

MULTIDISCIPLINARITY IN THE USE OF SCRIBBR AND EMPIRIO METHODOLOGIES FOR MODERN SCIENTIFIC RESEARCH

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Abstract: *The author traces some of crucial points related to applying multidisciplinary innovations to modern online research. Consequently, the methodologies of the Empirio and Scribbr platforms are used to write and defend a PhD dissertation. The highlights are the stages of the research process, key parameters, research methods, testing scientific hypotheses and the results of an empirical study. Due attention is given to the criteria for quantitative and qualitative research, assessment of their respective reliability, validity and objectivity, indicators of transparency, comprehensiveness and intersubjectivity. The author's arguments are supported by examples that include the use of Meta-Analysis, Statistical Package for the Social Sciences and the Seven-step model.*

Keywords: *multidisciplinary innovation, modern online survey, Empirio, Scribbr, research methods, empirical research.*

Introduction

Actuality and axioms of the terms used.

In an information database, there is no consensus regarding the scientific terminology used. This requires commenting on some basic points in scientific knowledge such as multi-, trans- and interdisciplinarity. This serves to apply the chosen methods more precisely.

Multidisciplinarity is usually defined as „combining different knowledge and methods to approach a problem that requires different perspectives”. In this aspect, it could be defined as: [4].

- the coordinated interaction of different areas of scientific knowledge to achieve a certain result;
- a comprehensive degree to broaden researchers' understanding, interests, skills and knowledge;
- an activity that involves the application of two or more academic disciplines.

Consequently, *multidisciplinarity requires working in a specifically chosen team to achieve a strictly defined goal.*

It is no accident that Michal J. Bardecki concludes that in „its most precise use in research, multidisciplinarity does not challenge or transcend conventional disciplinary boundaries, but rather individuals (or disciplinary-focused groups) work on distinct aspects of a common enterprise.” [1, pp.1179-1184]

From the perspective of PhD students, *multidisciplinarity refers to their ability to use their own and others' knowledge and skills (including artificial intelligence) for the needs of the research process.*



Professor John Robinson defines „transdisciplinary research as research that integrates knowledge across academic disciplines and with non-academic stakeholders to address societal challenges.” [11]

Transdisciplinary research is concerned with:

- a high level of synthesis or convergence of knowledge beyond disciplinary perspectives;
- cooperation and mutual enrichment between disciplines;
- the pluralistic approaches to understanding this concept.

The process of uniting and integrating traditional educational concepts and methods of analysis in order to reach new solutions is based on the concept of interdisciplinarity. Here it should be noted that:

- interdisciplinarity is a process of developing the integration of methods that are traditionally considered separate scientific fields;
- interdisciplinary researchers integrate the best elements of disciplinary knowledge;
- the concept requires adopting a certain disciplinary perspective, also called a scientific worldview, when reaching a specific conclusion. [8]

Accordingly, the harmonization of the connections between the separate scientific disciplines is characteristic of the process of interdisciplinarity. The three correlated terms refer to the involvement of multiple disciplines in the results for metric homogeneous continua.

My intent is to show some practices used for multidisciplinary innovation, in the Scribbr and Emprio methodologies for modern dissertation research. I hope that the above-mentioned text will be helpful for PhD students to successfully defend their dissertation theses.

Parts of the Scientific Research

Part I.

Application of the Scribbr methodology for writing a dissertation thesis

An application of Scribbr's methodology is based on „How to describe the methodology of your bachelor thesis + examples” by Franziska Pfeiffer. The author adheres to the position that „by answering six questions, you can easily and accurately describe your methodology” or form a methodology section in the thesis. These are arranged in the following logical sequence, namely: [9]

- What type of research do you do?
- How do you collect your data?
- What characteristics does your database have?
- How was the research conducted?
- How was the data analyzed?
- Are the quality criteria met?

For this purpose, the capabilities of the Scribbr platform¹ are used for academic assistance in writing a thesis, proofreading and editing services, plagiarism checker, citation generator and database.

¹ Scribbr was founded in 2012 by two ambitious students as an editing and proofreading company. It is now part of Learno, a global platform of companies with a shared vision. The partnership with QuillBot and LanguageTool enables to offer innovative tools based on artificial intelligence. Also

Scribbr's current topics are as follows:

- Academic writing;
- Plagiarism;
- Citing sources;
- APA Style;
- Methodology;
- Research process;
- Statistics;
- Dissertation structure;
- Language rules.

The methodological procedure for addressing the research question requires:

a. *How will you collect data, i.e. form the database for the study?*

The methods depend on the type of data you need, namely:

- Qualitative vs. quantitative: (words or numbers);
- Primary vs. secondary: (own or others' data);
- Descriptive vs. experimental: (measurements or experiment).

b. *How will you analyze the data, respectively:*

- For quantitative data – statistical analysis methods to test relationships between variables;
- For qualitative data - methods such as thematic analysis to interpret patterns and data.

The method of study may be:

- Statistical analysis (Quantitative);
- Meta-analysis (Quantitative);
- Thematic analysis (Qualitative);
- Content analysis.

Other services offered by the e-platform are as follows:

- Plagiarism Checker;
- Proofreading Services;
- Citation Generator;
- AI Proofreader;
- AI Detector;
- Paraphrasing Tool;
- Grammar Checker;
- Free Text Summarizer;
- Paragraph Rewriter.

If you want to know more about statistics, methodology, or research bias: Research Methods | Definitions, Types, Examples. <https://www.scribbr.com/category/methodology/>.

– **Statistics:** Chi square test of independence; Statistical power; Descriptive statistics; Degrees of freedom; Pearson correlation; Null hypothesis.

– **Methodology:** Double-blind study; Case-control study; Research ethics; Data collection; Hypothesis testing; Structured interviews.

– **Research bias:** Hawthorne effect; Unconscious bias; Recall bias; Halo effect; Self-serving bias; Information bias. [5]



The reference part of the research methodology presents:

a. Purpose of the methodology used

- in the methodological section, it is necessary to explain how the scientific research was conducted and how the adequate results were achieved;
- what methods were used to test hypotheses or to find an answer to the research question;
- does the research possess the quality of „reproducibility”.

This means that it is focused on validation – checking/verifying that the specified requirements are appropriate for your research. In other words, the validation procedure is related to experimental confirmation of the methods used by presenting objective evidence for them. A comparative, systematic and analytical approach is used to demonstrate validation.

b. Length of the methodological part

In essence, it depends on the data analysis and quality criteria. It is recommended that the size or length of the methodological part is 10% of the text, with an average length of the diploma thesis around 1000 words.

In the structure of the thesis, the methodological part is after the introduction and the theoretical framework.

c. Verb tenses used

- When using the quality criteria, use the present tense (e.g., „the study is valid because...”);
- When referring to previous studies and results, use the past tense („the target group was...”) and the present tense („the data are being analyzed...”);
- If your supervisor prefers the present tense, you should stick to that („the target group is...”).

The main part of the methodology section in the PhD thesis requires the student to propose answers to the following questions:

1. What type of research have you done?

The possible answers may vary but express the following:

- quantitative research that requires the results obtained to be illustrated with standardly designed tables, charts, graphs and diagrams;
- qualitative research. Summary results are presented visually with stylishly designed sentences that are based on evidenced figures;
- combination or mixed methods approaches.

Research triangulation, is understood as examining a topic, phenomenon, or process from multiple perspectives, data sources, or methods. This implies a complementary distribution of several methodologies and data sources. The aim is to improve the validity, reliability and depth of the results.²

As an example: Triangulation analysis expresses the figure: „participant observation” – „in-depth interviews” – „results of online surveys.”

2. How did you collect your data?

Data collection for research is recommended to be done depending on the type of research done, such as:

² The concept of triangulation comes from surveying, where it is used to determine the exact location of an object using several reference points.

2.1. Quantitative research data

- searching databases;
- analysis reports;
- process and analyze data;
- conduct meta-analysis;
- perform secondary or re-analysis;
- discourse analysis or „discourse research”;
- quantitative content analysis.

2.2. In the case of so-called „field research”, it is recommended:

- to do a survey;
- conduct interviews;
- confirm hypotheses with experiments;
- observations with significant numbers;
- discourse analysis;
- specification of the data collection approach.

2.3. Qualitative research data

- collecting specialist literature using the „snowball” method, i.e. cumulative;
- qualitative content analysis;
- investigation of specific cases, case studies or situations;

2.4. If field research is conducted, it is recommended that qualitative research approaches follow:

- qualitative interviews;
- in-depth observations;
- methodologically based experiments.

3. What characteristics does the collected data have?

This question depends on the type of study and the information database available. For this, they are most often used:

- literature review;
- web-based data;
- sample or sample, method of sampling, course of the sample examination and description of the sample;
- interview, characteristics and form structured, semi-structured and unstructured, time, place and description;
- inclusion and exclusion criteria or which data was used?

For example, the criteria should prove the questions as follows:

- inclusion criteria, answer the question: what data should be included in the scientific study?
- exclusion criteria, which data was not included in the study and why?

4. How was the research conducted?

The practical course of the study includes:

- have enough people responded to your interview request?
- how many have you interviewed?
- when did you get satisfactory results?
- researcher role and research situation.
- adherence to the description of the facts.



5. How was the data analyzed?

5.1. *Sample answers for quantitative research:*

- statistical tests;
- regression analyses;
- meta-analysis³;
- quantitative content analysis;
- a combination of the mentioned methods.

5.2. *Sample answers for qualitative research:*

- a systematic or interpretive presentation of the results of the study;
- coding and categorization of materials;
- qualitative content analysis;
- re-examination of a specific model;
- a combination of the mentioned methods.
- data processing, for example using Excel or SPSS⁴;
- interview with the help of a program;
- data analysis models.

6. Are the quality criteria met?

- criteria for a quantitative study, it is necessary to assess its reliability, validity and objectivity;
- criteria for qualitative research, means to meet the indicators of transparency, comprehensiveness and intersubjectivity. For example, the interaction between two realities leads to the creation of a third reality, with unique characteristics.

Ultimately, the development of the methodological section of the dissertation will largely depend on:

First, *the research methods used, the probabilistic hypotheses tested and proven, and the results obtained.*

Second, *the creation of a research design that will help develop your effective research methodology.*

Third, *the focus of the master's thesis being defended, the purpose, object, subject and object of the research.*

Fourth, *the available database of information sources and the doctoral student's willingness to present their own elaboration.*

³ Meta Analysis - the integration of results from several research methods of statistics to test relationships in testing scientific hypotheses.

⁴ Statistical Package for the Social Sciences - a software program running in Windows operating system. It can be defined as a tool for data entry, processing and statistical analysis in a graphical environment.

Part II.
Application of the Empirio empirical research methodology

1. Defining empirical research

Empirical research focuses on the following several more important areas:⁵

- research whose conclusions are drawn from concrete, verifiable facts or sources;
- its results are the product of scientific experiments and evidence;
- uses real-world evidence in defining working hypotheses;
- are based on observed and measured phenomena and derive knowledge from actual experience;
- scientific research formulates probabilistic and stochastic distributions (medium-sized hypotheses);
- systematic collection of knowledge by applying methods that are characterized as scientific;
- a fixed set of rules that control the experience and cognitive process for researchers.

Consequently, empirical research is any research where research conclusions are drawn solely on the basis of specific empirical data, i.e. of „verifiable” evidence.

The sentence „*I won't believe it until I see it*” in all likelihood applies! This statement belongs to the ancient empiricists, whose fundamental understanding contributed to the emergence of medieval science during the Renaissance. The term has its roots in the Greek language, derived from the Greek word „Εμπειρικός”, which literally means „experienced”.

2. Requirements to the research method

Objectivity

- a. It means: independence of the measurement from the person doing the measurement. Different people should always arrive at the same measurement result.
- b. Verified by: Measurement by different people

Reliability

- a. It means: independence of measurement from time. The same measurement results must be achieved at different times
- b. Checked by:
 - Repeated measurements (from German Test-Retest-Verfahren);
 - Splitting a measurement into several separate measurements (Split-Half-Methode);
 - Development of two test instruments that are designed to measure the same problem (Paralleltest-Methode).

Validity (reliability)

- a. Means: accuracy of measurement

The object to be measured must be correctly recorded by the test instrument. A distinction is made between criterion validity and construct validity.

- b. Checking:

⁵ Empirio is an online platform for modern online survey in Germany, finding participants for it, real-time analyses through charts and exporting results in Excel, CSV or SPSS formats. Comma separated values - A text file with a specific format that allows data to be recorded in a tabular format. Statistical Package for the Social Sciences - Structural equation modeling software to support scientific research, test hypotheses, study relationships between data and publish scientific papers for empirical research. The free plan offers unlimited questions and respondents. A plus plan for €14.95 per month adds convenience and customization options - add your own logo and design. [12]



- Criterion validity: comparison with an external criterion (e.g. comparing a study on manual skills with manual production);
- Construct validity: Comparison with other variables that are designed to measure the same criterion (e.g., thrift as measured by discount shopping, number of shoes on hand). [6]

3. Stages of the methodology of the research process

Lisa Luders and Hajo Zeib consider the following stages of the research process, presented as a linear progression: [7, 15]

First stage

- Theoretical research in the literature;
- Generate research questions and scientific hypotheses.

Second stage

- Method selection;
- Defining a target group.

Third stage

- Selection and design of data collection;
- Online Pretest Practice Test.

Fourth stage

- Recruitment of participants.

Fifth stage

- Data preparation.

Sixth stage

- Data evaluation.

Seventh stage

- Interpretation and reflection of data;
- Publication.

According to Jan M. Boelmann, the main parameters of the research process are indicated in the following sequence: [3, 11]

- a. Formulating a research question – based on a comprehensive literature review.
- b. Research conceptualization – subject selection, group of test subjects, empirical methodology and pilot study.
- c. Data collection through adequate survey procedures.
- d. Data preparation – transcription, data entry, modification and archiving.
- e. Data analysis using estimation methods.
- f. Statistical, computer-aided further processing of analysis results.
- g. Interpretation of results, reference to the question, theory and hypotheses.

4. Research methods for empirical research

First group. *Methods of data collection*

Written questionnaire

- Paper version;
 - Online option.
- Oral interview
- Structured interview;
 - Semi-structured interview;
 - Unstructured interview;
 - Group discussion.

Observation

- Participant vs non-participant observation;
- Overt vs covert surveillance.

Second group. *Experimental Models (Experimental Design)*

- An experiment
- A quasi-experiment
- Laboratory versus field research
- Controlled designs

Third group. *Basic Quantitative Scales*

- Nominal scale;
- Another scale;
- Interval scale;
- Ratio scale.

Fourth group. *Data preparation*

- Use of software and data entry;
- Code plan;
- Anomaly detection.

Fifth group. *Methods for quantitative data analysis*

- One-dimensional distributions;
- Two-dimensional distributions;
- Multidimensional distributions;
- Inferential statistical testing.

Sixth group. *Methods for qualitative data analysis*

- Qualitative content analysis;
- Justification of the theory.

Seventh group. *Bug tracking*

Quality criteria.

- Quantitative studies;
- Qualitative research.

„ α ” and „ β ” errors;

Additional errors in the research process. [7, 59-131]

The way empirical research is conducted always depends on various aspects. According to the modern Empirio platform, the method you want to use for empirical research should always be based on the following **criteria**:

- a. What problem is being studied?
- b. What theoretical information is available?
- c. What resources are available?
- d. What is your own level of knowledge?

5. Stages of empirical research

In defining the stages of empirical research, Empirio refers to Jürgen Raithel and Sieghard Beller. According to the authors, empirical research goes through seven stages of the process: [10, 25-32]; [2, 19-22]

Step 1. Research objective, problem statement and research question

What is the purpose of your work? What specific question (= research question) should be studied and what are the prerequisites for the work (timetable, existing guidelines, etc.)? The basis of the questions are often existing theories that can be found in the literature.



Step 2. Formation of theory and hypothesis

How can you formulate your research question as a logical, scientifically testable statement or hypothesis?

Step 3. Conceptualization phase

How do you want to proceed with your research? What empirical method will be used to collect data (e.g., a standardized questionnaire survey)? Which variables are relevant to the research question? How many and which people (= sample) do you want to include in your study?

Step 4. Study preparation and data collection

What should you pay attention to in order to ensure the smooth conduct of the study (planning, preparing for interviews, obtaining the consent of the study participants)? Once these things are clear, you do the data collection (e.g. send the survey to the participants).

Step 5. Data preparation

How do you want to save the collected data? Does the data collection need to be structured in a certain way before it is analyzed? Do you need a special analysis program (e.g. SPSS)?

Step 6. Data analysis

What method do you want to use to analyze your data? Do you need to perform hypothesis and significance testing?

Step 7. Interpreting and compiling written documents

How can your results be interpreted and recorded? Can they serve as a basis for further research or for practical application?

6. Quantitative and qualitative methods for empirical research

Quantitative research methods

Quantitative studies are described in the form of measurable correlations. They are characterized by a standardized and structured approach where facts are objectively measured using as much data as possible. They are usually used to test hypotheses and statistical dependencies.

Quantitative research methods are as follows:

- Standardized survey (this includes online surveys as well as written, oral or telephone interviews with standardized questionnaires);
- Standard observation;
- Standardized content analysis;
- Experiment (subjects are subjected to the same conditions, e.g. in a standardized online survey each subject has the same sequence of questions, the same rating scale, exactly the same questionnaire, etc.).

Qualitative methods are characterized by a non-standardized or predetermined approach in which descriptions and opinions of individuals or groups of people are recorded. Therefore, they are particularly suitable for investigating causes in exploratory or application-oriented research.

Qualitative research methods can be:

- Interviews with managers and experts;
- Educational research;
- Quality monitoring;
- Qualitative content analysis and document analysis;
- Case study;

- Group discussion (e.g. in the qualitative expert interview research participants are usually given a rough thematic guideline. *Consequently, the order, organization and responses to the questions are flexible and unrestricted*).

7. Approaches in empirical social research

Empirical social research is understood as a substantial specialization or subfield of empirical research and deals primarily with socially relevant, demographic and socioeconomic contexts or problems.

These main objectives and corresponding research approaches are typical of empirical research:

a. Descriptive or hypothesis testing or causal research approach (describing and explaining).

Causal relationships are described, explained and verified as precisely as possible. These studies serve as an important basis for the development of scientific theories or the creation of classifications and typologies.

b. Research approach or discovery and understanding.

Events and actions are thoroughly explored to determine the relationship between them. This research often involves preliminary studies or preliminary tests of phenomena that have not yet been studied in depth.

c. An application-oriented research approach (evaluation and change).

Problems and causes are investigated in order to implement practical measures to improve conditions.

d. Mixed types

Most studies combine different approaches to achieve their research objective. Researchers often begin with the exploratory research approach to gain an initial understanding of the research topic and then derive working hypotheses.

8. Scientific hypotheses for empirical research

Scientific hypotheses (= from Old Greek „ὑπόθεσις” *hypóthesis* and Late Latin *hypothesis*, which literally translates to „supposition”) are a central part of empirical research. They are valid in this context:

– *Hypotheses are scientific assumptions*

They are assumed to be true in relation to a pre-formulated research question until they are proved or disproved.

– *Anything that has not yet been refuted by observation*

Measurements or experiments are considered provisional truth until they can be disproved.

– *Hypothesis testing*

This procedure can be used to test the truth of established assumptions and results.

Consequently, a hypothesis can be formulated as a theoretical assumption that is based on observations of processes and is intended to be tested using scientifically derived empirical data.

The Empirio platform emphasizes the premise that the testing of a working hypothesis must meet **exact requirements**, namely:

1. When formulating the hypothesis, care should be taken *not to use long, complex and convoluted sentences*. They lead to ambiguity and misunderstanding.



2. Testability is affected by the hypothesis. Subjective and other unmeasurable formulations should be avoided. *Measurable alternatives* are used instead.
3. The more accurately a hypothesis relates to the topic, the better it can be used in research. *Very general formulations ensure that a topic is considered only superficially.*
4. *A concise, objective and accurate presentation of the working hypothesis is preferred.*
5. In order to know at the end of the study whether the hypothesis is confirmed or refuted, a *testing (provability)* of a hypothesis must be performed. *A null hypothesis or counter-hypothesis* is used for this purpose.
6. *A hypothesis that has only one possible answer cannot be used in scientific research.*
7. *A scientific hypothesis must be capable of being refuted.* This means that the hypothesis formulated may not be confirmed and rejected. The process is also called „falsifying a hypothesis.”

Conclusion

Firstly, using a multidisciplinary approach when considering Scribbr and Empirio's methodologies for modern PhD dissertation research allows a relational consensus to be reached when determining the structure of the research study. This does not ignore diversity in academic thought, but offers indications of good educational practices and higher quality research papers.

Second, the digital platforms considered provide academic services of high quality such as: access to new databases, mathematical-statistical and enterprise modeling, real-time analytics, professional modeling software, hypothesis testing, etc. Professional software allows to perform plagiarism checking, editing and correction of tests.

Third, the methodologies help young researchers to make a good scientific career. Under certain conditions, advise the PhD student how to write a scientific publication meeting the requirements of refereed journals. They offer a reliable partner for publishing academic or creative work. The above is a solid guarantee of success.

These arguments are reflected in the formation of certain educational standards with high academic requirements. Ignatius Loyola's sentence „*If the end is the salvation of the soul, then the end justifies the means*” is positioned on the use of professional software to integrate academic disciplines. From the perspective of the doctoral community, multidisciplinary increases access to modern information databases.

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