Teaching Techniques for DevOps Education

Summary

Introduction

Problem

With the increasing adoption of DevOps in industries(1), it is crucial to prepare students to meet the challenges associated with this methods(2). However, the current educational process often fails to furnish the new generation with the necessary practical and technical skills(3).

(1) Erich, Floris MA, Chintan Amrit, and Maya Daneva. "A qualitative study of DevOps usage in practice." *Journal of software: Evolution and Process* 29.6 (2017): e1885. [JA4]
(2) Kuusinen, Kati, and Sofus Albertsen. "Industry-academy collaboration in teaching DevOps and continuous delivery to software engineering students: towards improved industrial relevance in higher education." 2019 IEEE/ACM 41st International Conference on Software Engineering: Software Engineering Education and Training (ICSE-SEET). IEEE, 2019. [CA1]
(3) Leite, Leonardo, et al. "A survey of DevOps concepts and challenges." ACM Computing Surveys (CSUR) 52.6 (2019): 1-35. [JA1]

Widespread Industry Adoption

DevOps practices have been increasingly adopted across industries due to their ability to enhance collaboration between development and operations teams, leading to faster and more reliable software delivery [1]

- **Reference:** Erich, F., Amrit, C., & Daneva, M. (2017). "A qualitative study of DevOps usage in practice." Journal of Software: Evolution and Process, 29(6), e1885.
  - This study explores the adoption and implementation of DevOps practices in various organizations, highlighting the growing industry trend.

(1) Erich, Floris MA, Chintan Amrit, and Maya Daneva. "A qualitative study of DevOps usage in practice." *Journal of software: Evolution and Process* 29.6 (2017): e1885. [JA4]

Demand for Efficiency and Agility

Industries are adopting DevOps to meet the growing need for operational efficiency, agility, and scalability in software development, which are essential for staying competitive in today's fast-paced market. (4)

- **Reference:** Forsgren, Nicole, Jez Humble, and Gene Kim. Accelerate: The science of lean software and devops: Building and scaling high performing technology organizations. IT Revolution, 2018.
    - This book outlines how DevOps practices lead to improved software delivery performance and organizational success, which drives its adoption.

Integration with Cloud Technologies

The rise of cloud computing has further accelerated the adoption of DevOps, as cloud platforms provide the necessary infrastructure and tools to implement DevOps practices effectively. (5)

- **Reference:** Humble, J., & Farley, D. (2010). "Continuous delivery: Reliable software releases through build, test, and deployment automation." Proceedings of the Agile Conference, 2010.
    - Although focused on continuous delivery, this work underscores the role of cloud technologies in enabling DevOps practices.

Adoption Across Various Sectors

DevOps is not limited to the tech industry; it has seen growing adoption in sectors such as finance, healthcare, and retail, driven by the need for continuous integration and delivery. (6)

- **Reference:** Jabbari, R., bin Ali, N., Petersen, K., & Tanveer, B. (2016). "What is DevOps? A systematic mapping study on definitions and practices." Proceedings of the Scientific Workshop Proceedings of XP2016, 1-11.
    - This paper discusses the adoption of DevOps practices across different sectors, supported by empirical data.

Cultural and Organizational Shift

DevOps represents a cultural shift within organizations that prioritize collaboration, communication, and shared responsibility, which has been a key factor in its widespread adoption. (7)

- **Reference:** Lwakatare, L. E., Kuvaja, P., & Oivo, M. (2016). "An exploratory study of DevOps: Extending the dimensions of DevOps with practices." Proceedings of the 11th International Conference on Software Engineering Advances (ICSEA).
    - This study investigates the cultural and organizational shifts necessary for DevOps adoption.

Definition

- Towards definitions for release engineering and DevOps
  - *“DevOps aims to establish a mindset that focuses on a closer collaboration between teams by setting the common goal to develop high-quality software and operate resilient systems” (Dick et. al., 2015)*

Definition

- A Survey of DevOps Concepts and Challenges[3]
  - *“DevOps is a collaborative and multidisciplinary effort within an organization to automate continuous delivery of new software versions, while guaranteeing their correctness and reliability.” (Leite et. al 2019)*

Motivation

- A Survey of DevOps Concepts and Challenges[3]
  - *“Finally, academic researchers conduct studies to determine the state of practice in DevOps, thereby contributing to discussions among engineers and managers, and educate a new generation of software engineers on DevOps principles and practices.” (Leite et. al 2019)*

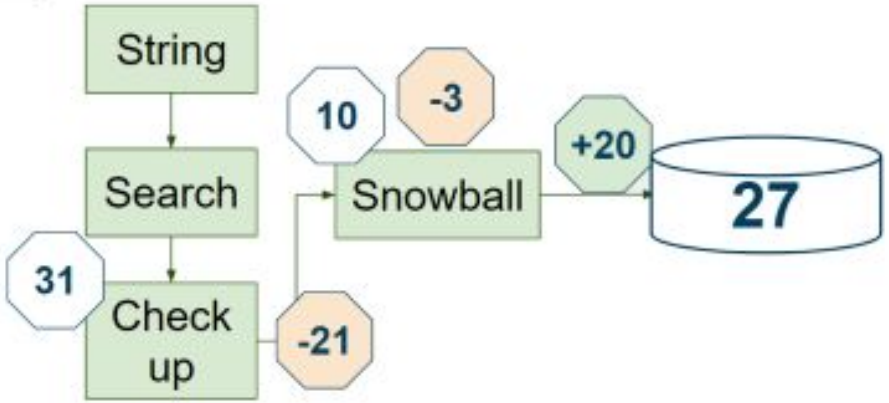
Teaching Methods

- **Delivery Method** refer to how instructional content is provided to learners.

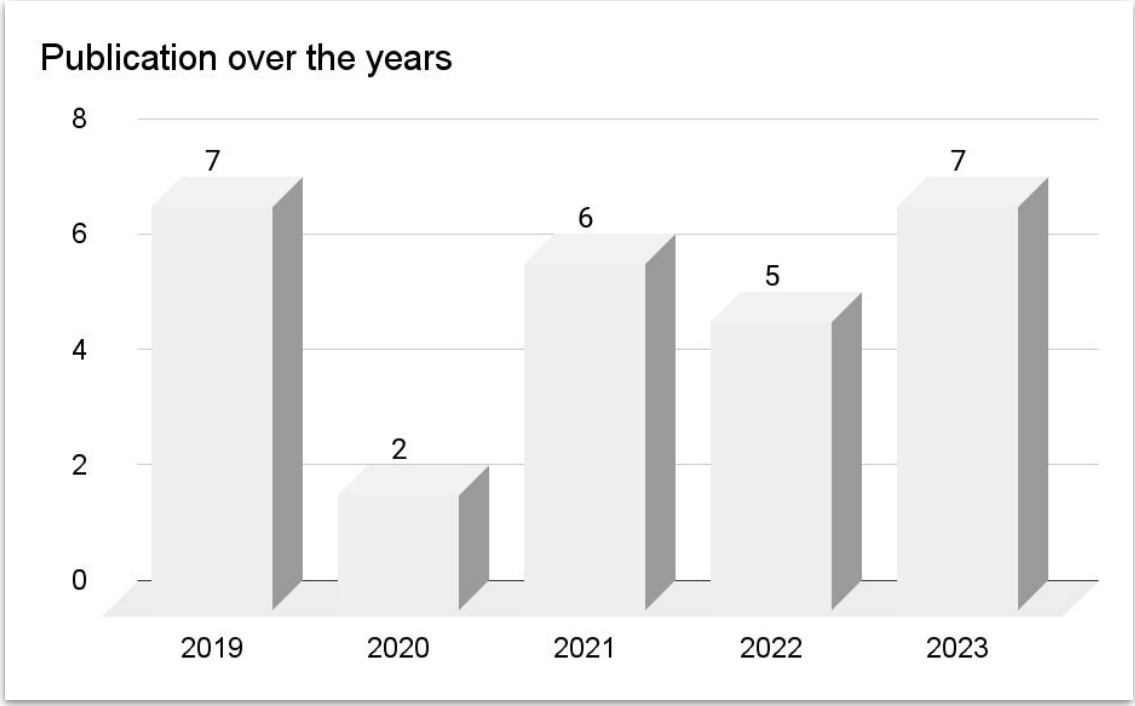
- **Active Method** involves engaging students in activities that require them to actively process and apply knowledge.

Systematic Literature Review

Sourcer Engine	Quantity
ACM Digital Library	25
IEE Explore	60
Science Direct	126



Systematic Literature Review



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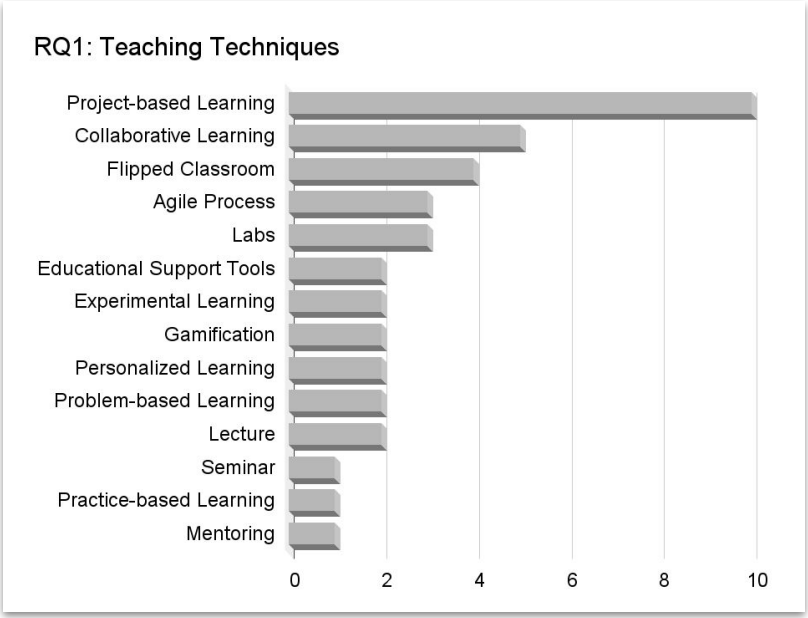

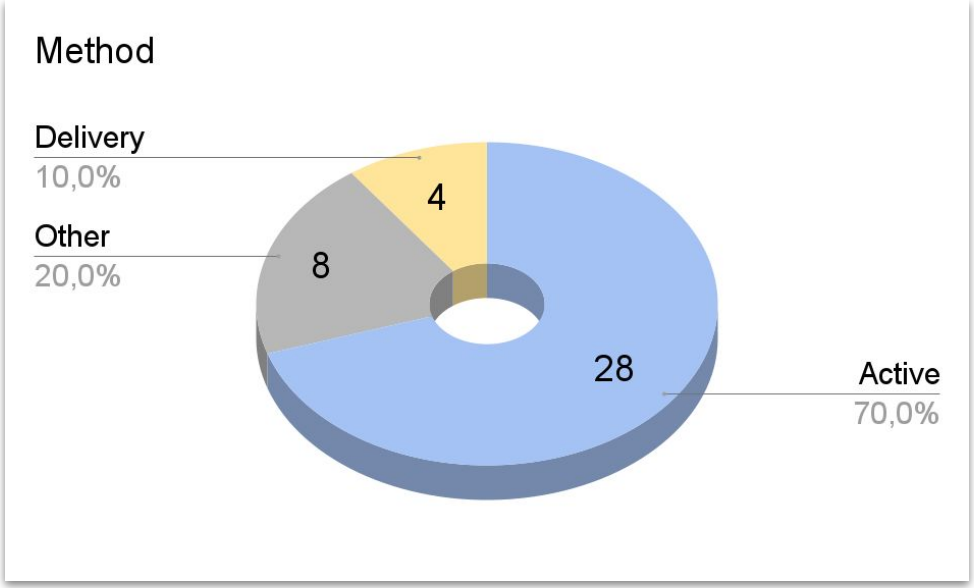

Active Method

In **Project-Based Learning (PjBL)**, students engage in real-world. This method emphasizes hands-on experience and problem-solving.

- **Reference:** Radenković, Miloš, Snežana Popović, and Svetlana Mitrović. "Project based learning for DevOps: School of Computing experiences." E-business technologies conference proceedings. Vol. 2. No. 1. 2022.
  - This study highlights the effectiveness of PjBL in teaching DevOps, showing how students' understanding of DevOps principles improves through active project engagement.

Active Method

The **Flipped Classroom** approach involves students learning theoretical concepts outside the classroom (e.g., through videos or readings) and then applying those concepts in class through practical exercises, discussions, and group activities.

- **Reference:** Cho, Hyun Jin, et al. "Active learning through flipped classroom in mechanical engineering: improving students' perception of learning and performance." International Journal of STEM Education 8 (2021): 1-13.
  - *This paper discusses the flipped classroom as an active learning strategy, applicable to DevOps by allowing more hands-on practice during class sessions.*

Active Method

Collaborative Learning involves students working together in teams to solve complex tasks. This approach fosters peer learning, communication, and teamwork.

- **Reference:** Stevanoviü, Jelena, et al. "Expanding the level of engineer knowledge for software modeling within corporate education by active and collaborative learning." 2020 IEEE Global Engineering Education Conference (EDUCON). IEEE, 2020.
  - *The principles discussed can be applied to enhance the collaboration and communication among cross-functional teams, which are vital for DevOps success.*

Survey with Students

Students Satisfaction with Active Methods.

Exploratory Performance Analysis

Apply active methods in Software Engineering classroom from topics about devops.

Objective

This study aims to evaluate the effectiveness of the active methods in the context of DevOps.

The proposal is to investigate how these pedagogical approaches can be implemented to improve the education of Software Engineering students, preparing them more effectively for the professional demands related to DevOps.

The study includes a review of the literature, surveys, and exploratory experiments, as well as an analysis of student performance during their preparation for the job market.

Summary

Thank You