Portal of Research Methods and Methodologies for Research Projects and Degree Projects

Anne Håkansson
Department of Software and Computer Systems,
The Royal Institute of Technology, KTH, Kista, Sweden

Abstract *Research methods and methodologies are extremely important when conducting research and degree projects. The use and application of the methods and methodologies are considered to be "necessarily vicious" and, unfortunately, often applied after the research has been conducted. The need for applying methods before the actually research and the reasons for doing so are often stressed in the literature and courses for research and scientific writing. This includes the aspects of selecting, understanding and applying research methods for a selected project. Unfortunately, it is difficult to choose well-suited methods and too often the selected methods and methodologies do not match each other. Instead, methods are applied without knowing about the consequences the applied method have both on the other chosen methods and on the results of the work or research. This paper provides a portal of research methods and methodologies to help the students to choose and apply the most suitable methods by illustrating which methods belong together and the distinctions between the different methods.*

Keywords: Research Methods, Methodologies, Research Projects, Capstone Projects, and Method Education

1 Introduction

When conducting research or degree projects, methods and methodologies are essential to plan and steer the work to achieve proper, correct and well-founded results. The research methods and methodologies are processes, or particular courses of actions, that assure the quality of results of the research and projects.

In some sciences, like the different disciplines within computer sciences, the focus is often on the work with the research rather than methods or methodologies for the research. Although, while focusing on the work, it is important that the research is supported with research methods and methodologies in the beginning of the process, since these affect the outcome.

The deprivation of significant constituents in the research process, effect the outcome of the research and projects. This can lead to misleading results that, unfortunately, are disseminated to the reasearch community and deceive other researchers.

As soon as the project is chosen, the research methods and methodologies should be considered. Choosing includes the whole spectrum of methods from assumptions, via collection and analysis, to theses and report writing. Many education programmes, bachelor, master and PhD programmes, include research methodology and scientific writing courses where students are supposed to learn and apply methods for research, and investigations, as well as, theses and reports.

Lots of good and rigorous literature about methods and methodologies has been provided during the years [1-4; 6-8; 11-16]. Also, a lot of material for carrying out projects and writing the theses has been provided for the students, like the formalities, i.e., the thesis organization [17], the content and reference system [9; 10], methodologies [3], as well as, the language [5; 17]. This literature is only a small selection of the vast collection of written material for research methods, methodologies and writing and is not a comprehensive set of material.

However, methods and methodologies are commonly neglected, or avoided, and regarded as "necessarily vicious". Typically, students consider the research methods and methodologies at the end of the research process, and enforce these after the work has been carried out and the theses need to be completed. Then, the research methods and methodologies, in general, are applied by "bending the methods" or, even worse, inventing new methods to suit their existing working process.

Moreover, when students choose methods for the research, projects and theses, they too often pick methods that do not match. Often methods that more or less suit the work are applied without considering the consequences these applied methods infer on each other.

Also, besides the lack of quality research methods, discussions about good foundations for the project together with acceptable arguments are often missing, as well as, discussions about validity, reliability, replicability and ethics. The students may not even be able to distinguish between the research method and data collection method.

This paper provides a portal of research methods and methodologies supporting students in selecting and applying the best suited methods by explicitly illustrating, which methods belong together and, thereby, showing distinctions between the different methods. The portal contains the methods and methodologies that are most commonly used in information and communication technology, which includes disciplines in computer sciences.

2   Choosing Methods and Methodologies

Carefully choosing methods and methodologies for a research or degree project is often a tedious and difficult task. There are many methods and methodologies, and studying all them requires a lot of effort. Some of these have the same name, which can make the selection confusing (for example experimental research methods and experimental research strategy) at the same time it can support the selection. A good example of a confusing definition is the term research methodology that refers to: the "systematic process of carrying out the research work and solving a problem including research methods" and "learning the logic behind the research methods, explaining why a certain method is used and not another one to support evaluation of research results". However, methodology also refers to "the systematic steps in data collection and data analysis" [13] including quality assurance, i.e., validity, reliability, replication and ethics [16].

Research methods, as a general concept, include a spectrum of methods. It is often defined as "the search for knowledge" or "systematic investigation to establish facts". The concept of research methods is also confusing because it can be considered to be a term for: "a collection of different methods, ranging from philosophical assumption to data analysis" but it can be considered as "a part of methodology denoting its own category of methods".

Early in the working process of research projects and degree projects, students know the subject to study but do not have enough background to know the problems within the subject. This requires a literature study and a planning of the activities to reach desired outcomes, or goals, and achieve the expected result(s). The literature study gives a foundation with background knowledge in the subject area and several possible problems that need to be solved. From the study and revealed problems, a problem statement is crystallized and a research problem formulated. Also, tentative goals and results are developed.

To reach the goals and results, a strategy (or strategies) for conducting the research or degree project is required, which must be implemented to carry out the research or degree project. The strategy consists of the different methods applied to steer the work that leads to correct, valid and reliable results. This does not imply that the results, from conducting the research, are the researchers desired results but will be correct results according to the work that has been carried out. The correct results, produced by the chosen strategy, are extremely important for the research and the society.

A main categorization of a research project and degree projects is to decide methodologies to apply to the research project. The methodologies are the processes, followed during the entire research activity. These are used as guidelines to carry out the research project. Quantitative methodology and qualitative methodology are considered to be polar opposites [12]. Roughly, the first decision is whether or not the research or degree project is about proving a phenomenon, by experiments or testing a system with large data sets (quantity), or if it is about studying a phenomenon, or an artifact, to create theories, products, and inventions by probing the terrain or environment (quality).

3   The Portal of Research Methods and Methodologies

To support selecting the best-suited methods, a portal of research methods and methodologies is provided. The portal makes a distinction between the main methods, i.e., quantitative research and qualitative methods, but also between other methods, ranging from assumptions to quality analysis.

The left side of the portal belongs to the quantitative research methodologies using experiments and large data sets to reach a conclusion; the right side is the qualitative research using investigations (or development) in an interpretative manner on, commonly, rather small data sets, to create theories or artifacts, see Figure 1.
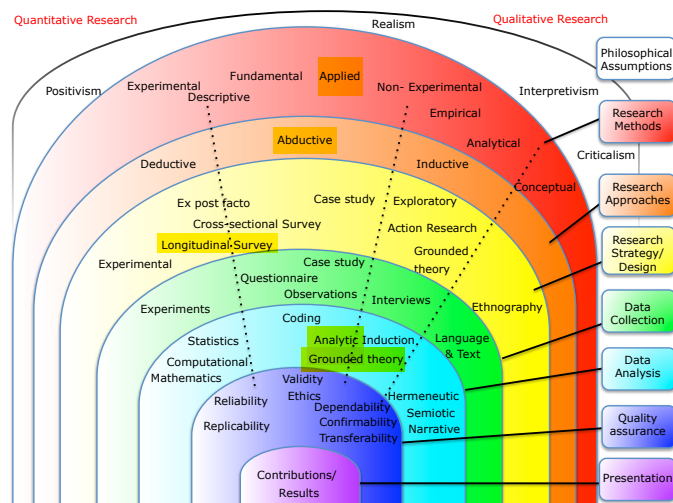

Figure 1. The portal of research methods and methodologies

The interpretation of the figure is that the left side includes the methods that work well with quantifications and the right side includes methods that work well with qualifications. Moving from the left side to the right, the methods move from being more quantitative research methodologies to more qualitative research methodology on the right side, with methods that more or less suit quantifications or qualifications.

The methods in the middle of the figure can move to both sides, left and right, deciding which part best suits the research or the degree project at hand. Once decided, it should not be a mix of methods from quantitative methods and quantitative methods within the different layers of the portal.

Hence, if the research is of the quantitative type, the methods that are on the right side on the second doted line, in the figure, Figure 2, shall not be used. This also applies for the opposite direction, from right to left, where the methods on the right side should not cross the second line, to the left, and, hence, the methods of qualitative type shall not use "pure" quantitative methods, as illustrated in Figure 3.
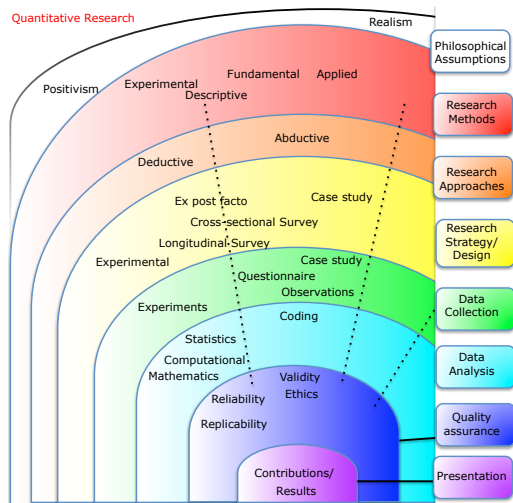
Figure 2. The quantitative research methods and methodologies

In the figure, Figure 2, all the research methods and methodologies that work well for quantitative research projects are presented. In figure below, Figure 3, all the research methods and methodologies that work well for qualitative research projects are presented.
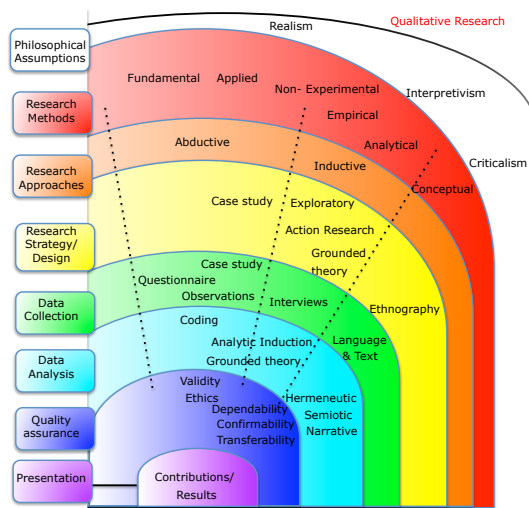

Figure 3. The qualitative research methods and methodologies

When selecting methods for the research project or degree project, every layer in the portal, starting from the top, must be investigated before entering the next layer and towards the port in the bottom. The first main category is quantitative or qualitative character. From this category, the first layer, to consider, is the outermost layer "Philosophical assumptions". Then, the selection moves inwards to the "Presentation" layer. At each level, all methods in the layer must be described, theoretically, before choosing a method and, then, applied to the research at hand. Hence, at least one method from each layer must be chosen, described and applied on the research project, or degree project, before moving to the next layer.

3.1   Quantitative and Qualitative research methods

The basic categories of research methods are, commonly, *Quantitative research method* and *Qualitative research method*. These two methods apply on projects that are either numerical or non-numerical. One of the research methods must to be selected, which decides whether the project is of quantitative character or qualitative character. This is the first choice of scientific standpoint and will affect the choice of research methods, strategies, data collection and analysis.

The method *Quantitative Research* method supports experiments and testing by measuring variables to verify or falsify theories and hypothesis, or computer systems' functionalities and interfaces. The formation of the hypothesis is that it has to be measureable with quantifications. Vague terms are unacceptable and the hypothesis must be evaluable and answerable. The method requires large data sets and use statistics to test the hypothesis and make the research project valid.

The *Qualitative Research* method concerns understanding meanings, opinions and behaviors to reach tentative hypotheses and theories or develop computer systems, artifacts and inventions. The method commonly uses smaller data sets that are sufficient enough to reach reliable results, where the data collection continues until saturation is reached.

It is possible to use both research methods as complement to get a complete view of the research area and situation. This method, called *triangulation*, is often used to ensure the correctness of results by increase credibility and validity of the results. Although the usage of several methods, triangulation is often carried out by applying one method at the time.

3.2   Philosophical assumptions

A philosophical assumption is the starting point for the research. The philosophical assumption is essential since it affects and steers the whole research. Hence, it constitutes assumptions about valid research and appropriate research methods and is the stand-point, which becomes the point of view for the project.

There are several core assumptions, or paradigms: Positivism, Realism, Interpretivism, and Criticalism [13; 11].

Positivism (objective) [13; 11] assumes that the reality is objectively given and independent of the observer and instruments. The researchers test theories, usually in a deductive manner, to increase predictive understanding of a phenomenon. The view of positivists is used in projects that are of experimental and testing character. They dismiss or evince a phenomenon by drawing inferences, about the phenomenon from the sample to a stated population, quantifying measures of variables, and testing hypothesis. The positivist assumption works well for testing performances within information and communication technology. *Post-positivist* is similar to positivist but post-positivists believe that the researchers' experience, knowledge and values can influence the observations, which makes it lean towards sociology and, hence, interpretation.

Realism (realistic) [13] assumes that things, in the reality, are known, or are of a perceived existence or nature. They do not depend on a person who is thinking about the things or is perceiving the things. The realists observe phenomenon to provide credible data and facts. From the collected data, the realists work with understanding the data and developing knowledge. The result is regarded as accurate worldly experiences (you see what you get) or as sensations. Realism can be used in interdisciplinary research in information and communication.

Interpretivism (interpretative) [13; 11] assumes that the reality is accessed only via social constructions. They attempt to understand phenomena by exploring richness, depth and complexity, often in an inductive manner, to discover the meanings people assign to the phenomenon. The view of interpretivists is used in projects with opinions, perspectives, and experiences characters to get context for phenomena. Works well in developing computer systems and artifacts.

Criticalism (critical) [13; 11] assumes that the reality is socially, historically, and culturally constituted, produced and reproduced by people. The critical assumptions focus on the oppositions, conflicts and contradictions in society and seeks to find and eliminate the causes of alienations, dominations and injustice and so on. The criticalism assumption can be used when learning about users' culture how it might affect the usages of computer systems.

From these assumptions, the researcher decides the perspective of the research, which is the approach taken to conduct the research, which are sometimes called assumptions or perspectives. Some examples of perspectives are: Pragmatism, Ontology, Epistemology, Axiology, Rhetoric, and Methodology.

Once the assumption is decided, the research question should be formed. From this question, the research method is chosen, which should provide a result (or results) for the given question.

3.3   Research Methods

Research methods provide procedures for accomplishing research tasks. These procedures are how to do the research with initiating, carrying out and completing research tasks. Hence, the research methods are the methods applied to the research project or degree project to support the process of conducting research.

In the portal, research methods and the research strategies and designs are distinguished. The distinction is the research methods are the framework for the research, which is theoretical frame for the methods. The research strategies and designs are the guidelines or methodologies, which are the steps carried out to conduct the research. The research method is, hence, on a higher level than the research strategies and designs.

Some of the research methods are also research strategies and designs, but can be described at different levels of details. This can be carried out by letting the research methods, first, introduce the method and, then, employ the research strategies and designs as methodologies that are applied to reach results.

The most common research methods are: Experimental or Quantitative, and Non-experimental including Descriptive, Qualitative, Analytical, Fundamental/Basic, Applied, Conceptual and Empirical.

Experimental research method studies causes and effects [1; 13]. The method deals with variables, establishes relationships between variables and finds causalities between the relationships. It can manipulate one variable and keep the other variables constant and check how the changes affect the result. This research method is often used when investigating systems' performances.

The *Non-experimental research* method examines existing scenarios and draws conclusions for the situation [1]. The method describes or predicts behaviour or opinions and can also describe relationships between variables but does not set out or test causalities between variables. This method has three different designs: relational (or correlational), comparative and longitudinal research and study. It can be used for studying users' behaviour or opinions of functionalities and interfaces.

The *Descriptive Research* method, also called statistical research, studies phenomenon and describes characteristics for a situation but not the causes or occurrences for the situation. The descriptive research method can use either quantitative or qualitative methods and often uses surveys, case studies and observations to produce accurate representations of persons, events or situations [6]. The method focuses on finding facts to establish the nature of something as it exists and can be used to find new characteristics, meanings and/or relationships in already existing data. It can be used for all kinds of research or investigations in computer science genre that aim to describing phenomenon or characteristics.

Analytical Research method tests pre-planned hypotheses based on existing knowledge and findings. It is concerned with validating hypotheses and uses facts and information that is already collected, and analyses the material to make a critical evaluation of the material. The method aids in decision making in areas, such as, product design and process design.

Fundamental Research, also called basic research or pure research, is a basic or applied research with a "curiosity-driven" focus observing a phenomenon to get new insights into the essence of nature. The method focuses on fundamental principles and testing theories. It generates new ideas, principles and theories. The result is innovations and new developments and solutions to old problems. This allows existing theories to be challenged and new theories to be developed. The fundamental research method is used for all kinds of research or investigations to generate innovations, principles and theories.

Applied research method involves answering specific questions or solving known and practical problems. The method examines a set of circumstances and the results are related to a particular situation. It often builds on existing research and uses data directly from the real work and applies it to solve problems and develop practical applications, technologies and interventions. Applied research is used for all kinds of research or investigations, which is often based on basic research and with a particular application in mind.

Conceptual Research method is used for developing new concepts or interpreting existing concepts [7]. It concerns theory development, historical research, literature reviews, and critical analysis and can be used to establish concepts in an area. The conceptual research can be used for investigating contents in a system with or without historic involvement. The literature reviews should not be confused with background data. Instead it is to study the literature to find, analyse and interpreting commonly used concepts.

Empirical research method relies on experiences and observations and derives knowledge from actual experience and tests predictions by focusing on real people and situations. It forms a body of knowledge and well-formed theories by involving collection and analysis of data and experiences to characterize, evaluate and reveal relationships between deliverables, practices and technologies. The empirical research seeks to gain knowledge by getting proofs based on evidence from experiments, observations or experiences. From the observable evidences that are collected, data are analysed with either quantitative or qualitative methods to explain the intrinsic situations.

Other important methods to be mentioned but not described in details in this paper are: Quasi-Experimental Research [13], Correlational Research and Historical Research [1].

If a single research method is not comprehensive enough or considered to be too weak to provide desired outcomes or results, several research methods, that complement each other, can be selected and applied to give a comprehensive picture of the situation or convincing and reliable research results.

3.4   Research Approaches

Research approaches are used for drawing conclusions and establishing what is true or false. The most common are inductive and deductive [15] but there is also a mixed approach, called abductive. The inductive approach establishes a general proposition from particular facts and the deductive approach derives conclusions from known premises. Abductive derives likely conclusions from an incomplete set of observations.

Inductive approach [13; 15; 4] or reasoning formulates theories and propositions with alternative explanations from observations and patterns. It can also be used in the development of an artifact. Data is collected, commonly with *qualitative methods*, and analysed to gain an understanding of phenomenon and establishing different views of the phenomenon. The outcome is based on behaviours, opinions, and experiences and must contain *enough* data to establish why something is happening, which are the reasons for the theories or requirements for an artifact.

Deductive approach [13; 15; 4] or reasoning tests theories to verify or falsify hypotheses. These theories are rigorously tested by deducing and testing a theory and hypothesis using, almost always, *quantitative methods* with large data sets. The hypothesis must be expressed in operational and measurable terms, explaining how the variables are to be measured and expressing the expected outcome to be achieved. The outcome is a generalisation that *must* be based on the collected data,

and explanations of causal relationships between variables, establishing what is happening.

Abductive approach or reasoning uses both deductive and inductive approaches to establish conclusions. In the method, the hypothesis, that best explain the relevant evidence, is chosen. The approach starts with an incomplete set of data or observations and uses preconditions to infer or explain conclusions. The outcome is a likely or possible explanation and is, hence, useful as heuristics.

3.5   Research Strategies / Designs (Methodologies)

The research strategies and designs are the guidelines, or the methodologies, for carrying out the research. The guidelines (methodologies) are for the research, which includes organizing, planning, designing and conducting research.

The research strategies and designs for quantitative research commonly are Experimental Research, Ex post facto Research, Surveys (Longitudinal and Cross-sectional), and Case Study, and for qualitative research, the strategies and designs commonly are Surveys, Case Study, Action Research, Exploratory Research, Grounded theory, and Ethnography.

Experimental research strategy and design concerns control over all factors that may affect the results of an experiment. As the research method, Experimental strategy/ design verifies or falsifies hypotheses and provides cause-and-effect relationships between variables, i.e., correlations between independent and dependent variables. The amount of collected raw data is often enormous and the analysis is carried out with statistics. The method is used in experiments with large data sets.

Ex post facto research is similar to experimental research but does not control or change the independent variable since it is carried out after the data is already collected. Ex post facto = after the fact, means that it searches back in time to find plausible causal factors. The method also verifies or falsifies hypotheses and provides cause-and-effect relationships between variables but cannot provide safeguards to make strong inferences [2]. The method can be used to study behaviours and can, therefore, also use qualitative methods.

Surveys, cross-sectional and longitudinal, assess attitudes and characteristics of a wide range of subjects. It is a descriptive research method, which examines the frequency and relationships between variables [13] and describes phenomenon that are not directly observed. Cross-sectional surveys collect information on a population, at a single point of time. Longitudinal surveys collect data over a period of time. Due to surveys' characteristics and using questionnaires, the method can be used with quantitative and qualitative methods.

Case study is an empirical study that investigates a phenomenon in a real life context where boundaries between phenomenon and context are not clearly evident. The case study is a strategy, which involves an empirical investigation of a particular phenomenon using multiple sources of evidence. Case studies can be based on quantitative and

qualitative evidences or of a mix of these methods and, hence, use either method or both methods.

Action research is performed by actions to contribute to practical concerns in a problematic situation. The method improves the way people address issues and solves problems, as well as, strategies, practices, and knowledge of environments. It is a systematic, cyclic method of planning, taking action, observing, evaluating and critical reflection. Action research often studies communities or settings with restricted data sets and, hence, qualitative methods are most suitable.

Exploratory research method provides a basis for general findings by exploring the possibility to obtain as many relationships between different variables as possible. It uses surveys to get an insight in the problem. It rarely provides definite answers to specific issues. Instead, it identifies key issues and variables to define objectives, using qualitative data collection.

Grounded theory seeks to develop a theory that is grounded in data. The method systematically collects and analyses data. The grounded theory is an inductive theory discovery method that allows the development of a theoretical account of general features of a topic.

Ethnography method is from anthropology, which means portrait of people or methodology to study people. It uses descriptive studies of culture and people that under investigation have something in common. Ethnography seeks to place the phenomena in their social and cultural context.

Other methods, not shown in the portal, is Creative Research and Design science. Creative Research method involves developing new theories, procedures and inventions, such as, artifacts or systems [8]. Design science is not in the portal since it is a framework for developing artifacts in the area of information systems and not a scientific research method. However, if design science is considered as a method, it should be noticed that designing an artifact is not science itself and using design science as a research strategy can create discussions. Also, design science includes parts of software engineering methods used when designing systems.

3.6 Data Collection Methods

Data collection methods are used to collect data for the research. The most commonly used methods for quantative research are Experiments, Questionnaire Case Study, and Observations; for qualitative research, Questionnaire, Case Study, Observations, Interviews, and Language and Text.

The data collection methods use samplings. Commonly, the quantative uses probability with stratification and theoretical samlings. Qualitative uses concenience, snowball, probability with stratification and theoretical samlings.

The different methods collect data for different purposes:
- *Experiments* collects a large data set for variables.
- *Questionnaire* collects data through questions, which are either quantifying data (closed, alternative questions) or qualifying data (open and reviewing questions).
- *Case Study* is an in-depth analysis of a single or small number of participants. The case study data colletion method is used with the case study research method.

- *Observations*, ethnograpy and participation, observe behaviour with focus on situations (participation) and culture (ethnograpy).
- *Interviews*, structured, semi-structured, and unstructured, give an deep understanding of a problem and capture participants' point of view.
- *Language and Text* are used for interpreting discourse and conversations, and meanings in texts and documents.

3.7 Data Analysis Methods

The data analysis methods are used to analyse the collected material. It is the process of inspecting, cleaning, transforming and modelling data. It supports decision-making and drawing conclusions.

The most commonly used data analysis methods for quantative research are Statistics, and Computational Mathematics and for qualitative research, the most commonly used are Coding, Analytic Induction, Grounded Theory, Narrative Analysis, Hermeneutic, and Semiotic.
- *Statistics*, descriptive and inferenctial statistics, is used to analyse data [13]. This includes calculating results for a population (or sample), as well as, evaluating the significance of the results.
- *Computational Mathematics* is used for calculating numerical methods, modelling and simlauations with an emphasize on algorithms, numerical methods, and symbolic methods.
- *Coding* analyses transcriptions of interviews and observations by turning qualitative data into quantitative data. Coding is naming and labelling concepts and strategies to numerate these concepts and strategies and apply statistics.
- *Analytic Induction* and *Grounded Theory* are iterative methods, that alternate between collections and analyses. The iterations continue until no cases dismiss the hypothesis or theory. Analytic induction stops when the hypothesis and grounded theory ends with a validated theory.
- *Narrative Analysis* concerns literary discussion and analysis. *Hermeneutic* (meaning of text/text-analogue), and *Semiotic* (meaning of signs and symbols) are used for analysing texts and documents and can be used to support traceability in requirements and interfaces.

3.8 Quality Assurance

Quality assurance is the validation and verification of the research material. The quantiative research, with a deductive approach, must apply and discuss validity, reliability, replicability and ethics [13; 14]. The qualitative research, with an inductive approach, must apply and discuss validity, dependability, confirmability, transferability and ethics [11]. Shortly, these terms mean:
- *validity*, in quantative research, makes sure that the test instruments actually are measuring what is expected to be mesured [7; 14].
- *reliability* refers to stability of the measurements [7] and is the consistency of the results for every testing.
- *replicability* is the possibiltiy, by another researcher, to repeat the same research and, hence, reach the same results

[4]. This requires well-described procedures to be used for the research.

- *ethics*, independent of quantative research or qualitative research, is the moral principles in planning, conducting and reporting results of research studies [11]. Ethics covers protection of participants, maintenance of privacy, avoiding coercion and having consent in written form, and treating material with confidentiality [13].

- *validity*, or trustworthiness, in qualitative research, makes sure that the research has been conducted according to existing rules [4]. Respondents can validate and confirm that the results are correctly understood.

- *dependability*, corresponds to reliability, and is the process of judging the correctness in conclusions, using auditing [11].

- *confirmability* confirms that the research has been performed in good faith without personal assessments that have affected the results [11].

- *transferability* is to create rich descriptions that can become a database for other researchers [11].

3.9   Contributions and results

The contributions and results present the whole research. The presentation of the research is a rigorous description of the theory of the research methods and methodologies. From this theoretic description, methods and methodologies chosen and applied to the research project. In the best of all worlds, the philosophical assumptions, the research methods and the research approaches are introduced and discussed early in the thesis. Then, the appliction of the research method and research strategies/designs are separately presented discussing pros en cons for each method and strategy/design. Data collection should also be presented separately, as well as, data analysis and quality assurance. The most important issue is to be fair to the collected material and not present conclusions, theories or artifacts that lack of foundations or evidences in the research work.

4   Conclusions and discussion

This paper provides a portal of research methods and methodologies that can be used to support the students to choose and apply the most suitable methods by showing the usages and, to some extent, the distinctions between the different methods. Although the paper distinguishes between methods, some of the qualitative methods can be used in quantative research and vice versa but, then, consequences of using the different methods need to be considered.

There are a lot of research methods and methodologies. Since, it is hard to cover all of them, the next step in the work, is to tune the portal and the description of the research methods and methodologies to better apply to the research in information and communication technology. It is also to give a better description of the processes and how different methods and methdologies, at different levels, complement each other better than others.

References

[1] Donald Ary, Lucy Cheser Jacobs, Chris Sorensen, and Asghar Razavieh. Introduction to Research in Education. Wadsworh, Cengage Learning, 8th edition, 2010

[2] Alan Bond. "Your Masters Thesis How to Plan, Draft, Write and Revise" Studymates Ltd, UK, 2006.

[3] Wayne Booth, Joseph M. Williams, Gregory G. Colomb. "The Craft of Research, 2nd edition, Guides to Writing, Editing and publishing." University Of Chicago Press; 1 edition, 2003.

[4] Alan Bryman, Emma Bell, Business Research Methods, Second edition. Oxford University Press, Inc. New York, 2007.

[5] Dewey and Dewey. Decimal Classification, "A Research Guide for students". Research, Writing, and Style Guides. MLA, APA, Chicago/Turabian, Harvard, CGOS, CBE), OCLC Online Computer Library Center, Inc, 1998. http://www.aresearchguide.com/styleguides.html

[6] Barry J. Fraser, Kenneth G. Tobin and Campbell J., McRobbie. Second International Handbook of Science Education. Springer Science, 2012.

[7] Pervez N. Ghauri, and Kjell Grønhaug. Research Methods in Business Studies (4th Edition), London: FT Pearson, 2010.

[8] Wayne Goddard and Stuart Melville. Research Methodology: An Introduction, Juta Academic, 2nd edition, 2004.

[9] Kim Kastens, Stephanie Pfirman, Martin Stute, Bill Hahn, Dallas Abbott, and Chris Scholz. "How to Write Your Thesis", 2009. http://www.ldeo.columbia.edu/~martins/sen_sem/thesis_org.html

[10] Rowena Murray. "How to Write a Thesis." Open University Press, 2006.

[11] Michael Myers. Qualitative research in Business and Management. SAGE Publication Inc. London, UK. 2009.

[12] Isadore Newman and Carolyn R. Benz. Qualitative-Quantitative Methodology: Exploring the interactive Continuum, 1998.

[13] Neil J. Salkind. Exploring research, 6th edition, Pearson International Edition. 2006.

[14] Mark Saunders, Philip Lewis and Adrian Thornhill, Research methods for business students. 5th edition, 2006.

[15] William Trochim, and James P. Donnelly. "The Research Methods Knowledge Base", 3rd Edition, 2007.

[16] Gina Wisker. The Postgraduate Research Handbook. Methodology. 2nd edition. Palgrave Macmillian, 2007.

[17] Justin Zobel. "Writing for computer science". Springer; 2nd edition, April 27, 2004.