

Concept Paper: MEAN or MERN

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Concept Paper

Web applications, also known as web apps, are effective tools for disseminating research findings and improving the general public's understanding of the study outcomes (Saia et al., 2022). So, what are web applications? Web apps are dynamic tools that are accessible via the web browser; they facilitate the human and computer interactions required to complete a given task. A web application consists of the front-end and back-end layers. The front-end layer refers to the components that are displayed on the user's screen. The back-end are the core components that power the application's functions. Examples of back-end components include databases and computer scripts.

Aggarwal (2018) in their study reported a shortage of skilled web developers and lack of adequate training for aspiring developers. However, React.JS, a Java Script library for front-end development originally authored by Facebook Inc. in 2013, may be changing the narrative due to its shallow learning curve. In recent times, MEAN (Mongo.DB, Express.JS, Angular, & Node.JS) and MERN (Mongo.DB, Express.JS, React.JS, & Node.JS) have become widely accepted and used as the stacks for web development (Aggarwal & Verma, 2018).

Problem Statement

According to Breaux and Moritz (2021), the data collected from the U.S. Bureau of Labor Statistics (BLS) revealed a significant labor shortage in the software development field. This shortage is projected to be on the rise for the next decade with an estimated cumulative growth of 22%. The failure of the university system to produce enough computer science graduates to fill up software development openings, has created a new world of opportunity for some creative instructional designers to collaborate with software developers. These collaborations have resulted in establishments of coding bootcamps and other alternative

methods of educating aspiring software developers. Although Breaux and Moritz (2021) reported that Informational Technology (IT) companies prefer to hire coding bootcamp graduates over computer science university graduates, the aim of this study is neither to confirm nor invalidate Breaux and Moritz's (2021) theory. Instead, this study is set to address one of the reported reasons for the continued labor shortage; i.e. the lack of effective training programs for aspiring software developers.

Keeping in mind that constructivist theory implies that learners construct knowledge rather than passively digest information, this study will focus on exploring the widely utilized stacks and training programs for application development using the constructivist approach. This study will explore the MEAN and MERN stacks for web development and analyze the effect of each stack on students' knowledge and skill retention.

Purpose

This study will seek to analyze how the choice of stack (MERN or MEAN) used to teach web development affects students' knowledge retention and proficiency. The research consists of two independent populations. The first independent population consist of 2 groups. The first group includes computer science professors who teach web development at coding bootcamps or universities using the MERN stack. The second group includes practicing MERN developers with at least 5 years of full-time web development experience. Similar to the first, the second independent population also consists of 2 groups. The first group includes computer science professors who teach web development at coding camps or universities using the MEAN stack. The second group includes practicing MEAN developers with at least 5 years of full-time web development experience.

Keeping in mind that there are thousands of software development positions left unfilled because of the shortage of effective training programs (Breux and Moritz, 2021), this study examines the most effective stack for web development training program. Effectiveness in this scenario is measured by learning curve and job market demands. Based on the findings, the researcher, being an instructional designer with an extensive background in computational science, will develop an e-learning course that educates aspiring web developers using the more effective stack between MEAN and MERN. Furthermore, the findings and recommendations will provide engagement opportunities for future web science researchers.

Goals and Objectives

This research will answer the following questions:

- 1) Considering that the only different components in MEAN and MERN are React.JS (R) and Angular (A), which library between React.JS and Angular is the easier for aspiring web developers to utilize to learn web development?
- 2) What stack is the more in demand between MERN and MEAN in the labor market?
- 3) What effect does the choice of stack have on students' knowledge retention?

Definitions

MongoDB: A cross-platform, open-source database that uses Java Script Object Notation (JSON).

Express.JS: A back-end application framework for Node.JS and application programming interface (API) development.

React.JS: A Java Script library that provides reusable templates and code for front-end development.

Node.JS: An open-source, cross-platform, back-end Java Script runtime environment

Angular: A development platform that was built in type script.

Stack: Web applications are designed using a “stack” of various technologies. A software stack could be best explained as a collection of independent components that work cohesively to execute an application (Aggarwal & Verma, 2018).

Review of Literature

The advantages of ReactJS over Angular and other JavaScript libraries cannot be overemphasized. While several themes emerged from the research on ReactJS framework for web development, this research illustrated a pattern of three common themes around the topic. There three common themes were (a) popularity and acceptability, (b) document object model (DOM) and JSX programming language, and (c) runtime error.

Popularity and Acceptability

Studies by Qu et al. (2021), Aggarwal (2018), and Sidiropoulos et al., 2021 reported that ReactJS is the most popular JavaScript library for front-end development. These studies suggested that ReactJS is the library of choice for most novice and skilled web developers. Aggarwal (2018) in their study attributed the acceptability and popularity of ReactJS to its speed and ability of applications developed with it to load new data without refreshing the page. Qu et al., (2021) in their study emphasized that proficient levels of expertise can be easily achieved within a short period of time in ReactJS because of its easy-to-understand architecture.

Document Object Model (DOM) and JSX Programming Language

ReactJS’s DOM is lightweight when compared to other JavaScript libraries including Angular (Aggarwal & Verma, 2018). ReactJS does not interact with browser generated DOM but one that is stored in the memory (Sidiropoulos et al., 2021). ReactJS DOM package provides specific methods that can be deployed at the top level of a web app. While JSX programming

language is not mandatory to use when developing with ReactJS framework, the option provided to ReactJS developers to use it in the marking-up of components and their corresponding binding events is a strength of ReactJS (Aggarwal & Verma, 2018).

Runtime Error and Debugging

Aggarwal & Verma (2018) and Mukhiya & Hung (2018) both explained that bugs occur at compile time in ReactJS. Whereas, the bugs occur at run time in Angular. According to these studies, debugging is easier when bugs occur at compile time because the compiler is able to detect the error and provide tips for debugging them. According to Qu et al. (2021), this is a strength of ReactJS framework and perhaps the greatest reason for its well acceptability in the web development community.

Research Methodology and Sample Design

The scope of the questions posed, basis, ontology, epistemology, and research ethics should determine the research methodology and design (Arghode, 2012). On that note, this study will use the mixed-method approach. Doing this will allow each research method (quantitative and qualitative) to compensate for each other's weaknesses. The first and second research questions are qualitative in nature and will be answered via survey, interviews, and secondary sources. The survey and interview participants will be practicing web app developers and computer science professors with over a decade of industry working experience in multi-national organizations.

To seek answers to the third question, 10 aspiring web app developers who are also researchers will be identified through purposeful sampling. Using the AB method, with the "A" group assigned a MERN web development full-stack e-learning course, and the "B" group assigned a MEAN e-learning course. The 10 participants will be split equally across both groups.

Upon completion of the course, they will be tested with a real-life web-app project to determine which learning path has proven to be the most effective. A VARK form will be used to participants' post-tests self-evaluation.

Data Collection Strategies

The study will utilize a variety of data collection strategies. They include survey, questionnaire, and interviews. For interviews, all recordings will be transcribed word for word.

Ethical Considerations

Although the participants do not fall under the vulnerable population category as explained in the Belmont Report, all ethical guidelines related to respect and protection of subjects' rights will still be duly followed. Prior to the commencement of the study, all the participants will be debriefed. Their rights to accept or decline participation at any given time of the study will be reiterated. Their contributions will be anonymous and protected according to the guidelines of the American College of Education (ACE).

Conclusion

As the web technology continues to advance, new challenges will continue to emerge (Breux & Moritz, 2021). These challenges will call for new research-based strategies to solve them. To that effect, it is crucial that web researchers understand that the scope of the study and questions posed should determine the research design. In the course of doing this, the researcher may end up mixing research methods, instruments and measurement tools. To ensure that this is done in an effective way, proper documentation and pre-evaluation of the research basis, ontology, epistemology, ethics, and methodology is important. Upon completion of the study, all methods and instruments should be reported correctly and explicitly justified. Recommendations for future study around the phenomenon should be made based on the findings.

In this case of this study, getting answers to the posed research questions will aid the creation of effective e-learning courses for aspiring web developers. This will play a crucial role in tackling the labor shortage reported by Aggarwal (2018). It is recommended that future studies continue to explore the factors that promote or impact knowledge retention and skill acquisition of aspiring web developers. Doing this will contribute to the existing knowledge and effective education of aspiring web developers.

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