

Research Methodologies in Computer Science

Anton Setzer*

Sunday 25th October, 2015, 14:22

This is a collection of notes I have accumulated regarding research methodologies, especially for the use of my project students. It is a document mainly directed for my students, and not an official document by the department of computer science.

1 Definition of Research Methodology

Definition (private communication by Markus Roggenbach)

The methodology is the general strategy that outlines the way in which the project is to be undertaken and, among other things, identifies the methods to be used in it.

2 List of Research Methodologies

- A good book (directed at Humanities) is [vPHZ12].
- [Ama15] lists as research methodologies the following: formal, experimental, build, process.
- [Wik15d] list under “See also” the following methodologies:
 - Action Research (good source: [Jär05]; Wikipedia: [Wik15a])
 - Design research (mentioned in [Jär05]),
 - Constructive Research (Wikipedia: [Wik15c]).
 - Participant Observation (Wikipedia: [Wik15f]).
 - Empirical Research (Wikipedia: [Wik15e]).
 - Case Study (Wikipedia [Wik15b]).
 - Design Science Research.

*Department of Computer Science, Swansea University, Singleton Park, Swansea SA2 8PP, UK, email: a.g.setzer@swan.ac.uk, WWW: <http://www.cs.swan.ac.uk/~csetzer/>, Tel: +44 1792 513368, Fax: +44 1792 295651.

- * Good source: [CLM15], Sect. 2, p. 4 - 6.
- * Other sources: Basekerville et. al. [BKS15], Vaishnavi/kuechler [VK15], Hevner et. al. [HMPR04] and Wikipedia entry [Wik15d].
- Sources about general scientific methods
 - Dodig-Crnkovic [DC02] is a good scientific article describing research methodologies in computer science.
 - Vera Goebel and Thomas Plagemann [GP15].
 - [HAH⁺06] is a scientific article, but more concerned about how to teach research methodologies.

3 Research Methodologies, especially suitable for student projects

- For student projects in developing of software the following are particularly suitable (others might be suitable as well):
 - Design Research
 - Action Research
 - Design Science Research
 - Case Study
 - Constructive Research.
- For HCI projects (private communication by Matt Jones)
 - Good source book [CC08]
 - User centred design
 - experimental studies
 - Ethnography
 - Participative design
 - Technology probes

References

- [Ama15] José Nelson Amaral. About computing science research methodology. With significant contributions from Michael Buro, Renee Elio, Jim Hoover, Ioanis Nikolaidis, Mohammad Salavatipour, Lorna Stewart, and Ken Wong. Available from <https://webdocs.cs.ualberta.ca/~c603/readings/research-methods.pdf>, retrieved 14 October 2015.

- [BKS15] Richard L Baskerville, Mala Kaul, and Veda C Storey. Genres of inquiry in design-science research: Justification and evaluation of knowledge production. *MIS Quarterly*, 39(3):541–564, 2015.
- [CC08] Paul Cairns and Anna L Cox. *Research methods for human-computer interaction*, volume 12. Cambridge University Press New York, NY, USA, 2008.
- [CLM15] Jacob Stenum Czepluch, Nikolaj Zangenberg Lollike, and Simon Oliver Malone. The use of block chain technology in different application domains. Bachelor Project in Software Development. The IT University of Copenhagen. Available from <http://lollike.org/bachelor.pdf>, 20 May 2015.
- [DC02] Gordana Dodig-Crnkovic. Scientific methods in computer science. In *Proceedings of the Conference for the Promotion of Research in IT at New Universities and at University Colleges in Sweden, Skövde, Sweden*, pages 126–130, 2002.
- [GP15] Vera Goebel and Thomas Plagemann. Research/scientific methods in Computer Science. Available from <http://www.uio.no/studier/emner/matnat/ifi/INF9970/h09/undervisningsmateriale/ResearchMethods-CS.pdf>, retrieved 14 October 2015.
- [HAH⁺06] Hilary J. Holz, Anne Applin, Bruria Haberman, Donald Joyce, Helen Purchase, and Catherine Reed. Research methods in computing: What are they, and how should we teach them? In *Working Group Reports on ITiCSE on Innovation and Technology in Computer Science Education*, ITiCSE-WGR '06, pages 96–114, New York, NY, USA, 2006. ACM.
- [HMPR04] Alan R. Hevner, Salvatore T. March, Jinsoo Park, and Sudha Ram. Design science in information systems research. *MIS Quarterly*, 28(1):pp. 75–105, March 2004.
- [Jär05] Pertti Järvinen. Action research as an approach in design science. Series of Publications D - Net Publications D-2005-2, University of Tampere, Department of Computer Science, May 2005. Available from <http://iris.nyit.edu/kkhoo/Spring2008/Topics/DS/DesignSc.ActionResearch-2005-2.pdf>.
- [VK15] Vijay Vaishnavi and Bill Kuechler. Design science research in information systems. Available from <http://desrist.org/desrist/content/design-science-research-in-information-systems.pdf>, last visited 14 Oct 2015.
- [vPHZ12] Willie van Peer, Frank Hakemulder, and Sonia Zyngier. *Scientific methods for the humanities*, volume 13. John Benjamins Publishing, 2012.

- [Wik15a] Wikipedia. Action research. Available from https://en.wikipedia.org/wiki/Action_research, retrieved 14 October 2015.
- [Wik15b] Wikipedia. Case study. Available from https://en.wikipedia.org/wiki/Case_study, retrieved 14 October 2015.
- [Wik15c] Wikipedia. Constructive research. Available from https://en.wikipedia.org/wiki/Constructive_research, retrieved 14 October 2015.
- [Wik15d] Wikipedia. Design science research. Available from https://en.wikipedia.org/wiki/Design_science_research, retrieved 14 October 2015.
- [Wik15e] Wikipedia. Emperical research. Available from https://en.wikipedia.org/wiki/Empirical_research, retrieved 14 October 2015.
- [Wik15f] Wikipedia. Participant observation. Available from https://en.wikipedia.org/wiki/Participant_observation, retrieved 14 October 2015.