Remote Health

Course materials

Scientific work for professionals

Digital Health | Health@Work

Contents

Why scientific working matters?

Scientific working provides a reliable foundation for decision-making in Digital Health.
Especially when dealing with digital interventions, such as stress apps, biofeedback systems, or home-based neurofeedback, it is crucial to evaluate safety and effectiveness.

Scientific working enables professionals to:

- **critically assess digital interventions**
- **distinguish real effects from chance or placebo**
- **formulate evidence-based recommendations**
- **ensure data quality and transparency**

It prevents poor decisions and builds trust among users, employers, and institutions.

Risks of Lacking Scientific Standards

Faulty data analysis or flawed methods often lead to incorrect conclusions. Examples:

- Incorrect weighting → distorted results
- Missing data → faulty analyses
- Misinterpreted correlations → wrong decisions

Especially in the digital health sector, such errors can mean that ineffective or even burdensome measures are used.

Scientific work is the foundation of every credible digital health intervention.

The research process

The research process includes several structured steps:

1. Identify a topic
2. Formulate a research question
3. Develop a hypothesis (if quantitative)
4. Choose the appropriate method
5. Collect data
6. Analyze data
7. Interpret findings

Each step builds on the previous one.
Good structure prevents problems later in the project.

Finding a topic

A research topic should:

- be relevant for digital health or prevention
- be scientifically editable
- have sufficient literature base
- be realistic within the available time resources

Examples of digital health:

- Effectiveness of a digital stress score tool
- Neurofeedback home training for concentration difficulties
- The rule of app usage frequency in stress reduction

Planning the approach

A solid research plan includes:

- **clear milestones**
- **realistic time frame**
- **defined data sources**
- **clear responsibilities**
- **technical availability**

Planning ensures that the analysis is feasible and that practical obstacles are avoided.

What good planning achieves

- Structure
- Focus
- Smooth writing & analysis
- Reliable results

Without planning: chaos.
With planning: a clear direction.

Research questions & hypotheses

A research question determines:

- **WHAT is being investigated**
- **WHY it matters**
- **HOW the study must be designed**

A good research question is:

- **Precise**
- **clearly formulated**
- **theory-based**
- **Answerable**

Examples:
“How does the stress score change after 4 weeks of daily app use?”
“Which factors influence compliance with home-based neurofeedback?”

Good vs. bad questions

Bad:

"Is neurofeedback good?" → too vague

Good:

"Does daily neurofeedback home training improve attention span in adolescents?"
→ measurable, specific, properly structured

Hypotheses

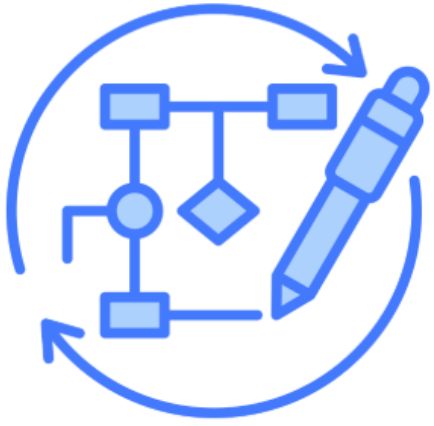
Hypotheses are testable statements.
They are especially important in quantitative research.

Example:
H1: "Using the stress app significantly reduces the stress score within four weeks."

A hypothesis must be:

- **Falsifiable**
- **clearly expressed**
- **based on measurable variables**

Purpose of a hypothesis



A hypothesis guides:

- **which data is collected**
- **which statistical method is needed**
- **how results should be interpreted**

Hypothesis = the Compass of the Analysis

Methods: qualitative & quantitative

Qualitative methods help understand:

- user experiences
- barriers to usage (e.g., compliance issues)
- Motivation
- well-being

Typical qualitative methods:

- Interviews
- focus groups
- Observations
- case studies

They are ideal for Digital Health research involving subjective experience.

Quantitative methods measure:

- Effects
- Changes
- Connections
- Patterns

Examples in the digital health sector:

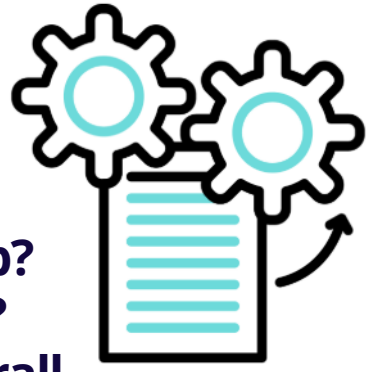
- Stress score (0–100)
- Sleep duration via app
- HRV measurements
- Training frequency in neurofeedback

Mixed Methods

The combination of quality and quantity is particularly valuable:

- **Numbers + Meaning**
- **Measurement + Explanation**
- **Results + User Feedback**

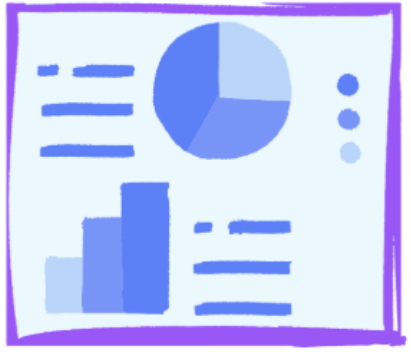
Ideal for digital health interventions.



Example combination

Qualitative: Why do some users engage less with the app?
Quantitative: How much does the stress score decrease?
Integration: Both types of data together explain the overall picture.

Statistical concepts



Key terms:

- **Variable: e.g., stress score**
- **Sample: participants**
- **Scale level: nominal, ordinal, interval , ratio**
- **Measurement: how the value is collected**

These elements determine which statistical tests are appropriate.

Descriptive statistics

Descriptive statistics summarize data:

- **Mean**
- **Median**
- **standard deviation**
- **Distributions**
- **visualizations (histograms, boxplots)**

They help understand the basic shape of the data before testing hypotheses.

Inferential statistics

Inferential statistics determine:

- whether an effect is real or due to chance
- whether differences are statistically significant
- how strong relationships are

Important methods:

- t-test
- ANOVA
- correlation
- Regression

Example: Stress app analysis

Research question:

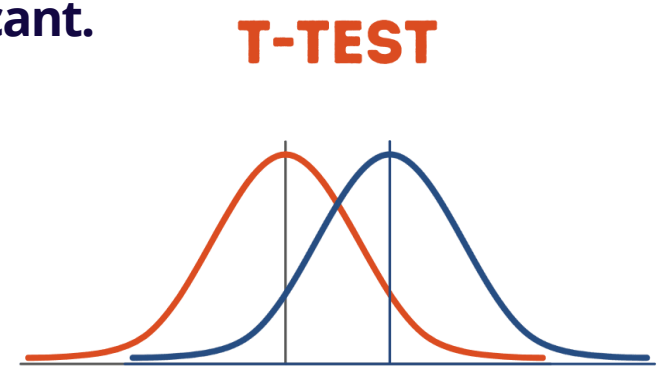
"Does the app reduce stress?"

Method:

Pre- and post-t-test

Interpretation:

If $p < .05 \rightarrow$ the change is statistically significant.



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