

# Putting Software Testing Terminology to the Test

## M.A.Sc. Seminar

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# Table of Contents

## 1 Introduction

- The Need for Standardized Terminology
- The Lack of Standardized Terminology

## 2 Project

- Research Questions
- Methodology

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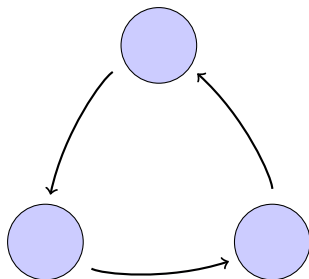
# The Need for Standardized Terminology

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If software engineering holds code to high standards of clarity, consistency, and robustness, the same should apply to its supporting literature!

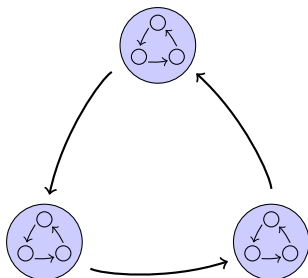
## Interorganizational

Schools, companies, etc.



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## Intraorganizational

Kaner et al. (2011, p. 7) say  
“complete testing” could require the  
tester to:

- discover “every bug”,
- exhaust the time allocated,
- implement every planned test,
- ...



# The Lack of Standardized Terminology

## “The Problem”

- Unfortunately, a search for a systematic, rigorous, and complete taxonomy for software testing revealed that the existing ones are inadequate:
  - Tebes et al. (2020) focus on *parts* of the testing process (e.g., test goal, testable entity),
  - Souza et al. (2017) prioritize organizing testing approaches over defining them, and
  - Unterkalmsteiner et al. (2014) focus on the “information linkage or transfer” (p. A:6) between requirements engineering and software testing.

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- Load testing is “conducted to evaluate the behaviour of a test item under anticipated conditions of varying load” (ISO/IEC and IEEE, 2022, p. 5; 2017, p. 253), such as:
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  - loads that are as large as possible (Patton, 2006, p. 86)

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“Okay testing team, we want to conduct alpha testing on our product. What’s our timeline? Budget? Sample size?”

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## Research Question 3

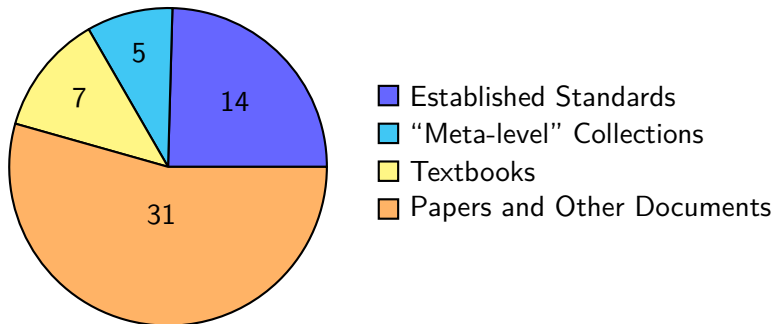
Is it possible to resolve/reduce any of these discrepancies systematically?

## Research Question 1

What testing approaches does the literature describe?

# Literature Review Time!

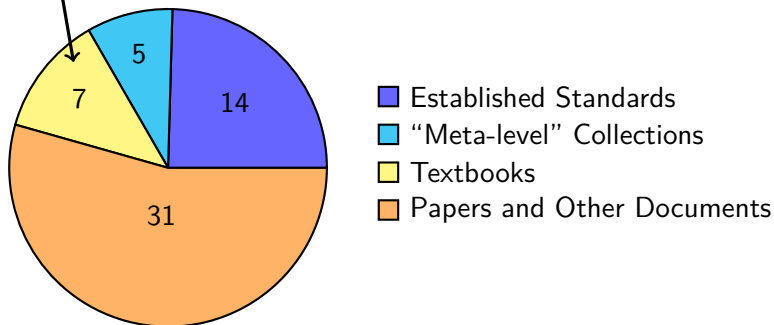
# Methodology: Sources



Summary of how many sources comprise each source category.

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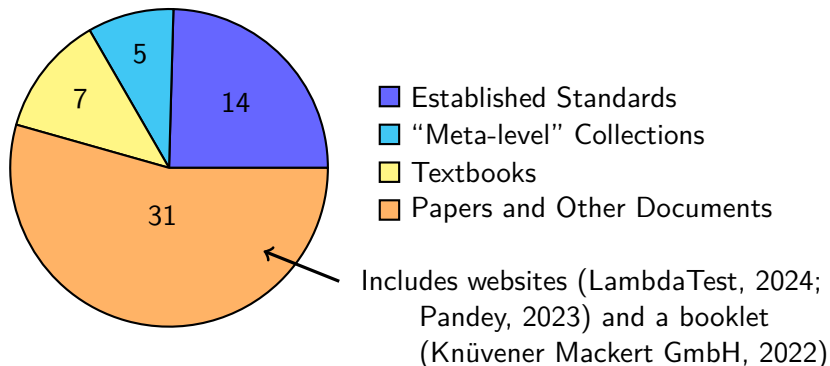
Textbooks trusted at McMaster were our ad hoc starting points  
(Patton, 2006; Peters and Pedrycz, 2000; van Vliet, 2000)



Summary of how many sources comprise each source category.



# Methodology: Sources

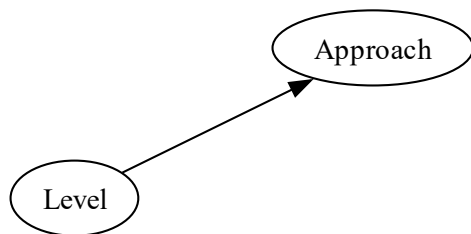


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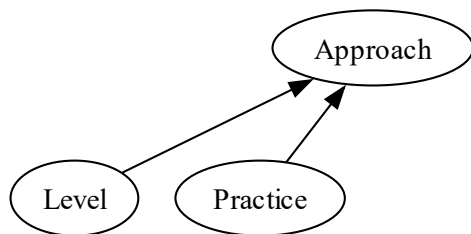
## Approach

**Approach:** a “high-level test implementation choice” (ISO/IEC and IEEE, 2022, p. 10) used to “pick the particular test case values” (2017, p. 465)

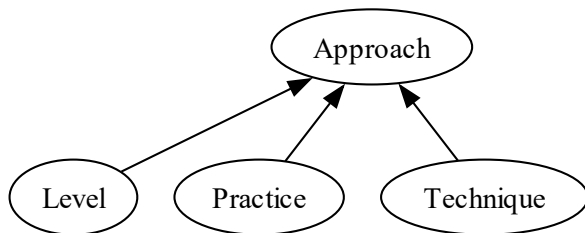
# Methodology: Categories



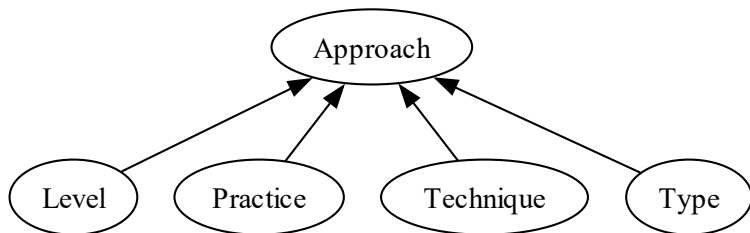
**Level:** a stage of testing with “particular objectives and . . . risks”, each performed in sequence (ISO/IEC and IEEE, 2022, p. 12; 2021, p. 6)



**Practice:** a “conceptual framework that can be applied to . . . [a] test process to facilitate testing” (ISO/IEC and IEEE, 2022, p. 14; 2017, p. 471)

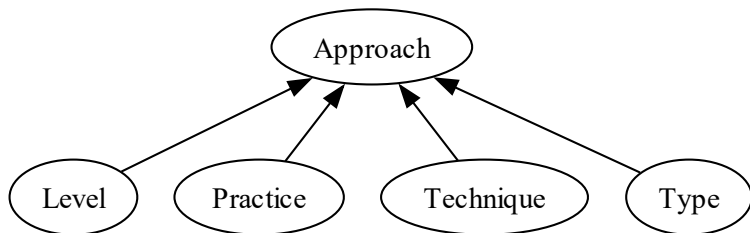


**Technique:** a “defined” and “systematic” (ISO/IEC and IEEE, 2017, p. 464) “procedure used to create or select a test model, identify test coverage items, and derive corresponding test cases” (2022, p. 11)



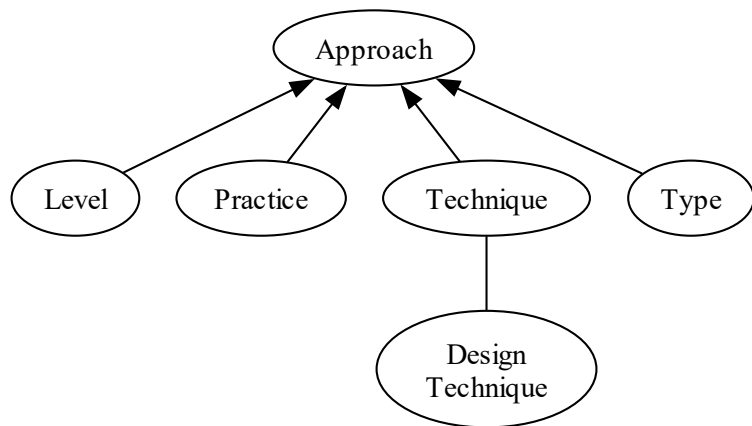
**Type:** “Testing that is focused on specific quality characteristics” (ISO/IEC and IEEE, 2022, p. 15; 2021, p. 7; 2017, p. 473)

# Methodology: Graph Notation



Arrows point from a *child* node to a *parent* node.

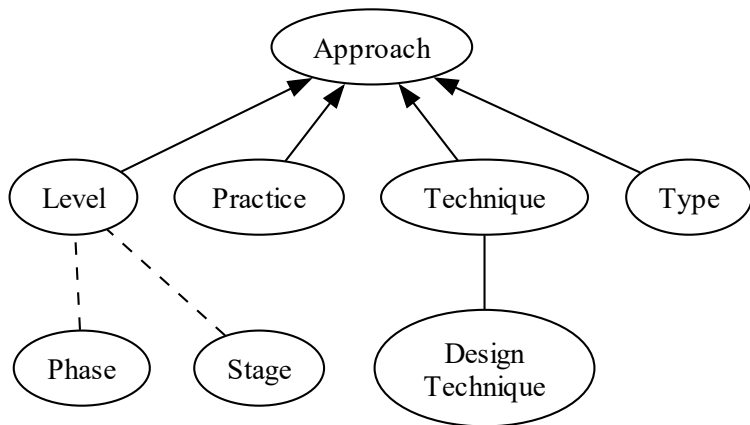
# Methodology: Graph Notation



Lines without arrowheads connect *synonyms*.



# Methodology: Graph Notation



Dashed lines indicate the relationship is *implied*.

# Methodology: Procedure

## Approaches

- A row is created for each test approach, such as the following which is based on (ISO/IEC and IEEE, 2022)

Name	Category	Definition	Parent(s)	Synonym(s)
A/B Testing	Practice (p. 22)	Testing “that allows testers to determine which of two systems or components performs better” (p. 1)	Statistical Testing (pp. 1, 35), ...	Split-Run Testing (pp. 1, 35)

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- This information is gathered from sources by looking for
  - Glossaries
  - Testing-related terms
  - Terms described *by* other approaches
  - Terms that *imply* other approaches

- It seems that the existence of a software quality implies the existence of a test type associated with it

# Methodology: Procedure

## Other Information

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- Some test approaches use shared or complicated terminology

- It seems that the existence of a software quality implies the existence of a test type associated with it
- Some test approaches use shared or complicated terminology
- For each of these, we record its
  - Name
  - Definition
  - Precedence for a related test type (only for qualities)
  - Synonym(s)

# Acknowledgment

- Dr. Smith and Dr. Carette have been great supervisors in the past and have, both then and now, provided me with valuable guidance and feedback
  - They have helped me refine the scope of this project
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- The past and current Drasil team have created a truly amazing framework!

Thank you!  
Questions?

# References I

- Matthias Hamburg and Gary Mogyorodi, editors. ISTQB Glossary, v4.3, 2024. URL [https://glossary.istqb.org/en\\_US/search](https://glossary.istqb.org/en_US/search).
- ISO/IEC and IEEE. ISO/IEC/IEEE International Standard - Systems and software engineering–Vocabulary. *ISO/IEC/IEEE 24765:2017(E)*, September 2017. doi: 10.1109/IEEESTD.2017.8016712.
- ISO/IEC and IEEE. ISO/IEC/IEEE International Standard - Software and systems engineering –Software testing –Part 4: Test techniques. *ISO/IEC/IEEE 29119-4:2021(E)*, October 2021. doi: 10.1109/IEEESTD.2021.9591574.
- ISO/IEC and IEEE. ISO/IEC/IEEE International Standard - Systems and software engineering –Software testing –Part 1: General concepts. *ISO/IEC/IEEE 29119-1:2022(E)*, January 2022. doi: 10.1109/IEEESTD.2022.9698145.

# References II

- Cem Kaner, James Bach, and Bret Pettichord. *Lessons Learned in Software Testing: A Context-Driven Approach*. John Wiley & Sons, December 2011. ISBN 978-0-471-08112-8. URL <https://www.wiley.com/en-ca/Lessons+Learned+in+Software+Testing%3A+A+Context-Driven+Approach-p-9780471081128>.
- Knüvener Mackert GmbH. *Knüvener Mackert SPICE Guide*. Knüvener Mackert GmbH, Reutlingen, Germany, 7th edition, 2022. ISBN 978-3-00-061926-7. URL <https://knuevenermackert.com/wp-content/uploads/2021/06/SPICE-BOOKLET-2022-05.pdf>.
- LambdaTest. What is Operational Testing: Quick Guide With Examples, 2024. URL <https://www.lambdatest.com/learning-hub/operational-testing>.
- Pranav Pandey. Scalability vs Elasticity, February 2023. URL <https://www.linkedin.com/pulse/scalability-vs-elasticity-pranav-pandey/>.

# References III

- Ron Patton. *Software Testing*. Sams Publishing, Indianapolis, IN, USA, 2nd edition, 2006. ISBN 0-672-32798-8.
- J.F. Peters and W. Pedrycz. *Software Engineering: An Engineering Approach*. Worldwide series in computer science. John Wiley & Sons, Ltd., 2000. ISBN 978-0-471-18964-0.
- Erica Souza, Ricardo Falbo, and Nandamudi Vijaykumar. ROoST: Reference Ontology on Software Testing. *Applied Ontology*, 12:1–32, March 2017. doi: 10.3233/AO-170177.
- Guido Tebes, Luis Olsina, Denis Peppino, and Pablo Becker. TestTDO: A Top-Domain Software Testing Ontology. pages 364–377, Curitiba, Brazil, May 2020. ISBN 978-1-71381-853-3.

# References IV

- Michael Unterkalmsteiner, Robert Feldt, and Tony Gorschek. A Taxonomy for Requirements Engineering and Software Test Alignment. *ACM Transactions on Software Engineering and Methodology*, 23(2):1–38, March 2014. ISSN 1049-331X, 1557-7392. doi: 10.1145/2523088. URL <http://arxiv.org/abs/2307.12477>. arXiv:2307.12477 [cs].
- Hans van Vliet. *Software Engineering: Principles and Practice*. John Wiley & Sons, Ltd., Chichester, England, 2nd edition, 2000. ISBN 0-471-97508-7.
- Hironori Washizaki, editor. *Guide to the Software Engineering Body of Knowledge, Version 4.0*. January 2024. URL <https://waseda.app.box.com/v/SWEBOK4-book>.