

Programmer Experience vs Code Quality: A Systematic Literature Review

Federal University of Minas Gerais

Jefferson G. M. Lopes
Eduardo Figueiredo

- 1) Recap - MSc research
- 2) Systematic Literature Review
- 3) Results
- 4) Discussion

Recap - MSc research

Recap - MSc research

Workana

workana Freelancers Jobs How it works Business Register Sign in Post a project

5 ★★★★★
4+ ★★★★★
3+ ★★★★★

Projects completed
All 1 - 10 +10

Hourly rate
USD 7 USD 40

Verified freelancers
All Verified only

J. P.
Full Stack Developer
Singapore
Hourly rate: **USD 25.00**
Completed projects: 0
Hours worked in hourly projects: 0

I'm an experienced software developer with over 6 years of experience in frontend && backend development, primarily using C# (ASP), Django (framework), Flutter, React Native, Angular, React, Node, PHP as my main weapons. I'm capable of developing Frontends && Backends for c ... [View more](#)

Django (3 to 5 years) React.js (3 to 5 years) PHP (3 to 5 years)

Gabriel G.
Full Stack Developer
Singapore
Hourly rate: **USD 30.00**
Completed projects: 7
Hours worked in hourly projects: 0

Programming or scripting languages :
- HTML5 for general web content
- Javascript/Jquery/Bootstrap/AJAX for handling web events and dynamic web content
- CSS for HTML element properties customization, i.e. customize look and feel
- PHP and Wordpress environment for CMS. ... [View more](#)

WordPress (+10 years) PHP (+10 years) WooCommerce (+10 years) [View more](#)

Cross-validation

Workana

Skills

Skills	Certifications	Projects worked	Experience years
PHP		14 projects	1 year
MySQL		9 projects	1 year
HTML5		8 projects	1 year
WordPress		8 projects	1 year
JavaScript		7 projects	1 year
Bootstrap		1 project	1 year
E-commerce		1 project	1 year


GitHub

The screenshot shows a GitHub repository page with a search bar at the top. Below the search bar, there are filters for 'Type', 'Language', and 'Sort'. A dropdown menu for 'Language' is open, showing options: All (checked), JavaScript, Vue, Python, C++, Dart, HTML, and Java. The repository list includes:

- Business-Management-System** (Public): Enterprise management system based on <https://github.com/thiagopena/djangoSIGE> with interface enhancements, new features and optimizations.
 JavaScript 1 star 5 forks Updated last month
- Institutional-Website** (Public): Institutional website for sales of mattresses and armchairs.
 Vue Updated on Jan 5
- Monty-Hall-Problem** (Public):
 Vue Updated on Jan 4
- Calculator** (Public): Calculator developed with Vue framework.
 Vue Updated on Jan 4
- Domain-Generator** (Public): Project of a domain generator using Vue.js, GraphQL and Node

Recap - MSc research

From Workana to Github

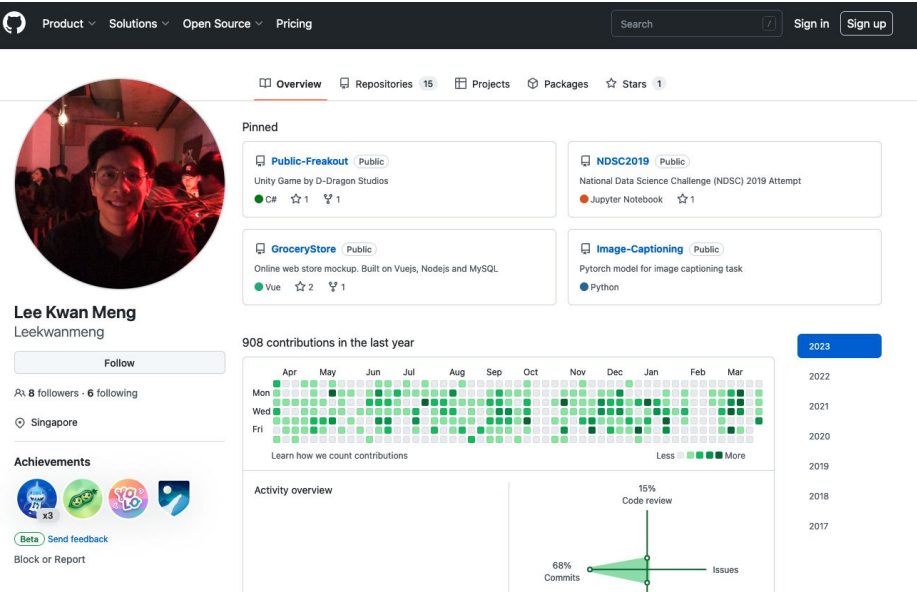
 **K. M.**
Software developer, building microservices
1 ★★★★★ Singapore

Hire

Completed projects: 0
Hours worked in hourly projects: 0

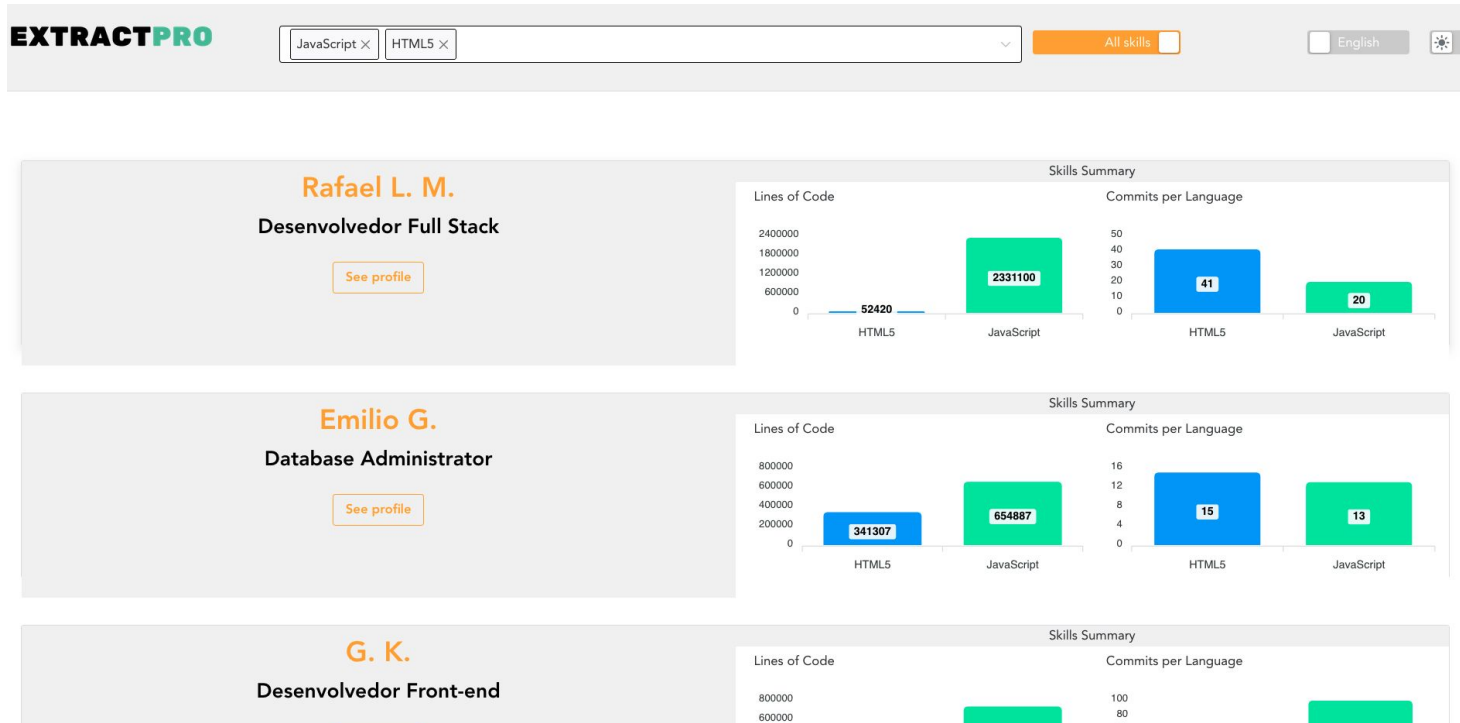
Interested in taking on software development projects. Able to learn new languages and frameworks quickly to build products. Some of my projects can be seen here <https://github.com/Leekwanmeng>

JavaScript Python Java



The screenshot shows the GitHub profile of Lee Kwan Meng. At the top, there are navigation links for Product, Solutions, Open Source, and Pricing, along with a search bar and Sign in/Sign up buttons. The profile header includes the name 'Lee Kwan Meng' and 'Leekwanmeng', a 'Follow' button, and statistics: '8 followers · 6 following' and 'Singapore'. Below this are 'Achievements' for GitHub 42x3, 500, and YoYo, and a 'Beta Send feedback' button. The main content area is titled 'Overview' and features a 'Pinned' section with four repositories: 'Public-Freakout' (Unity Game by D-Dragon Studios, C#, 1 star, 1 fork), 'NDSC2019' (National Data Science Challenge (NDSC) 2019 Attempt, Jupyter Notebook, 1 star), 'GroceryStore' (Online web store mockup. Built on Vue.js, Node.js and MySQL, Vue, 2 stars, 1 fork), and 'Image-Captioning' (Pytorch model for image captioning task, Python). Below the pinned repositories is a '908 contributions in the last year' heatmap showing activity from April to March 2023. The heatmap shows consistent activity throughout the year. To the right of the heatmap is a vertical timeline of years from 2023 to 2017. At the bottom, there is an 'Activity overview' section with a gauge chart showing '68% Commits' and '15% Code review'.

Recap - MSc research



Recap - MSc research

Developer Details

EXTRACTPRO

Emilio G.

Database Administrator

English



Statistics

Identified Languages

(Data extracted from Workana and Github repository mining)

JavaScript HTML5 PHP SQL Python

Total of Analyzed Repositories

(Data extracted from Github profile)

18

LOC Total

(Data extracted from Github repository mining)

1,348,998

Total of Identified Commits

(Data extracted from Github repository mining)

187

Sources

GitHub

Visit

WORKANA

Visit

Charts

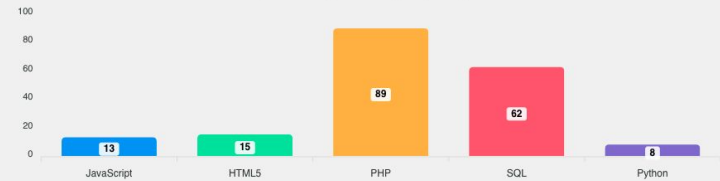
LOC

(Data extracted from Github repository mining)



Commits

(Data extracted from Github repository mining)



Master's research questions:

We have found a way to link a developer's self-declared skills with their portfolio. So what more can we do with that?

- RQ1: Exists a convergence between self-declared skills with software quality metrics?
- RQ2: Exists a software quality metric, or set of metrics, that better represents the self-declared skills?

Related works:

- Dieste et al. : there is little correlation between experience and external software quality. Research group: about 100 ppl
- Askar et al. : there is a positive correlation between student's experience and efficiency (external software quality). Research group: about 200 ppl

There are more works in the field, but with conflicting results.

What we will do differently:

- Explore a larger set of languages, not only Java;
- Mass extraction of user profiles, larger N;
- More self-declared parameters;

Systematic Literature Review

Developer's experience is a key self-declared metric that we have available.

- What the literature defines as “experience” in this context?
- And what about quality?
- They can be related somehow? Or there's really no consensus?

Systematic Literature Review

Objective: Do developer experience influences code quality?

Research questions:

- RQ1: How the developer experience is evaluated?
- RQ2: How the software quality is evaluated?
- RQ3: How the developer experience affects code quality?

Study Design

Searched Databases:

- IEEE Xplore;
- arXiv;
- ACM Digital Library;
- Springer;

Study Design

Some of the searched terms:

- developer experience AND code quality
- "years of experience" software quality
- impact of programming experience on code quality
- programming experience effect on software defects
- senior developer competencies AND software reliability
- impact of programming experience on software defects
- .
- .
- .

Study Design

Inclusion criteria:

- Study has to investigate the relationship between developer's experience AND code quality;
- Empirical research, published in a conference or journal;
- Clearly defined methodology;

Study Design

Exclusion criteria:

- Gray literature;
- Purely theoretical frameworks;
- Publication year before 1999;

Study Design

Triage:

- Read abstract, conclusion and perform a visual scan of the paper looking for keywords;
- Exclude studies that clearly don't meet the criteria;

Evaluation:

- For the papers that passed through the triage phase, read the full text;
- Include or exclude studies at this point;

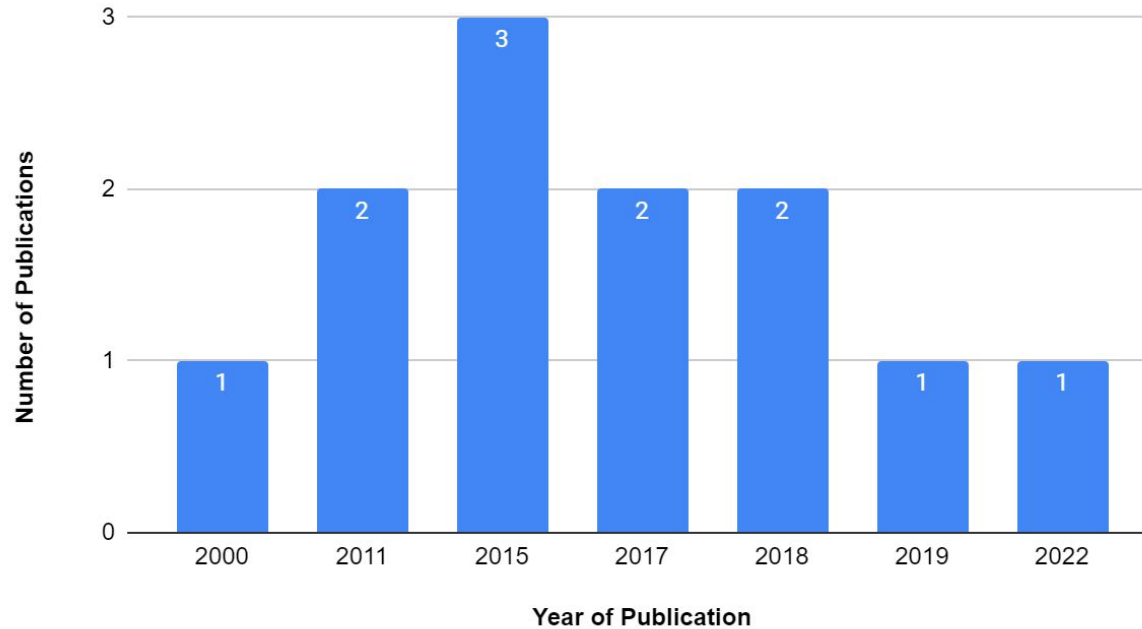
Results

In total, 12 studies met all the criteria:

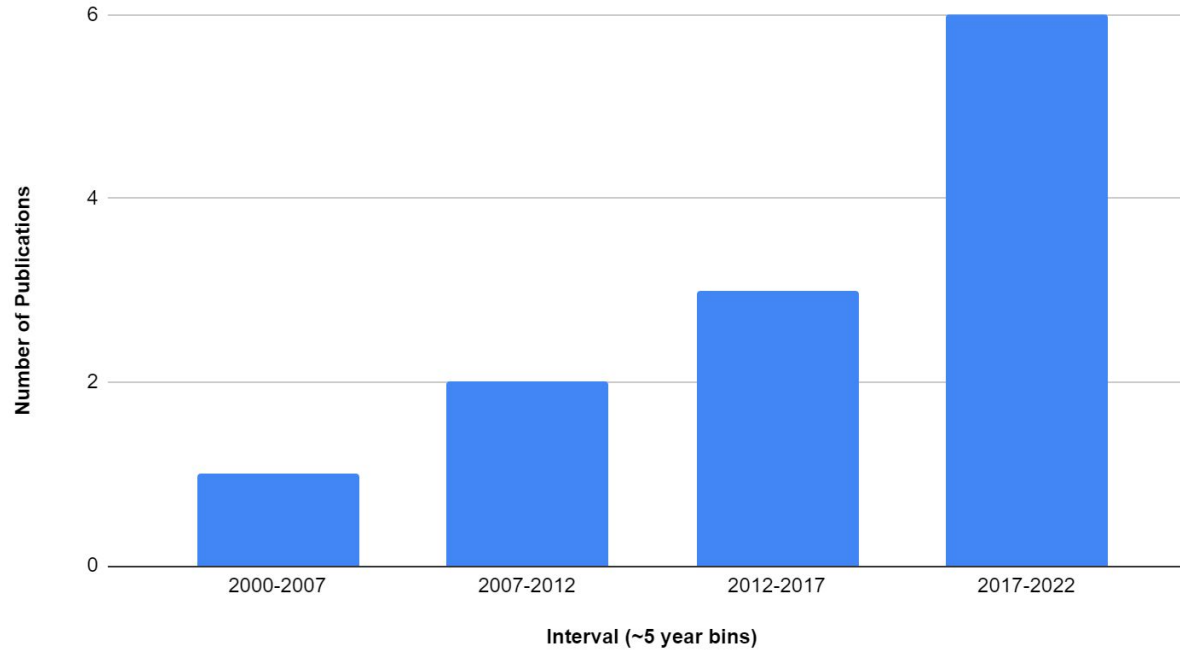
Some of them:

- Predicting Risk of Software Changes;
- An exploratory study on the influence of developers in technical debt;
- An Empirical Study of Developer Quality;
- Periodic Developer Metrics in Software Defect Prediction;
- Influence of Developer Factors on Code Quality
- .
- .
- .

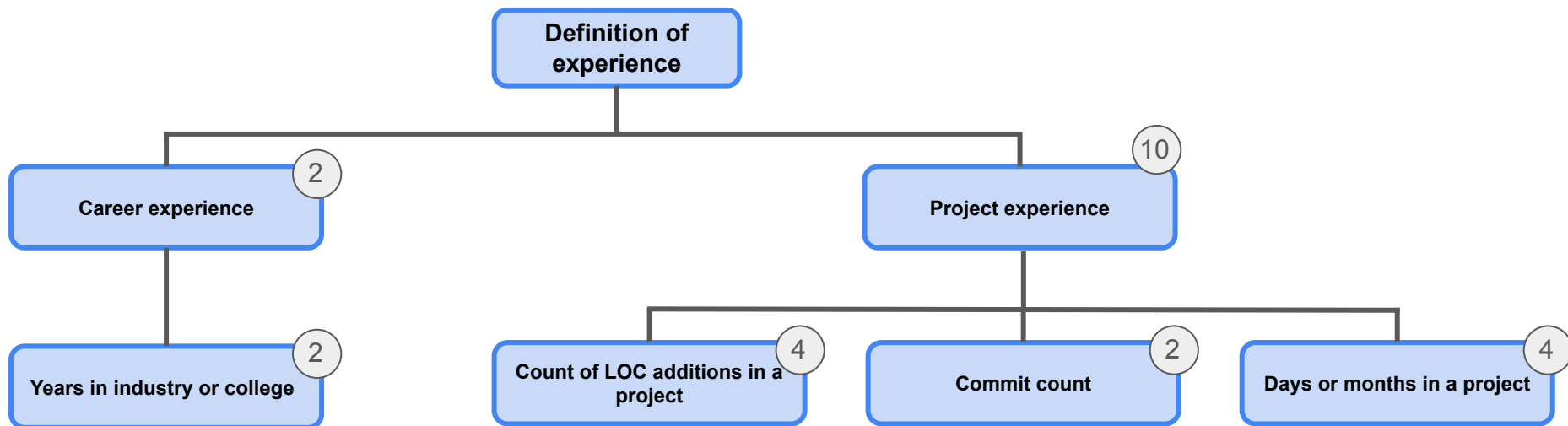
Number of Publications versus Year of Publication



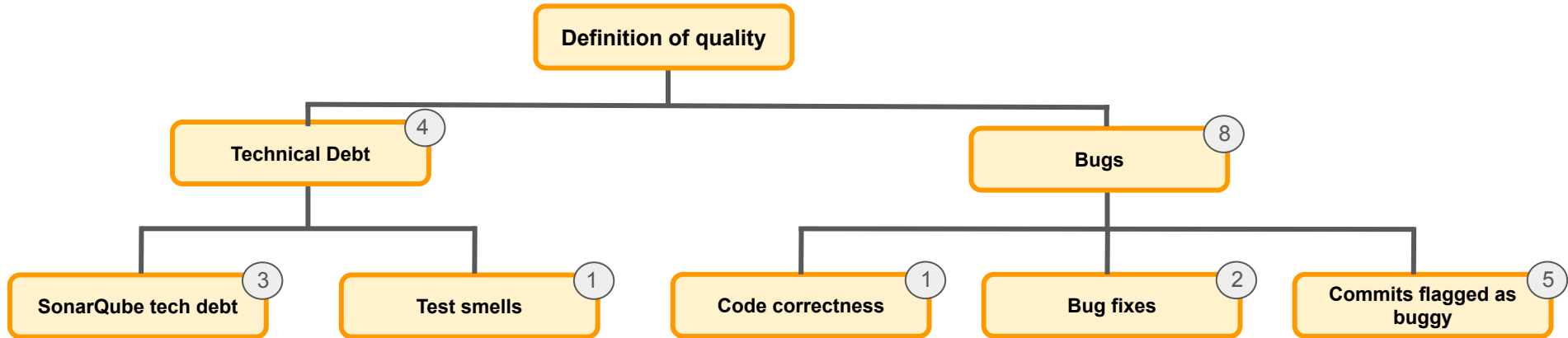
Number of Publications versus Interval (~5 year bins)



RQ1: How the developer experience is evaluated?

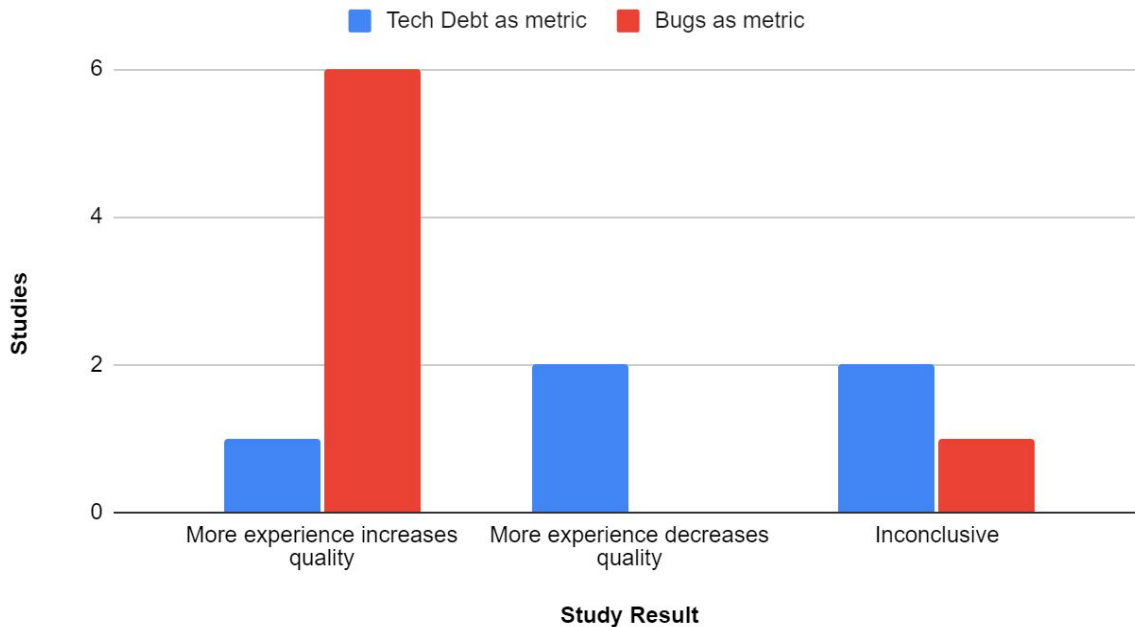


RQ2: How the software quality is evaluated?



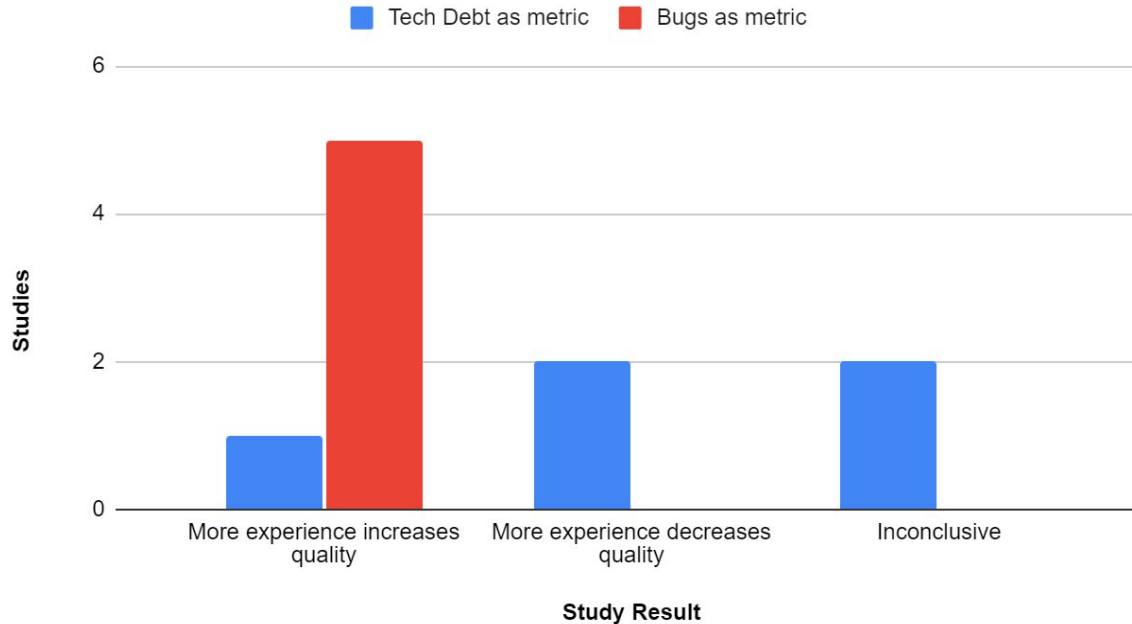
RQ3: How the developer experience affects code quality?

Overall Experience and Code Quality



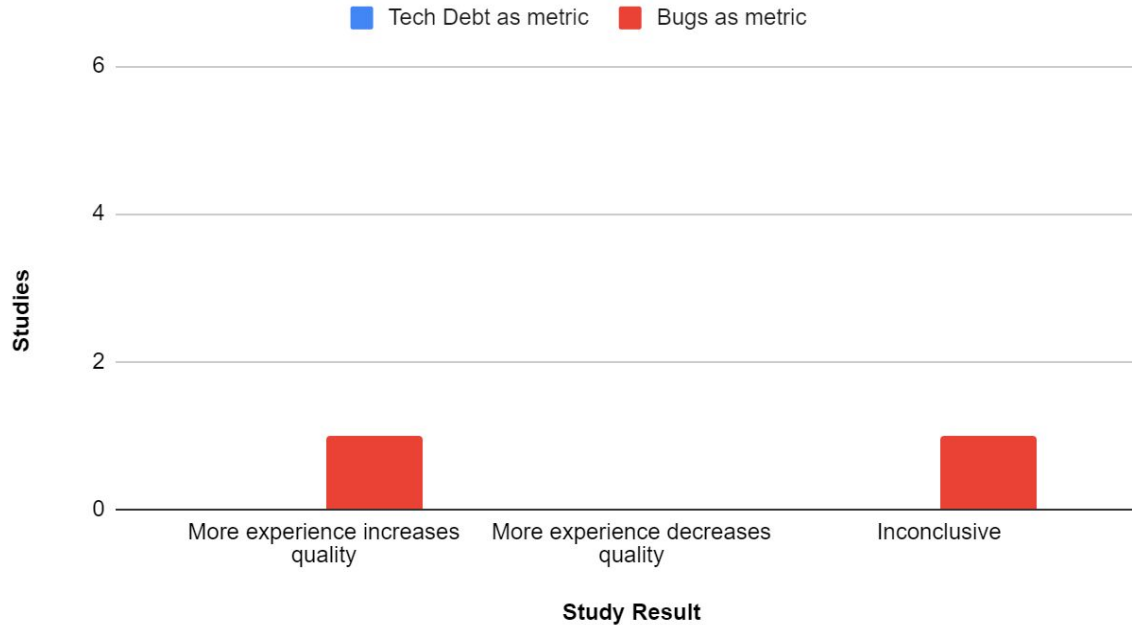
RQ3: How the developer experience affects code quality?

Project Experience and Code Quality



RQ3: How the developer experience affects code quality?

Career Experience and Code Quality



Discussion

Facts:

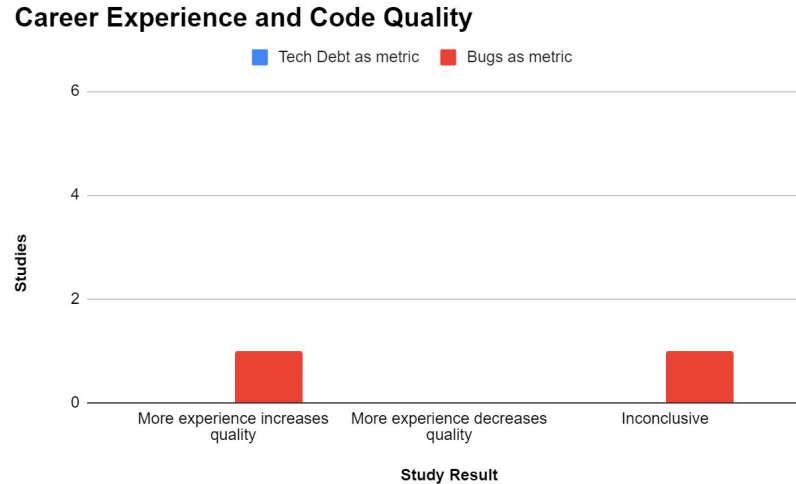
- Strong correlation between code quality and project experience, when the quality metric is bugs;
- Inconclusive and contradictory results when using Tech Debit;
- Little research about experience using the definition as years of professional experience;

Questions yet to be answered:

- Why studies that uses bugs have such a high convergence?
- Why studies that uses tech debit don't agree on a conclusion?
- What could be the reasons for inconclusive results?

Opportunities:

- There's a lack of studies tracking career experience and code quality after 1999;



Opportunities:

- Research before 1999 is inconclusive:

Table 6 Mean quality of subjects depending on overall programming experience

QLTY	Academia		Industry	
	#Subjects	Mean	#Subjects	Mean
No experience (<2 years)	6	36.08 %	5	58.97 %
Novice (2–5 years)	25	60.09 %	20	61.24 %
Intermediate (5–10 years)	22	61.99 %	29	63.36 %
Expert (>10 years)	1	.00 %	15	53.57 %
Total subjects	54	57.08 %	69	60.30 %

Table 6 - Empirical evaluation of the effects of experience on code quality and programmer productivity: an exploratory study

Opportunities:

- And after that is contradictory:

The most important result is that years of experience are not able to predict programmer performance at all. The only exception is years of programming experience in academia (in other words, years of training), which does appear to have a positive influence on programmer performance. Other influential variables are testing framework experience and routine use of the IDE, which we believe reflects the positive influence of modern programming tools on programmer performance.

Excerpt from Empirical evaluation of the effects of experience on code quality and programmer productivity: an exploratory study

Programmers with more programming experience have better performance than programmers with less programming experience.

Excerpt from Links between the personalities, styles and performance in computer programming

Opportunities:

- By collecting developer's self-declared parameters and analyzing its repositories, one can simultaneously study the relationship between:
 - Career experience and Technical Debt;
 - Project experience and Technical Debt;

Opportunities:

- This investigation will probably lead to better results for my MSc research questions, that are:
 - RQ1: Exists a convergence between self-declared skills with software quality metrics?
 - RQ2: Exists a software quality metric, or set of metrics, that better represents the self-declared skills?

Thank you

Contact:

- jeffersoncontatobh@gmail.com
- [linkedin.com/in/jefferson-gml/](https://www.linkedin.com/in/jefferson-gml/)

Any Questions?