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| **Ref No.** | **Title & Year** | **Authors** | **Methodology** | **Benefits** | **Limitations** |
| 1 | **A Comparative Study of Exploratory Testing and Scripted Testing in Terms of Defect Detection (2022)** | Usman, M. et al. | Empirical experiment comparing ET & ST for defect detection. | • Finds more critical defects.• Adapts to unexpected issues. | • ST less adaptive.• Misses unknown bugs. |
| 2 | **Exploratory Testing in Agile Software Development: A Comparative Study with Scripted Testing (2022)** | Ghafari, M. et al. | Case study in Agile teams. | • Fits well with Agile cycles.• Provides faster feedback. | • Needs experienced testers.• Low traceability. |
| 3 | **Combining Scripted and Exploratory Testing for Better Software Quality (2023)** | Itkonen, R. et al. | Interviews + defect analysis of hybrid method. | • Improves coverage.• Boosts bug detection. | • Difficult to coordinate.• Risk of duplicate effort. |
| 4 | **Effectiveness of Exploratory Testing Compared to Scripted Testing in Real-Time Applications (2023)** | Sharma, A. et al. | Controlled experiment on real-time modules. | • Adapts to UI changes.• Handles dynamic inputs. | • Less repeatable.• Hard to validate results. |
| 5 | **Test Efficiency Analysis: Exploratory vs Scripted Testing for Web Applications (2024)** | Iyer, S. et al. | Quantitative study on web modules. | • Finds more UI/UX defects.• Improves user-facing quality. | • ST better for regression.• ST better for compliance. |
| 6 | **Software Exploratory Testing: Present, Problem and Prospect (2021)** | Jiujiu Yu, Jishan Zhang, Liqiong Pan, Yun Chen, Ning Wu, Wenling Sun | Literature review + Agile challenge analysis. | • Summarizes ET globally.• Identifies Agile-specific issues.• Suggests automation & documentation improvements. | • No experimental validation. |
| 7 | **Scripted and Scriptless GUI Testing for Web Applications: An Industrial Case (2023)** | Axel Bons, Beatriz Marín, Pekka Aho, Tanja E.J. Vos | Industrial case study comparing scripted vs scriptless GUI tools. | • Scripted better for process bugs.• Scriptless better for UI issues & coverage.• Complement each other. | • Only 2 tools tested.• Limited domain applicability. |
| 8 | **Fostering the Diversity of Exploratory Testing in Web Applications (2022)** | Julien Leveau, Xavier Blanc, Laurent Réveillère, Jean-Rémy Falleri, Romain Rouvoy | Browser extension + n-gram model to guide testers. | • Increases test diversity.• Avoids repetitive loops. | • Focused on web apps.• Depends on tester following suggestions. |
| 9 | **Enhancing Exploratory Testing by Large Language Model and Knowledge Graph (2024)** | Yanqi Su, Dianshu Liao, Zhenchang Xing, Qing Huang, Mulong Xie, Qinghua Lu, Xiwei Xu | Combines LLM reasoning with System KG to create test scenarios. | • Handles poor-quality bug reports.• Generates realistic scenarios.• Improves bug detection. | • Needs advanced LLMs.• Privacy & cost concerns. |
| 10 | **Automated Web Application Testing Driven by Pre-recorded Test Cases (2022)** | Nezih Sunman, Yiğit Soydan, Hasan Sözer | Semi-automated crawling using exploratory recordings. | • Reduces crawl time.• Minimal setup required. | • Slight coverage loss.• Dependent on recording quality. |
| 11 | **Towards a Hybrid Testing Process Unifying Exploratory Testing and Scripted Testing (2012)** | Syed M.A. Shah, Cigdem Gencel, Usman S. Alvi, Kai Petersen | Literature review + interviews + method engineering. | • Merges ET flexibility with ST structure.• Improves risk management.• Better defect detection. | • Skill-dependent.• ET repeatability issue remains. |
| 12 | **Levels of Exploration in Exploratory Testing: From Freestyle to Fully Scripted (2018)** | Ahmad Nauman Ghazi; Kai Petersen; Elizabeth Bjarnason; Per Runeson | Literature review + checklist-based analysis; designed a 5-level classification of ET; evaluated via focus groups & survey; qualitative analysis. | • Provides 5-level ET scale from freestyle to fully scripted.• Offers reusable test-charter templates.• Identifies key factors (defects, effort, traceability).• Encourages mixing levels for balanced benefits. | • Limited to 4 Swedish companies.• Not all participants had experience with every level.• High-exploration levels reduce traceability.• Needs more quantitative validation. |
| 13 | **Testing Competence: Scripted Testing Versus Exploratory Testing (2014)** | Vandna Dahiya | Manual C programming test comparison of ET & ST. | • ST offers planning & predictability.• ET encourages creativity.• ET finds bugs faster. | • ST is rigid.• ET lacks documentation & tracking. |
| 14 | **Comparing a Hybrid Testing Process with Scripted and Exploratory Testing: An Experimental Study with Practitioners (2014)** | Syed M.A. Shah, Usman S. Alvi, Cigdem Gencel, Kai Petersen | Experimental comparison of ET, ST, and Hybrid on seeded defects. | • Hybrid balances coverage & flexibility.• ET highest bug detection. | • Hybrid less effective than ET in some cases.• Experience-dependent. |
| 15 | **Evaluating the Effectiveness of Exploratory Testing in Industrial Practice (2013)** | Majid Iqbal, Ali Shah, Kai Petersen, Cigdem Gencel, Usman S. Alvi | Industrial comparison of ET and ST measuring DDE & coverage. | • ET finds critical defects.• ST ensures coverage & compliance. | • ET has lower coverage.• ST has lower detection rate. |

**Research Gaps**

1. **No practical, widely adopted framework** that merges ET’s adaptability and bug-finding ability with ST’s structure and coverage without adding overhead or depending heavily on expert testers.
2. **Automation support for ET is limited** — existing tools are experimental and lack large-scale industrial validation.
3. **Coverage vs defect detection trade-off** remains unresolved; no approach achieves both high coverage and high DDE efficiently.
4. **Traceability and documentation issues** in ET persist, with few lightweight solutions that don’t hinder its flexibility.
5. **AI-enhanced ET approaches** show promise but face privacy, cost, and lack of standard benchmarking for evaluation.

**Filtration criteria:**

**Inclusion Criteria**

* **Year Range:** 2012–2024
* **Sources:** IEEE, ACM, Elsevier, Wiley, peer-reviewed conferences/journals
* **Focus:** ET, ST, or Hybrid ET+ST (comparisons or enhancements)
* **Study Types:** Experiments, case studies, surveys, literature reviews
* **Language:** English

**Exclusion Criteria**

* Published before 2012 or after 2024
* Non-peer-reviewed or non-research content
* No focus on ET/ST methods
* Automation-only studies without ET/ST link
* Non-English papers
* Duplicate studies