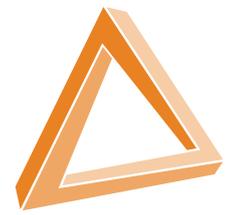


Byte-sized edtech research



Support Your Team

Competencies in Data Analysis: **What to Look for in Recruitment**



Fig. 1 - what are the competencies needed for data analytics, and how do we identify and measure them?

- **Data Analytics** is the process of **examining data** in order to draw **conclusions** and make better **decisions** (NIST, 2015; Radovilsky et al., 2018)

- Data Analytics techniques are widely used in organizations to make better **organizational decisions**. This process might, for example, **boost business performance** by increasing revenues, improving operational efficiency, or optimizing marketing campaigns

- The demand for professionals in the rapidly growing field of data analytics keeps **rising** (Basu, 2017; Marr, 2018), hence **identifying, evaluating, and teaching data analytics competencies** is an important goal for academic institutions and organizations in **every sector**

- What are these competencies though? And how to **identify** and **measure** them for candidates for a data analytics position is an equally important question. Literature reviews reveal there are **discrepancies** between our ideas of the **required skills** and **capabilities** of the role (Radovilsky et al., 2018) and as yet there is no specific data analytics competency **framework**. Policymakers and educators have often therefore looked to **other sets of skills** to use as benchmarks, such as “**21st-century skills**”, “**deeper learning skills**”, or “**higher-order thinking skills**”

- In a 2012 NRC report from Pellegrino & Hilton, as a way to organize the various terms for ‘21st-century skills’, and provide

a starting point for further research as to their **meaning** and **value**, research identified **three broad domains** of competence: **cognitive, interpersonal** and **intrapersonal**. These domains represent **distinct facets** of human thinking

- A 2022 study by Weiser et al. (TBA) added two further categories to these 3 domains, and **surveyed** data analysts across industry, government, NGOs, and academia, to compare **expert responses** to a proposed set of competencies **derived from the literature**. The goal was to create a list of the **most important competencies to succeed in data analytics assignments**, based on a carefully confirmed **consensus** between experts in the field

- Results from this research revealed:

- Competencies such as **analysis, a drive for continuous learning, problem-solving, and reasoning and argumentation**, all received over **90% consensus** among experts
- 24 further competencies received over **75% consensus**
- Risk taking, career orientation, and an artistic flair were largely seen as **non-essential**, and experts were unable to reach consensus on those competencies
- There was no consensus among the experts that **ethics is one of the most important competencies** to succeed in assignments. This finding, however, merits further research

“One of the most surprising findings of this study is that data analytics experts have not chosen ethics as one of the most important competencies to succeed in data analytics... Ethical issues are constantly raised in new industrial, educational, and governmental data science and artificial intelligence projects (Metcalf et al., 2020)”

(Weiser et al., 2022)



01 What does a Data Analyst do?

- In the past, **data analytics tasks** were done by a **limited number of professionals**: scientists, researchers, economists
- During the last **decade**, as developments in science and technology have become widely applied in various sectors of the economy, the demand by employers for **data analytics expertise** has risen and often results in **new occupations being defined** (Martinez, 2018)
- Analysts in an organization, who work with data, are **key to success in decision-supporting data management** (Watson, 2014)
- The data analytics process comprises **many tasks** (Gartner, 2018), each of which is usually performed by an **expert**:
 1. The ETL (Extract, Transform, Load) process starts with collecting data from many **sources** and combining it to transform the different types of data into a **common format**
 2. The next stage is **cleaning the data**. In this process, **duplicate records** and **irrelevant records** are deleted, **missing values** are filled, and the data is checked for **errors**
 3. When the data is ready for analysis, it is uploaded into the **analytics system**
- In an analytics system, data can become the basis for a **model** that can be **trained to forecast future information**
- Data can also be presented in **data visualization systems** such as **dashboards, graphs, and charts**, to be used to **support decisions** for the organisation

02 What are Professional Competencies?

- What is the difference between **skill** and a **competency**?
- A **skill** is a specific ability that can be **learned**, which one needs to **perform a given job well** (OECD, 2005)
- A **competency** is more than just knowledge and skills. It involves the ability to meet **complex demands** by drawing on and mobilizing psychosocial **resources** (including skills and attitudes) in a particular **context** (OECD, 2005)
- **Professional competencies** are therefore skills, knowledge and attributes that refer to the ability to **perform effectively within a professional role**. They are usually the competencies one has to show in an interview for a job
- In today's economy, jobs require workers who are more **collaborative** and **creative** in their problem-solving techniques. While the **“hard” technical skills** associated with programming remain a prerequisite for **new hires** (e.g. programming languages, databases), the industry also wants workers who can demonstrate a range of so-called **“soft” skills** (like the aforementioned ‘21st century skills’), and who can demonstrate the **resiliency and flexibility** to work on a **range** of tasks

03 Conclusions & Implications

- As concepts such as **data science, artificial intelligence (AI), machine learning (ML), deep learning, distributed, and quantum computing** gradually enter the mainstream, knowledge workers who originally focused mainly on **technology and programing** will require a **deeper set of competencies** and a **deeper understanding** of the **challenges** associated with these concepts (Tissenbaum & Ottenbreit-Leftwich, 2020).
- **Identifying the essential data analytics competencies** is an important step towards overcoming this challenge. Yet there is still **extensive work** to be done in order to **develop a workforce** that has these competencies, since, as suggested by experts surveyed in the study: “the problem with this list is that many of the competencies are not very trainable. Many are shaped by genetics and early life experience. By relying on these competencies you are selecting for upper middle class, well-socialized people who, by definition, are part of dominant culture that has defined the competencies”, and expanding the workforce beyond this group is a **key challenge** for the **educational system, for academia and for industry**
- This question of **trainability** should be the focus of future work, but assuming that many of these skills are trainable, we urge:
 - Policymakers, academic institutions, and educators to **establish programs and reassess existing curricula and materials**, in order to **support** students’ and employees’ acquisition of these essential competencies
 - **Training programs** should facilitate the systemic development, implementation, and evaluation of **cognitive, intrapersonal, and interpersonal competencies**
 - Focusing on all three categories of essential competencies will help institutions **better prepare students and employees** for existing and future roles as **citizens, employees, managers and educators**

“Researchers and organizations are facing **new challenges** that often lie outside their training and comfort zone (Zook et al., 2017). Although only **integrity** was included in the final list of competencies, it makes sense to **emphasize the importance** of the possibly **more comprehensive** competency of **ethics**.”

(Weiser et al., 2022)



Important Competencies for Data Analysis

Competency Name (*)	Cognitive	Intrapersonal	Interpersonal	Responses	Important/ Essential	Consensus (%)
Analysis	X			64	62	97
Continuous Learning		X		65	61	94
Problem Solving	X			65	60	92
Reasoning/Argumentation	X			64	58	91
Critical Thinking	X			64	57	89
Trust			X	64	57	89
Intellectual Interest		X		65	56	86
Responsibility		X		65	56	86
Collaboration Cooperation			X	65	56	86
Personal Responsibility		X		62	53	85
Professionalism		X		62	53	85
Share Information			X	60	51	85
Communication			X	64	54	84
Commitment to Trustworthiness			X	64	54	84
Interpretation	X			62	52	84
Teamwork			X	65	54	83
Communication (non-technical)			X	65	54	83
Integrity		X		64	53	83
Cope with Uncertainty		X		64	53	83
Scientific Literacy	X			65	53	82
Information Literacy	X			62	50	81
Proficient Learner		X		62	50	81

Notes

- Data analytics competencies are **personal characteristics** of individuals that may influence how they approach **data analytics tasks** and how they **acquire data-relevant knowledge and skills**
- You will see in the table above the three domains from the 2012 NRC report from Pellegrino & Hilton: **cognitive, interpersonal and intrapersonal**. These are summarised thusly:
 - The **cognitive** domain involves **reasoning and memory**. It includes competencies like **analysis, problem solving, scientific literacy and creativity**
 - The **intrapersonal** domain involves the capacity to **manage one’s behaviour and emotions** to achieve one’s goals. It includes competencies like the ability to **cope with uncertainty, perseverance, adaptability, flexibility, and self-direction**
 - The **interpersonal** domain includes the competencies which are used to **express information to others, to interpret others’ messages** (both verbal and nonverbal) and to **respond appropriately**. It involves **expressing ideas, and interpreting and responding** to messages from others, and includes competencies like **communication and collaboration**
- It should be noted that there was a **gap** between the **expectations** of the authors of the Weiser et al. (2022) research report (expectations derived from the literature as mentioned above), and the **actual results** of the survey of industry experts, which emphasizes the **diversity of opinions** on the topic, and the need for a specific data analytics competencies **framework** to ensure focusing on the essential competencies in holders of the role
- (*) A detailed **explanation** of each competency listed above is present in the appendix of the Weiser et al. (2022) report this Byte-Sized is based on