

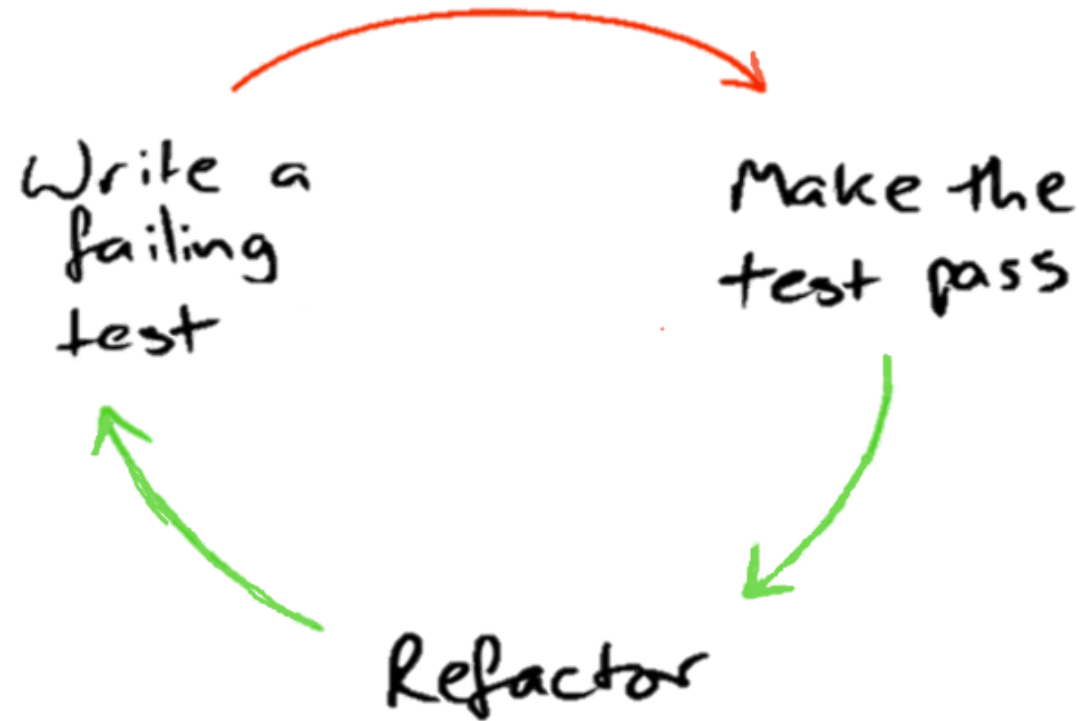
Understanding the Dynamics of Test-driven Development

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TEST-DRIVEN DEVELOPMENT (TDD)

The main goal of this work is studying some of the factors that play a role when assessing TDD effects



This will benefit the *adoption* and *adaption* of TDD by the industry

PROBLEMS

- Effects of Test-driven development not well understood
- Many studies (experiments) but few replications
- Process conformance reported as one of the main issue
- The TDD process (and process conformance) might change according to the context
- Knowledge transfer back to the industry/practitioners world

SOLUTIONS

- Replicate existing experiments to support / create knowledge
- Include process conformance in the study design
- Consider the context (development task) in which TDD is used
- Create guidelines for industry/practitioners to adopt TDD

RESEARCH QUESTION I

How the level of process conformance to TDD impacts its effects on:

- External code quality
- Developers productivity

RQI – PRELIMINARY RESULTS

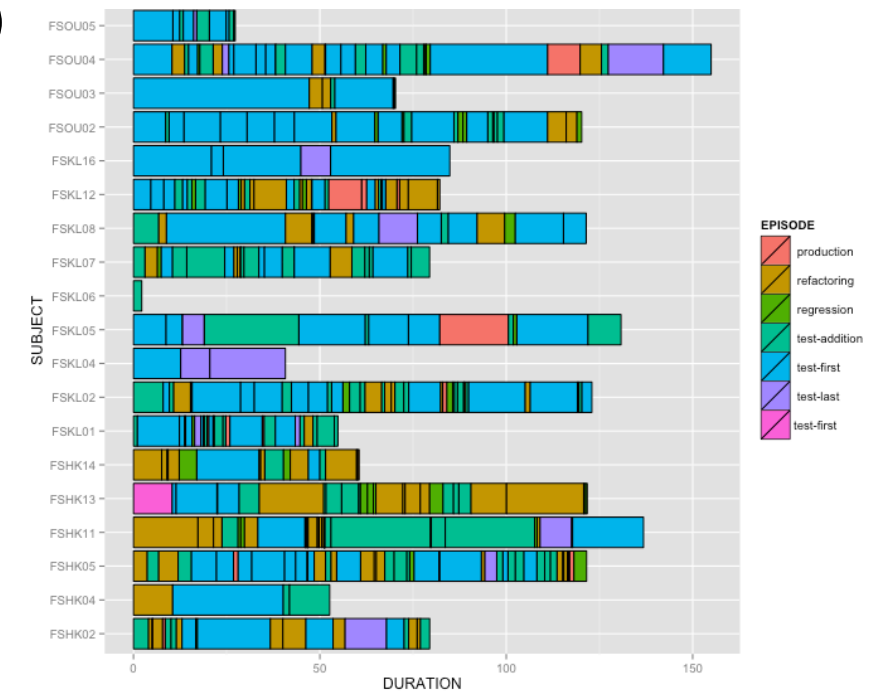
- Two *close* experiment replications:
 - Same task, duration, training, subject's background
 - Different sample size (18 vs. 22)
- Experiment 1:
 - Process conformance and external quality are *weakly* correlated
 - No impact of conformance on productivity
- Experiment 2:
 - No correlations (or valid regression model) at all

RQI – RESEARCH IDEA

What makes a TDD development session a good TDD development session?

- It's fine grained (5-10 minutes per cycle)
- It's uniform (approx. same cycle duration)
- It's sequenced (cycles follow red-green-refactor)

A better TDD process conformance model!
(based on data from industrial experiment)



RESEARCH QUESTION 2

What type of task* is better suited for TDD in terms of:

- Software external quality
- Developers' productivity

**Type of task*

- *Algorithmically oriented*
- *Architecturally oriented*
- *Bugfix*

RQ2 - CHALLENGES

It might be difficult to access and compare data for the three task types:

- Use open source codebases (e.g.; GitHub)
- Partially reuse data collected for RQ1
- Use comparative case study rather than (quasi-)experiments

CONTRIBUTION

Academia

- Creation of new evidence about the value of TDD
- Build a conformance model to be implemented in future TDD studies

Industry

- Creation of guidelines regarding the adoption of TDD

PROGRESS

Empir Software Eng
DOI 10.1007/s10664-013-9259-7

On the role of tests in test-driven development: a differentiated and partial replication

Davide Fucci · Burak Turhan

A Replicated Experiment on the Effectiveness of Test-first Development

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Abstract *Background:* Test

Factors Impacting Test-driven Development: Results from an Enhanced Replication

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ABSTRACT
Background: Test-driven development (TDD) is an iterative software development technique where unit-tests are defined before production code. The proponents of TDD claim that it improves both external quality and developers' productivity. In particular, Erdogmus et al. (i.e., original study) proposed a two-stage model to investigate these claims regarding TDD's effects.
Goal: Our aim is to enhance the model proposed in the original study by investigating two additional factors that can

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try to verify or refute the claims. have been inconclusive so far [3], on the analysis of tests as a factor med effects. The role of tests has g the previous investigations of TF e work of Erdogmus et al. [5], in is used to predict external quality the number of tests and the test- re the main differentiating points sical development practices [5]. In *lose replication* [6], also refered of Erdogmus et al.'s experiment, ndy. Through this replication we

Impact of Process Conformance on the Effects of Test-driven Development

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ABSTRACT
Background: One limitation of the empirical studies about test-driven development (TDD) is knowing whether the developers followed the advocated test-code-refactor cycle. Research dealt with the issue of process conformance only in terms of internal validity, while investigating the role of other confounding variables that might explain the controversial effects of TDD. None of the research included process conformance as a fundamental part of the analysis.
Goal: We aim to examine the impact of process conformance on the claimed effects of TDD on external quality, developers' productivity and test quality.
Method: We used data collected during a previous study to

workflow, being counterintuitive and costly to implement [1, 6, 22].
TDD is based on the fast and short iteration of three phases [4]:
1. Create a unit-test for a functionality that has not been implemented.
2. Develop the necessary code to make the test pass.
3. Internally improve the code base through refactoring [13].
The need for upfront design is set aside and the unit-tests drive the design and implementation decisions. Hence, TDD should also be considered a design technique that produces a test suite as a by-product, rather than a testing technique [15].

Four peer-reviewed papers:

- Replication of controlled experiment (no conformance)
- Two addressing specifically RQ1
- None addressing RQ2

A third paper addressing RQ1 is under preparation

Towards a Model for Assessing Process Conformance in TDD Experiments

PLANNING

3Q-2014

- Finalizing material regarding RQ1

4Q-2014

- Data collection for RQ2

1Q-2015

- Data analysis for RQ2
- Publication(s) for RQ2

2Q-2015

- Publication(s) for RQ2
- Dissertation draft

Q&A

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PROGRESS (I)

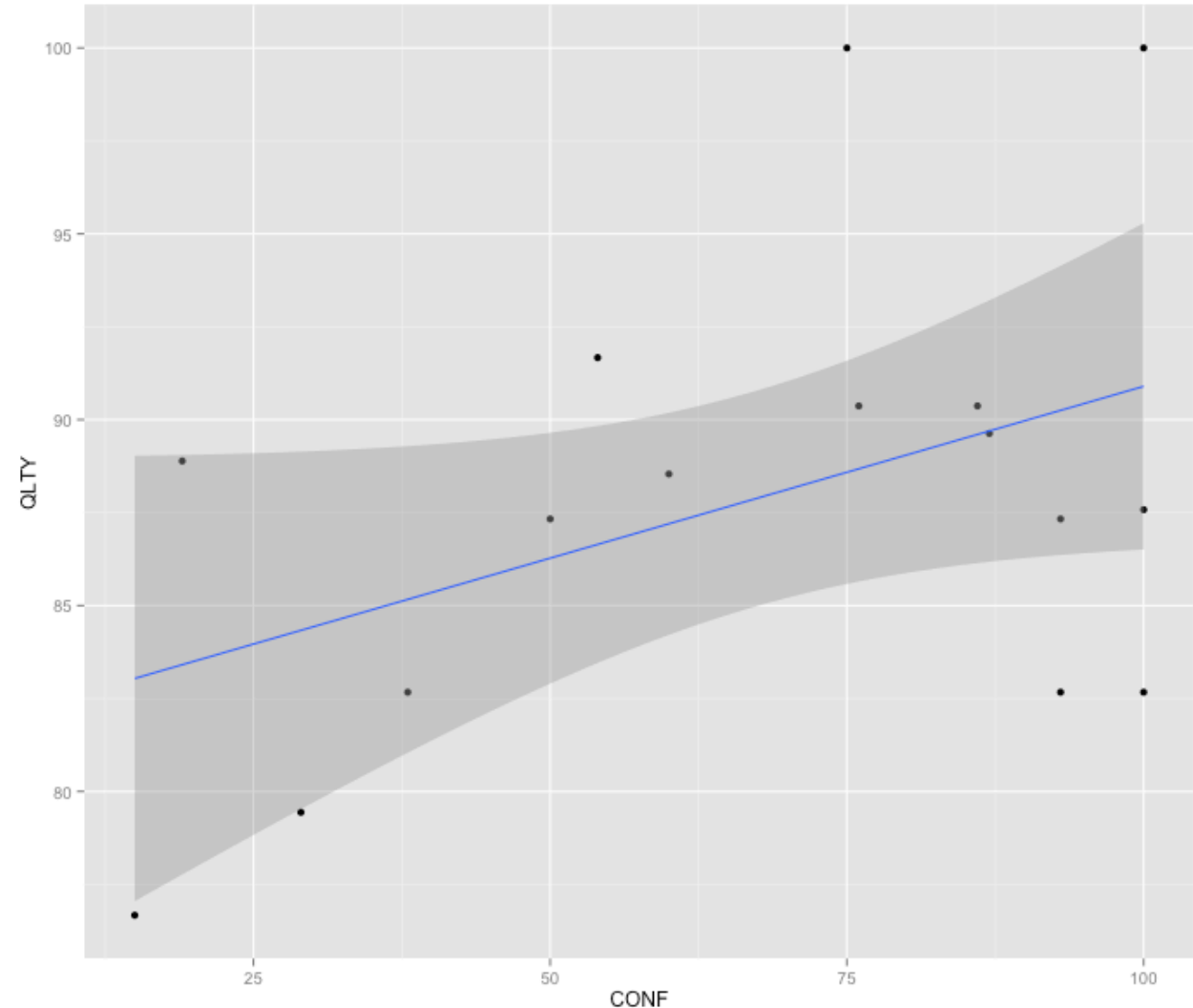
Are process conformance and external quality linearly correlated?

$$H_0: QLTY = \alpha + \beta \times CONF; \beta = 0$$

$$H_1: QLTY = \alpha + \beta \times CONF; \beta \neq 0$$



(R-squared = 0.14)

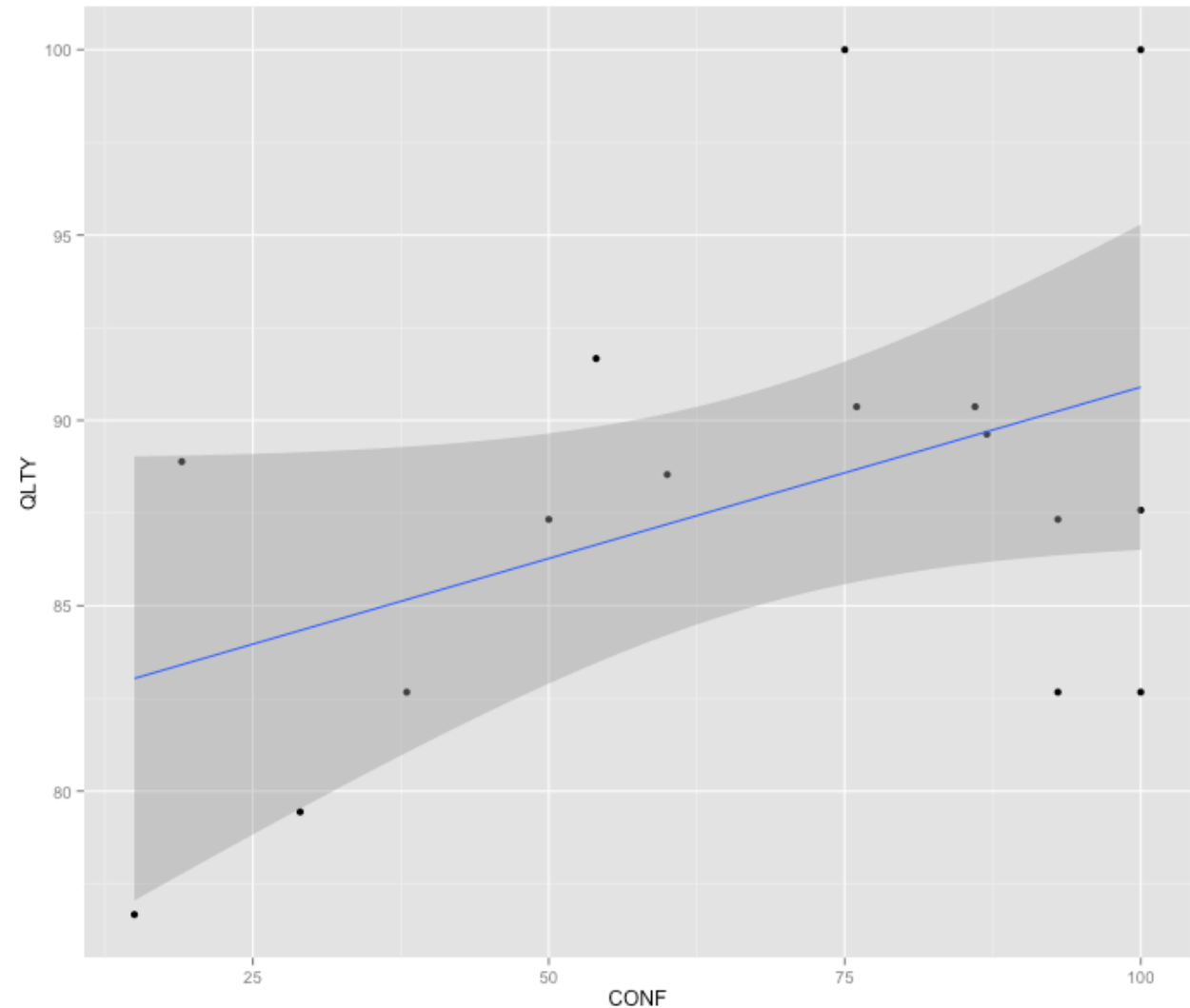


PROGRESS (I)

Are process conformance and developers' productivity linearly correlated?

$$H_0: \text{PROD} = \alpha + \beta \times \text{CONF}; \beta = 0$$

$$H_1: \text{PROD} = \alpha + \beta \times \text{CONF}; \beta \neq 0$$

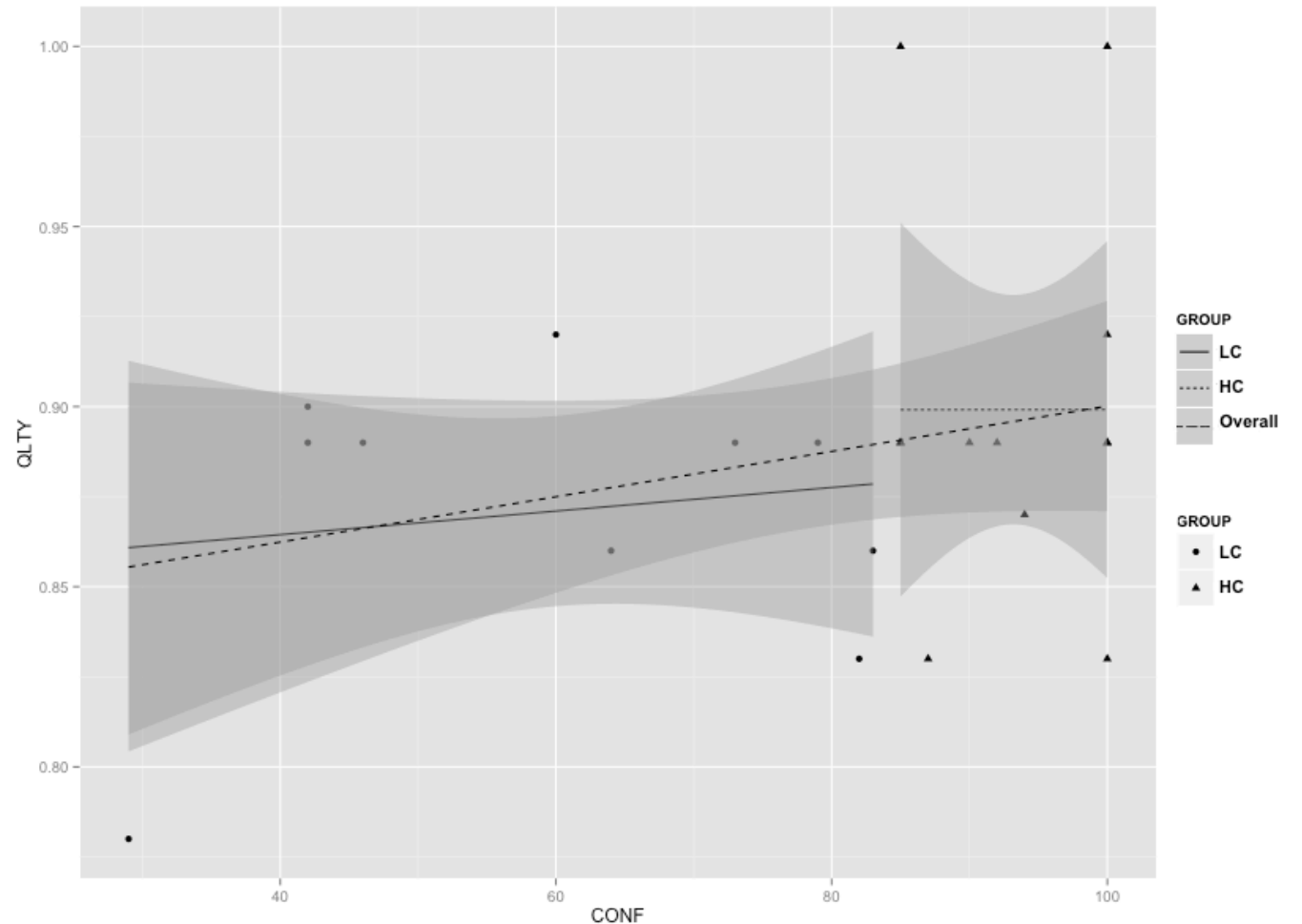


PROGRESS (2)

Are process conformance and external quality linearly correlated?
(when considering high and low conformant separately?)

$$H_0: QLTY = \alpha + \beta \times CONF; \beta = 0$$

$$H_1: QLTY = \alpha + \beta \times CONF; \beta \neq 0$$

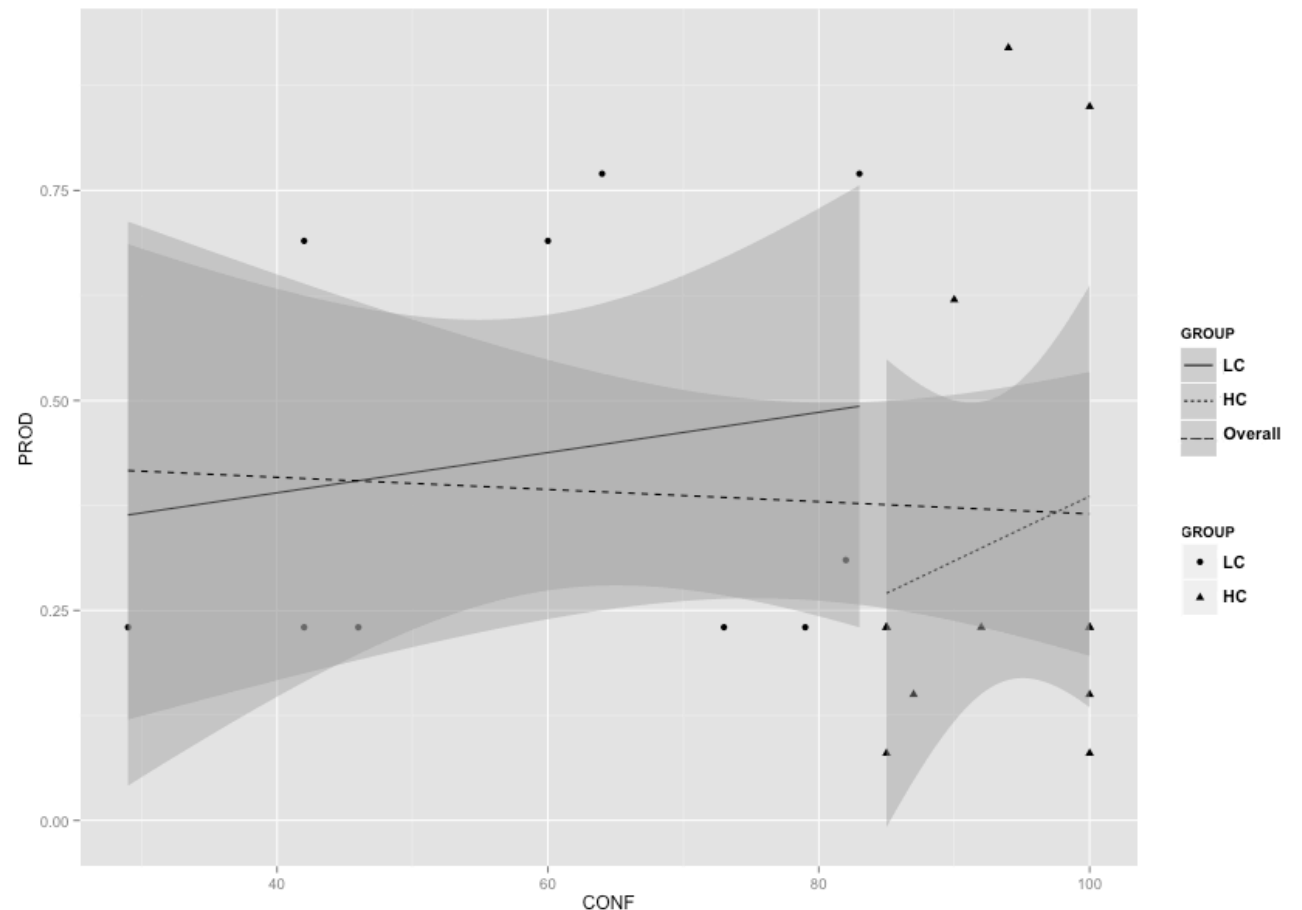


PROGRESS (2)

Are process conformance and developers' productivity linearly correlated?
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METRICS

- TEST = unit-tests per minute
- PROD = delivered user stories per minute
- QLTY = sum of external quality of each user story
 - User-story quality = % of passing acceptance tests
- CONF = % of development events categorized as TDD

