



# Evaluation of Competences

**DAAD Project: Introducing Data Literacy at GJU (IDL@GJU)**

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- ▶ what are data literacy competences? (input)
- ▶ which competences are required? (group work 2)
- ▶ what competences are missing?
  - ▶ evaluation of competences in freshmen students (this part)
  - ▶ situation of incoming students (group work 3)
- ▶ how to close the gap (group work 3 and further activities)

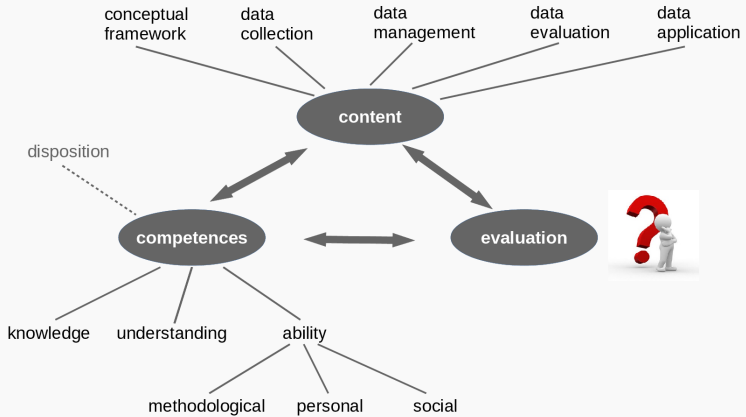


## Definition

**Data literacy** is the ability to collect, manage, evaluate, and apply data in a critical manner. [Ridsdale et al., 2015]

Conceptual Framework		Data Collection			Data Management							
Introduction to Data		Data Discovery and Collection	Evaluating and Ensuring Quality of Data and Sources		Data Organization	Data Manipulation	Data Conversion (from format to format)	Metadata Creation and Use	Data Curation, Security, and Re-Use	Data Preservation		
Data Evaluation						Data Application						
Data Tools	Basic Data Analysis	Data Interpretation (Understanding Data)	Identifying Problems Using Data	Data Visualization	Presenting Data (Verbally)	Data Driven Decisions Making (DDDM) (Making decisions based on data)	Critical Thinking	Data Culture	Data Ethics	Data Citation	Data Sharing	Evaluating Decisions Based on Data

Source: [Ridsdale et al., 2015]





[Schüller and Busch, 2019]

## The Kirkpatrick Four Levels

evaluate the steps of learning

1. Reaction: Did they like it?
2. Learning: Did they get it?
3. Behaviour: Can they do it?
4. Results: Does it matter?

They discuss some instruments: levels 1 and 2 can be easily covered, level 3 partially but intrinsic motivated behavior (level 4) cannot be measured.



[Schüller and Busch, 2019] suggest that questions as in **GMAT (General Management Admission Test)** (especially regarding "data sufficiency") can serve as "good example".

- ▶ Measures your ability to analyze a quantitative problem, recognize which data is relevant, and determine at what point there are enough data to solve the problem.
- ▶ You will be given a problem that consists of a question and two statements. Using the data in the statements, plus your knowledge of math and everyday facts, you decide whether you have enough data in the statement to answer the question asked.

<https://www.mba.com/exams/gmat/about-the-gmat-exam/gmat-exam-structure/quantitative>

Determine the price of two type A footballs if the total cost of a type A and a type B football is \$500.

1. Type B football costs \$200.
2. Two type A and three type B footballs costs \$1200.

- ☐ Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked.
- ☐ Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked.
- ☐ BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement ALONE is sufficient to answer the question asked.
- ☐ EACH statement ALONE is sufficient to answer the question asked.
- ☐ Statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

**https :**

**`//www.test-guide.com/gmat/free-gmat-practice-tests/gmat-data-sufficiency-practice-test-1.html`**



## GRE General Test

The **GRE General Test** measures your verbal reasoning, quantitative reasoning, critical thinking and analytical writing skills – skills that have been developed over a long period of time and are not related to a specific field of study but are important for all.

The Quantitative Reasoning section measures your ability to:

- ▶ understand, interpret and analyze quantitative information
- ▶ solve problems using mathematical models
- ▶ apply basic skills and elementary concepts of arithmetic, algebra, geometry and data analysis

[https://www.ets.org/gre/revised\\_general/about/content/](https://www.ets.org/gre/revised_general/about/content/)





**"Data analysis** topics include basic descriptive statistics, such as mean, median, mode, range, standard deviation, interquartile range, quartiles and percentiles; interpretation of data in tables and graphs, such as line graphs, bar graphs, circle graphs, boxplots, scatterplots and frequency distributions; elementary probability, such as probabilities of compound events and independent events; conditional probability; random variables and probability distributions, including normal distributions; and counting methods, such as combinations, permutations and Venn diagrams. These topics are typically taught in high school algebra courses or introductory statistics courses. Inferential statistics is not tested."

[https://www.ets.org/gre/revised\\_general/prepare/quantitative\\_reasoning](https://www.ets.org/gre/revised_general/prepare/quantitative_reasoning)

The "Math Review" is a 194 page document explaining the content and examples. ([https://www.ets.org/s/gre/pdf/gre\\_math\\_review.pdf](https://www.ets.org/s/gre/pdf/gre_math_review.pdf))

Questions 4 to 6 are based on the following data.

**Workforce of Country X**

**Percent Distribution of Workforce  
by Employment Sector**



**Workforce in the Service Sector  
by Area and Union Membership**



4. Approximately how many people are in the production and transportation sector of the workforce?

- A. 9 million
- B. 12 million
- C. 15 million
- D. 18 million
- E. 21 million

[https://www.ets.org/gre/institutions/about/general/quantitative\\_reasoning\\_sample\\_questions/](https://www.ets.org/gre/institutions/about/general/quantitative_reasoning_sample_questions/)



The **SAT (Scholastic Assessment Test)** is a globally recognized college admissions test that allows students to show colleges what they know and how well they can apply that knowledge. It tests students' knowledge of reading, writing and math - subjects that are taught every day in high school classrooms.

<https://www.dodea.edu/assessments/resources/sat.cfm>

### Questions

- ▶ Reading Section: Data interpretation
- ▶ Math Section: Problem Solving and Data Analysis



A Data Interpretation question requires you to **interpret data** (usually in the form of a table, chart, or graph) and understand how it relates to the passage.

Pathogen Occurrence in Honey Bee Colonies With and Without Colony Collapse Disorder

Pathogen	Percent of colonies affected by pathogen	
	Colonies with colony collapse disorder (%)	Colonies without colony collapse disorder (%)
Viruses		
IAPV	83	5
KBV	100	76
Fungi		
<i>Nosema apis</i>	90	48
<i>Nosema ceranae</i>	100	81
All four pathogens	77	0

50

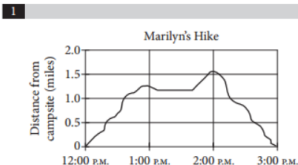
Based on data in the table, in what percent of colonies with colony collapse disorder were the honeybees infected by all four pathogens?

- A) 0 percent
- B) 77 percent
- C) 83 percent
- D) 100 percent

<https://blog.prepscholar.com/sat-sections>



There are 17 Problem Solving and Data Analysis questions on the SAT. **All of these questions are on the Math Calculator subsection** (meaning you'll see none of these on the No Calculator subsection). These questions focus on data interpretation (i.e., how to read charts, graphs, tables, etc.) as well as rates, ratios, percentages, linear and exponential relationships, and probability.



The graph above shows Marilyn's distance from her campsite during a 3-hour hike. She stopped for 30 minutes during her hike to have lunch. Based on the graph, which of the following is closest to the time she finished lunch and continued her hike?

- A) 12:40 P.M.
- B) 1:10 P.M.
- C) 1:40 P.M.
- D) 2:00 P.M.

<https://blog.prepscholar.com/sat-sections>



## GMAT, GRE and SAT

- ▶ All tests are "ex-post"
- ▶ The content and structure of the tests is well defined and published.
- ▶ Numerous sample tests allow for the preparation.
- ▶ The students take the test with a specific goal in mind and prepare.

## Freshmen Data Literacy Evaluation / Assessment

- ▶ is not really "ex-post"
- ▶ preparation is not possible
- ▶ it is of no importance to students



- ▶ Multiple Choice
- ▶ Short Answer (text or numerical)
- ▶ Matching
- ▶ Drag and drop

## ▶ Rating Scale

\* 2. How likely is it that you would recommend this company to a friend or colleague?

NOT AT ALL LIKELY					EXTREMELY LIKELY					
0	1	2	3	4	5	6	7	8	9	10

## ▶ Likert Scale

8. I'm satisfied with the investment my organization makes in education:

- ☐ Strongly agree                      ☐ Disagree  
☐ Agree                                      ☐ Strongly disagree  
☐ Neither agree nor disagree

## ▶ Ranking Questions

5. Rank the following shows in order of preference—1 being your favorite and 5 being your least favorite.

11	<input type="text" value="5"/>	The office
11	<input type="text" value="4"/>	Parks and Recreation
11	<input type="text" value="3"/>	Arrested Development
11	<input type="text" value="2"/>	Orange is the New Black
11	<input type="text" value="1"/>	New Girl



## Preface

An adequate preface is important:

- ▶ Students must know the purpose and must be sure that they are not evaluated
- ▶ Students must trust that the evaluation is anonymous.
- ▶ Students must not be discouraged even if we ask questions they do not know.

## Language

- ▶ The language should be sufficiently easy. ( $\Rightarrow$  Arabic (English098))
- ▶ We should not use technical language to formulate questions.





The test should have elements regarding the different domains and the levels knowledge, understanding and ability.

## Ideas

- ▶ Disposition: how important is data for your major? (selection, rating scale, Likert scale)
- ▶ where do we find data? what can be relevant data?
- ▶ calculate some values (very easy calculation, very few numbers): average, median, ...
- ▶ answer simple questions by interpreting data
- ▶ determine whether statements are correct based on data given
- ▶ ???

-  Ridsdale, C., Rothwell, J., Smit, M., Ali-Hassan, H., Bliemel, M., Irvine, D., Kelley, D., Matwin, S., and Wuetherick, B. (2015).  
Strategies and best practices for data literacy education:  
Knowledge synthesis report.
-  Schüller, K. and Busch, P. (2019).  
*Data Literacy: Ein Systematic Review.*  
Number 46. Hochschulforum Digitalisierung.