

## CURRENT AND PREVALENT TECHNOLOGIES IN WEB CURRICULUM

**Ronald J. Glotzbach**

*Associate Professor / Purdue University (USA)*

### Abstract

The Web Programming and Design major at Purdue University utilizes a variety of technologies within the curriculum to educate students in current and future web trends. This paper will investigate current and prevalent web development technologies that could enhance the program. Web development technologies are numerous, with each technology playing a critical role in building robust and interactive websites. At the core of every web page are HTML, CSS, and JavaScript, which combine to structure content, manage presentation, and create dynamic interactions. HTML (Hypertext Markup Language) provides the foundational structure, CSS (Cascading Style Sheets) handles styling, or the look and feel of the website, and JavaScript provides interactivity. Together, they collectively form the backbone of web development. PHP (Hypertext Preprocessor) remains a common and powerful technology used in server-side scripting, contributing significantly to back-end development. PHP is embedded within HTML code and executes on the server, delivering dynamic content to the client, and is known for its ease of use. WordPress, one of the most popular content management systems, relies heavily on PHP for its core functionality, showcasing the enduring relevance of this scripting language in web development. Front-end libraries and frameworks such as jQuery, React, and Angular have gained prominence for enhancing the user interface and experience. The jQuery library offers developers an easier means of altering CSS and handling events as the page is used. React, developed by Facebook, facilitates the creation of reusable components for building efficient user interfaces, while Angular, a comprehensive framework by Google, offers a structured approach for dynamic web applications. Node.js has become a popular technology for server-side scripting, enabling developers to use JavaScript for server-side development and the creation of scalable and high-performance applications. Database technologies, the backbone of data storage and retrieval, include MySQL and MongoDB among many others. MySQL, a relational database management system, is renowned for its reliability and scalability, making it a preferred choice for data-driven applications. MongoDB, a NoSQL database, excels in handling unstructured data, providing flexibility and scalability for applications dealing with large datasets. The web development arena has a plethora of technologies that can perform similar tasks, each contributing to the creation of modern, scalable, and interactive web experiences. The combined effect of these technologies enables developers to deliver impactful and meaningful web solutions. Through the implementation of these technologies within the curriculum, students will be better prepared for the employment opportunities that lie ahead.

**Keywords:** *Curriculum, web technologies, web pedagogy.*

---

### 1. Introduction

In the ever-evolving landscape of technology, current web technologies play a pivotal role in shaping the way we interact, communicate, and access information online. From dynamic user interfaces to seamless data exchange, these technologies have transformed the web into a dynamic and interconnected ecosystem.

One of the cornerstones of contemporary web development is the use of responsive design. With the proliferation of various devices, including smartphones, tablets, and desktops, responsive design ensures that websites adapt fluidly to different screen sizes. Cascading Style Sheets (CSS) and frameworks like Bootstrap or Tailwind CSS enable developers to create visually appealing and functional interfaces that deliver a consistent user experience across platforms.

The shift towards Single Page Applications (SPAs) represents another significant trend in web development. SPAs use dynamic loading to update content on a single page, providing a smoother and faster user experience compared to traditional multi-page websites. Popular JavaScript libraries and

frameworks such as React, Angular, and Vue.js empower developers to build powerful SPAs, enhancing the interactivity and responsiveness of web applications.

Application Programming Interfaces (APIs) play a crucial role in connecting disparate systems and enabling seamless data exchange. Representational State Transfer (REST) and GraphQL are two prevalent approaches for designing APIs, facilitating communication between web servers and clients. This allows for the integration of third-party services, enhancing the functionality and feature set of web applications.

The rise of Progressive Web Apps (PWAs) represents a convergence of web and mobile app capabilities. PWAs leverage modern web technologies to offer an app-like experience, including offline functionality, push notifications, and improved performance. This approach blurs the lines between web and native applications, providing users with a versatile and efficient means of accessing content.

Security is paramount in the current web landscape, and technologies such as HTTPS, Content Security Policy (CSP), and JSON Web Tokens (JWT) are instrumental in safeguarding user data and preventing unauthorized access. With a focus on encryption, secure communication, and proper authentication mechanisms, these technologies contribute to building a safer online environment.

In the Web Programming and Design major at Purdue University, the goal of the curriculum is to prepare students for real-world applications by staying abreast of the most used technologies and languages. With the landscape changing constantly, some of the popular technologies change while others remain a staple of web development.

## 2. Web technologies and languages

PHP, or Hypertext Preprocessor, is designed for web development and is a widely-used server-side scripting language (Sotnik, Manakov, & Lyashenko, 2023). Created in 1994 by Rasmus Lerdorf, PHP has since become a cornerstone of dynamic website construction (Tatroe & MacIntyre, 2020).

One of PHP's key strengths lies in its versatility. It seamlessly integrates with HTML, allowing developers to embed PHP code directly into HTML pages (Sotnik, Manakov, & Lyashenko, 2023). This flexibility facilitates the creation of dynamic web content, enabling the execution of server-side scripts to generate dynamic web pages based on user interactions.

PHP supports a broad spectrum of databases, including MySQL, PostgreSQL, and MongoDB, making it an excellent choice for database-driven web applications (Tatroe & MacIntyre, 2020). Its open-source nature has fostered a large and active community of developers, contributing to a wealth of libraries, frameworks, and resources that streamline development processes.

Over the years, PHP has undergone significant updates and improvements, with the latest major version being PHP 8. This version brings enhanced performance, new features, and improved syntax, reinforcing PHP's relevance in modern web development. Despite facing competition from other server-side languages, PHP remains a popular and reliable choice for building dynamic, scalable, and interactive web applications.

Cascading Style Sheets (CSS) is a necessary technology in web development, serving as the styling language for HTML documents. Developed in the late 1990s, CSS enables developers to create and alter the presentation and layout of web pages, ensuring a separation of content and design. The "cascading" in CSS refers to its hierarchical nature, where styles can be defined at various levels and cascade down to affect the presentation of HTML elements. This hierarchy allows for consistent styling across a website and facilitates efficient maintenance and updates.

CSS empowers developers to control typography, colors, spacing, and layout, providing a high level of customization for the visual aspects of a website. Responsive web design is made possible through CSS media queries, enabling developers to adapt layouts to different devices, ensuring a seamless user experience across all devices.

The latest versions of CSS, such as CSS3, introduce advanced features like animations, transitions, and flexbox/grid layouts, enhancing the possibilities for creative and interactive web design. As an integral part of the front-end development stack, CSS continues to evolve, contributing to the creation of visually appealing, user-friendly, and responsive web interfaces.

JavaScript is a dynamic, versatile programming language that plays a central role in modern web development. Initially developed by Netscape in the mid-1990s, JavaScript has evolved into a powerful tool for creating interactive and dynamic content on the client side of web applications. As a scripting language, JavaScript enables developers to manipulate and modify HTML and CSS dynamically, allowing for real-time updates without requiring page reloads. Its widespread adoption across browsers has solidified its position as an essential component of front-end web development.

JavaScript is an object-oriented language with a C-style syntax, making it accessible to a broad audience of developers. It supports asynchronous programming through features like callbacks and promises, facilitating the creation of responsive and interactive web applications.

The advent of Node.js has expanded JavaScript's capabilities beyond the browser, enabling server-side development as well. This full-stack versatility has contributed to JavaScript's popularity, as developers can use the same language for both client and server-side scripting, streamlining development workflows. Figure 1 illustrates an example full-stack application approach.

*Figure 1. An example of a full stack web application setup using client-side and server-side languages along with a database for storage, maintenance, and retrieval of information.*



Web databases are integral components of dynamic and data-driven websites, playing a pivotal role in storing, managing, and retrieving information. These databases enable web applications to handle large volumes of data efficiently, ensuring seamless user experiences and personalized content delivery.

One of the most commonly used types of web databases is relational databases, with MySQL, PostgreSQL, and Microsoft SQL Server being popular choices. These databases organize data into tables with defined relationships, offering a structured and efficient way to manage complex datasets. They are particularly well-suited for applications that require robust transactional support.

MySQL is a relational database management system (RDBMS) known for being open-source as well as its reliability, performance, and ease of use (Grippa & Kuzmichev, 2021). Developed by Swedish company MySQL AB, it is now owned by Oracle Corporation. MySQL uses Structured Query Language (SQL) as its primary interface, making it an integral part of the database landscape.

Structured Query Language (SQL), is a domain-specific language used to manage and manipulate relational databases. It provides a standardized way to interact with databases, allowing users to define, query, and manipulate data. SQL consists of several sub-languages, including Data Definition Language (DDL) for defining and modifying database structures, and Data Manipulation Language (DML) for querying and updating data.

MySQL uses SQL to perform a wide range of database operations. Developers and administrators use SQL commands to create and modify database tables, retrieve specific data using queries, update records, and manage permissions (Grippa & Kuzmichev, 2021). The structured and intuitive nature of SQL makes it accessible to users with various levels of expertise in database management.

MySQL's compatibility with SQL standards and its support for transactions, indexing, and complex queries make it a preferred choice for web developers, powering many dynamic and data-driven applications on the internet. The combination of MySQL and SQL provides a robust foundation for efficient and scalable database management in a wide array of applications.

NoSQL databases, such as MongoDB and Cassandra, provide an alternative approach, offering flexibility in handling unstructured or semi-structured data. These databases excel in scenarios where data structures may evolve rapidly, accommodating the dynamic nature of modern web applications.

Web developers interact with databases using languages like SQL (Structured Query Language) for relational databases or specialized queries for NoSQL databases. Server-side scripting languages, such as PHP, Python, or Node.js, facilitate the communication between the web application and the database, allowing for the retrieval and manipulation of data based on user interactions.

The use of web databases is crucial for e-commerce platforms, content management systems, social media, and a myriad of other web applications that rely on efficient data storage and retrieval to provide dynamic and personalized content to users in real-time.

Another common and popular technology in use today is Python. Python has emerged as a versatile and powerful programming language, gaining immense popularity for web development due to its simplicity, readability, and an extensive collection of libraries and frameworks. Whether it's building dynamic websites, web applications, or robust backend systems, Python has become a go-to language for developers seeking efficiency and ease of use (Forcier, Bissex, & Chun, 2008).

One of the key factors contributing to Python's prominence in web development is its readability. Python's syntax is clean and straightforward, resembling the English language, making it easy for developers to write and maintain code (Forcier, Bissex, & Chun, 2008). This readability not only enhances collaboration among developers but also accelerates the development process, allowing teams to build and iterate on web applications more efficiently.

Django and Flask, two of the most prominent web frameworks for Python, have played a pivotal role in shaping the language's dominance in web development. Django, a high-level web framework, follows the "don't repeat yourself" (DRY) principle and promotes rapid development by providing a plethora of built-in features such as an ORM (Object-Relational Mapping), admin panel, and a templating engine. Flask, on the other hand, is a lightweight and modular micro-framework that allows developers to choose and integrate components based on their project requirements, providing flexibility and customization.

### 3. Conclusions

In summary, current web technologies encompass a wide array of tools and practices that drive the dynamic and interactive nature of the modern web. When combined, PHP, JavaScript, CSS, and MySQL create a comprehensive web development stack. PHP handles server-side logic, MySQL manages data storage, JavaScript enhances client-side interactivity, and CSS ensures a polished and visually cohesive presentation. This integration enables the creation of feature-rich, dynamic, and aesthetically pleasing websites, providing users with a seamless and engaging online experience. From responsive design to powerful JavaScript frameworks and secure data exchange mechanisms, these technologies collectively shape the digital experiences we encounter daily, fostering a more connected and efficient online world. Additionally, Python's rise in web development can be attributed to its readability, powerful frameworks, extensive library ecosystem, and adaptability. Whether building large-scale web applications or crafting smaller projects, Python's versatility and community support make it a compelling choice for developers worldwide. As the landscape of web development continues to evolve, Python stands as a reliable and efficient language, empowering developers to bring their ideas to life on the web. Of the many options for web development, choosing the best one for educating students can be daunting. Staying apprised of the current trends along with knowledge of the most used and useful technologies can help keep curriculum moving forward.

### References

- Forcier, J., Bissex, P., & Chun, W. J. (2008). *Python web development with Django*. Addison-Wesley Professional.
- Grippa, V. M., & Kuzmichev, S. (2021). *Learning MySQL* (2<sup>nd</sup> ed.). O'Reilly Media.
- Sotnik, S., Manakov, V., & Lyashenko, V. (2023). Overview: PHP and MySQL features for creating modern web projects. *International Journal of Academic Information Systems Research (IJAIRS)*, 7(1), 11-17.
- Tatroe, K., & MacIntyre, P. (2020). *Programming PHP: Creating dynamic web pages*. O'Reilly Media.