung, da in naher Zukunft Algorithmen wichtiger denn je sein werden. Durch ein früh (im Grundschulalter) allgemein geweckten Interesse, wird zudem die Wahrscheinlichkeit vergrößert, dass die Kinder in Erwägung ziehen, später einen in den Bereich der Informatik

Project phases



Project „PrimaSearch“ (Uni Saarland, TH Ingolstadt, DLR_School_Labs)

Thank you

for your attention!

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Friederike.Klan@dlr.de
Alexander.Decker@thi.de

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