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Research Article

Evaluating Web Frameworks for Personal Learning Decision-Making: A Comparative Analysis

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Abstract:

Nowadays with rapid evolution of World Wide Web, the web frameworks of different programing languages are crucial for development standardization, but the huge type of web frameworks makes challenges for chosen the appropriate one for personal learning therefore, this study evaluates and compare the PhP and Python popular web frameworks in terms of their job market trends, web performances, learning resources and community support. Findings of job market trends shows that PhP web frameworks such as Laravel and Slim are being widespread in Europe region, while the python web frameworks such as Django and Flask are being more widespread in the United States. Whereas the findings of performance testing shows that Laravel outperform better in loading speed comparing to the other web frameworks treated in this study, while Django perform better in visual stability and Flask is better than Slim in responsiveness. As well, the survey findings shows that Online tutorials and ChatGPT are most used learning resources comparing to traditional community forums. These findings offer valuable understanding for developers and students in choosing the appropriate web framework for their personal learning based on job market demands and project requirements and can be used by educators and policymakers in curriculum adaption and teaching strategy to meet the industry needs.Moreover, this study contributes to a deeper understanding of Laravel, Django, Slim and Flask framework adoption in professional and academic settings considering the gap in the literature regarding the comparison of frameworks especially for performances, learning resources and job market trends.

1. Introduction

Web applications are developed by developers to be used by individuals, groups, or society to achieve their goals depending on their needs. Considering this widespread use of web applications and the rapid advancement of technology have led to significant changes in this field. Web frameworks have become an integral part of modern web applications development practices which simplify and speed up the development process and they have impact on development experience and performance of web application. Since there are currently many web frameworks available, developers, students, educators, and organizations must carefully consider the evaluation of several factors such as job market demand, performance metrics, learning curve and community support in their decision-making about chosen web framework for personal learning and professional purpose.

Web frameworks which are treated in this study such as Laravel, Django, Slim, and Flask have a considerable traction in different regions and industries where some web frameworks are more popular in specific region due to their alignment with job market demands and some of them are more popular because of their performance metrics. Additionally, learning curve and community

support play a crucial role in determining the easy of learning and integrating them in projects.

This study aims to provide evaluation and comparison of web frameworks in terms of number of job postings on LinkedIn per web frameworks, performance of web frameworks and the learning curve and community support associated with each web framework. These objectives are designed to offer an informed decision during the web frameworks selection by developers, students, educators, and organizations to contribute in professional and academic settings.

The LinkedIn platform is selected as data source for job market trends because of its widespread for professional networking and career development. Based on conducted research, the da Motta Veiga et al., 2020; Orgad Shani, 2024 has highlighted that LinkedIn is effective in understanding global job market trends especially in technology field [5, 6]. Furthermore, other studies have focus on job market trends and professional network but few of them examine job posting related to other web framework, this led to gap in existing studies [3, 4].

In terms of performance metrics of web frameworks, this study highlights the importance of Google's Core Web Vitals, which measure Largest Contentful Paint (LCP), Cumulative Layout Shift (CLS), First Input Delay (FID), Interaction to Next Paint (INP). According to Dobbala et al. (2022) and Vepsäläinen et al. (2024) the metrics are significant in the success of web applications even, yet limited studies have been conducted for comparative performance of different web frameworks using these metrics [8, 9].

The third objective focuses on the learning curve and community support for web frameworks: Laravel, Django, Slim and Flask. According to del Pilar Salas-Zárate et al. (2015), Reynolds et al. (2021) and Hasnain & Ullah (2023) the Online tutorials, AI Tools, and community plays a significant role in the learning process for developers [12, 13, 15].

This study through practical and educational settings aims to contribute into the factors that impact the adoption of web frameworks, thus, these findings will be beneficial for developers and students for personal learning plan but also beneficial to educators and policymakers on designing curricula and strategies aligned with job demands and evolving landscape of web development.

1.1. Research Objectives

Through the following research objectives this study evaluates and compare the web frameworks in terms of job posting and web performances, also it aims to assess the learninxg curve and community support for the web frameworks such as Laravel, Django, Slim and Flask:

1. Comparing number of jobs posting on LinkedIn per web frameworks
2. Evaluation of web frameworks' performances
3. Assessing the learning curve and community support of web frameworks

Contribution of this study is on personal learning decision-making from students and developers regarding the inclusion of these web frameworks in professional settings. Additionally, this study contributes to the policymakers and educators regarding the implication of curriculum design and teaching strategies in computer science education.

2. Material and Methods

The most appropriate research method for this study is the comparative methods because of the nature of research objectives related to this study [1]. The comparative methods allow data collection, analysis, and interpretation of the quantitative research to answer the research objectives through interpretation of the results for generating knowledge [1].

To address the first research objective 'Comparing number of jobs posting on LinkedIn per web frameworks' through quantitative research design [2] are applied the following research steps:

1. LinkedIn platform – this platform was chosen for data collection because it is primarily used for professional networking and career development, and it is also considered as convenient and accessible in this case.
2. Time frame data collection – the first quarter of 2022, and month June, July of 2024 was selected as time frame for primary data collection from LinkedIn.
3. Search query selection – Searches are made by framework name as Laravel, Django, Slim and Flask, and state (country) as United State, European Union, and Kosovo.
4. Results extracted – after performing the search query are extracted the results as number of job postings per framework and state (country).
5. Results analysis – Collected primary data from LinkedIn are analyzed in python programing language through the generation of plot, in the y-axis of the graph is dragged the Job posting, in the X-axis of the graph is dragged the Framework, while, to cluster on X is dragged Country.
6. Objective – These data are analyzed to compare which of the framework has more

open positions on LinkedIn per the United State, European Union, and Kosovo selected time frame 2022 and 2024.

The second research objective 'Evaluation of web performance of web application build with web frameworks' is addressed through experimental research design [2] which are applied the following research steps:

1. CRUD development – The CRUD applications are redeveloped using the following web frameworks: Slim, Laravel, Flask, and Django based on previous authors experiences, published video on verified pages and written tutorials on developers' blogs.
2. CRUD deploying – CRUD application of each framework is deployed in a laptop with the following performances: Processor: Intel(R) Core (TM) i7-1065G7 CPU @ 1.30GHz (8 CPUs), 1.5GHz, Memory: 8192MB RAM, 500 GB SSD.
3. Web Vital Tool – it is chosen this tool to measure the performance of CRUD application developed in different frameworks due to its credibility and industry recognition. It is initiated by trusted Google company; it provides the reliable metrics for evaluation of web performances.
4. CRUD application testing - During the usage of web vital tool are performed the following CRUD functionalities as create, read, update, and delete to test the web performances as LCP, FID, CLS and INP of each framework. Functionalities are performed in MySQL person table, where data are added only for the first author. In this case same person data are repeated across 100, 1000, and 10000 rows for testing and measurements purposes.
5. Results extracted: the collected data from testing are extracted for analysis. This process is considered as convenient, accessible and cost effective.
6. Results analysis: During analysis of collected data the statistical methods t-test and ANOVA One Way are applied through SPSS to show the statistical significance of measurements of LCP, FID, CLS and INP per each framework.
7. Objective – the collected data are analyzed to compare which of the framework is delivering a greater user experience on the web. This analysis helps reducing the time required for framework comparison and aids in making decisions about which framework to choose for personal learning.

Challenges during this research - The key challenge faced during this research was the performance of the laptop which is used for experimental research. Considering this challenge, it was impossible to continue experimental research with a more records as 100000, 1000000 rows as it was planned per CRUD functionalities during the measurements through web vitals. This led to a smaller sample size of data per 8 rows, which hindered the ability to gain a deeper understanding of loading performance, visual stability, interactivity, and assesses responsiveness for each framework when dealing with larger datasets.

The third research objective 'Assessing the learning curve and community support of web frameworks' is addressed through Sequential Exploratory Design (QUAL→ Quan) [16,17,18] because it gives priority to qualitative components which are followed by the quantitative data collection and analysis with the aim of increasing the generalizability of the findings. The collected data from filled surveys from 61 respondents were analyzed and present in the results section through chart diagrams after receiving responses from students, developers, business representatives in the field of Information Technology. The survey is shared through social network profile and LinkedIn of corresponding author, which is addressed to this category of people to fill the survey anonym based on their real experience with web frameworks treated in this study.

3. Results and Discussions

In this section are shown the results of research objectives through comparative method which are derived from quantitative data collected and categorized through research steps presented in Methodology section. Also, in this section are shown findings through interpretation and analysis of results related to research objectives in the context of existing research and potential for future research. In the following subsection are the **results** per each research objective.

3.1. Results of comparing number of jobs posting on LinkedIn per web frameworks

During the first quarter of 2022, and month June, July of 2024 are analyzed number of jobs posting on LinkedIn per web frameworks such as Laravel, Slim, Django, and Flask (Details provided in appendix 1). During data analysis is extract number of jobs posting by frameworks and country than the findings are visualized in Figure 1 using plots generated by Python programing language.

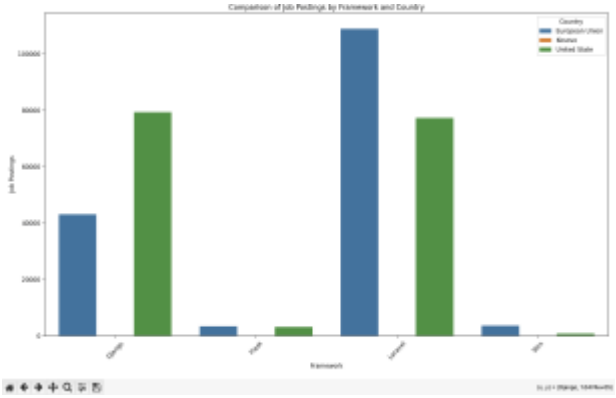

Figure 1 *Job position on LinkedIn per web frameworks*

The results show that job posting for PhP web frameworks such as Laravel and Slim were significantly higher in European Union compared to United States. Contrary, the Python web frameworks such as Django and Flask had more job posting in the United States than in European Union. In Kosovo, PhP web frameworks job posting dominate comparing to python web frameworks, which result is naturally because Kosovo is in Southeast Europe.

These results are valuable for all developers all over the world to understand demands in international job market which lead to guidance of them based on their career goals and their region preference for employment. This guidance serves to developers on identifying trends in job market and make informed decision about their professional development. Also, these results guide the policy makers in educational settings to incorporate frameworks in their curricula.

3.2. Results of evaluation of web frameworks' performances

The web performance of CRUD application developed using Laravel, Slim, Django, and Flask are evaluated by Web Vitals, a standardized metrics initiated by Google to measure the performance of web applications developed in different technologies. These metrics provide insides of user experience focusing on usability and accessibility of web applications. In the following are the metrics included in Web Vitals:

1. Largest Contentful Paint (LCP) measures loading performance when the page first starts loading. LCP should occur within 2.5 seconds or 2500 milliseconds.
2. Cumulative Layout Shift (CLS) measures visual stability. CLS should be 0.1 second (100 milliseconds) or less.
3. First Input Delay (FID) measures interactivity. FID should be 100 milliseconds (0.1 second) or less.
4. Interaction to Next Paint (INP) assesses responsiveness. INP should be 200 milliseconds or less.

To gather empirical evidence of web performance metrics of CRUD application are conducted several steps which are described in Methodology section then are applied the statistical methods t-test and ANOVA One Way through SPSS to analyze and compare the evaluated web performance across web frameworks.

In the following table are shown these results of the collected quantitative data (Details provided in appendix 2)

Table 1 *ANOVA One Way results per web frameworks*

		Sum of Squares	df	Mean Square	F	Sig.
LCP	Between Groups	49555939.875	3	16518646.625	8.528	**.000**
	Within Groups	116222083.875	60	1937034.731		
	Total	165778023.750	63			
CLS	Between Groups	28467.172	3	9489.057	7.724	**.000**
	Within Groups	73708.188	60	1228.470		
	Total	102175.359	63			
FID	Between Groups	1056468925.788	3	352156308.596	3.969	**.018**
	Within Groups	2395912194.829	27	88737488.697		
	Total	3452381120.617	30			
INP	Between Groups	8036552242.311	3	2678850747.437	4.474	**.015**
	Within Groups	11975124363.022	20	598756218.151		
	Total	20011676605.333	23			

The results shown in the above table are statistically significant difference between web frameworks Laravel, Django, Slim and Flask, where the p value per LCP, CLS, FID and INP is less than 0.05, indicating that the choice of web framework impact performance metrics. Considering these results, in the following are shown the details of the comparison of web frameworks of t-test.

Table 2 *Group Statistics: Laravel and Django web frameworks*

LCP	Framework	N	Mean	Std. Deviation	Std.ErrorMean
	LARAVEL	16	754.94	240.570	60.142
	DJANGO	16	2717.31	2602.780	650.695
CLS	**LARAVEL**	16	16.50	18.221	4.555
	DJANGO	16	.13	.342	.085
FID	**LARAVEL**	5	4919.94000000	6735.399062268	3012.162031764
	DJANGO	8	1.07500000	.265921578	.094017476
INP	**LARAVEL**	4	6762.00000000	6720.448794537	3360.224397269
	DJANGO	5	379.20000000	287.811049128	128.713014105

Table 3 *Independent Sample Test: Laravel and Django web frameworks*

	Equal variances	Levene's Test F	Sig.	T-test t	df	Sig. (2-tl)
LCP	Assumed	74.259	**.000**	-3.003	30	**.005**
	Not assumed			-3.003	15.256	**.009**
CLS	Assumed	156.765	**.000**	3.594	30	**.001**
	Not assumed			3.594	15.011	**.003**
FID	Assumed	162.451	**.000**	2.124	11	**.057**
	Not assumed			1.633	4.000	**.178**
INP	Assumed	263.238	**.000**	2.160	7	**.068**
	Not assumed			1.898	3.009	**.154**

Table 2 shown the descriptive statistics for web performance metrics of the **Laravel** and **Django**, where:

1. LCP is statistically significantly lower per LARAVEL (754.94±240.570 millisec-onds) than per DJANGO (2717.31± 2602.780 milliseconds), t (30) = -3.003, p=0.005.
2. CLS is statistically significantly lower per DJANGO (0.13±0.342 milliseconds) than per LARAVEL (16.50± 18.221 milliseconds), t (30) = 3.594, p=0.001.
3. FID has no significant difference per DJANGO and LARAVEL even DJANGO has a lower mean 1.07500000±.265921578 milliseconds) than the FID per Laravel (4919.94000000± 6735.399062268 milliseconds), t (11) = 2.124, p=.057.
4. INP has no significant difference per DJANGO and LARAVEL even DJANGO has a lower mean (379.20000000±.287.811049128 milliseconds) than the INP per Laravel (6762.00000000 ± 6720.448794537 milliseconds), t (7) = 2.160, p=.068.

While the Table 3 shows the results of independent sample t-tests for each web performance metric to compare the means of Laravel and Django frameworks.

1. LCP and CLS has significant differences between Laravel and Django, with Django performing better for both metrics.
2. FID and INP has no significant differences between Laravel and Django, but descriptive statistics suggest that Django might still be better than Laravel.

Table 2 shown the descriptive statistics for web performance metrics of the **SLIM** and **FLASK**, where:

1. LCP is not statistically significantly different per SLIM and FLASK even SLIM has a lower mean (623.88±320.241milliseconds) than the LCP per FLASK (685.13± 901.803 milliseconds), t (30) = -.256, p=.800.

Table 4 *Group Statistics: Laravel and Django web frameworks*

	Framework	N	Mean	Std. Deviation	Std.ErrorMean
LCP	**SLIM**	16	623.88	320.241	80.060
	FLASK	16	685.13	901.803	225.451
CLS	**SLIM**	16	56.31	65.985	16.496
	FLASK	16	12.25	15.093	3.773
FID	**SLIM**	11	49.24545455	153.491871861	46.279540666
	FLASK	7	14369.67142857	19210.301900605	7260.811634210
INP	**SLIM**	9	256.88888889	297.037221760	99.012407253
	FLASK	6	43653.33333333	48659.210592309	19865.039539631

Table 5 *Independent Sample Test: Slim and Flask web frameworks*

	Equal variances	Levene's Test F	Sig.	T-test t	df	Sig. (2-tl)
LCP	Assumed	16.280	**.000**	-.256	30	**.800**
	Not assumed			-.256	18.724	**.801**
CLS	Assumed	432.649	**.000**	2.604	30	**.014**
	Not assumed			2.604	16.565	**.019**
FID	Assumed	52.101	**.000**	-2.518	16	**.023**
	Not assumed			-1.972	6.000	**.096**
INP	Assumed	7.698	**.016**	-2.728	13	**.017**
	Not assumed			-2.185	5.000	**.081**

2. CLS is statistically significantly lower per FLASK (12.25 ± 15.093milliseconds) than per SLIM (56.31± 65.985 milliseconds), t (30) = 2.604, p=.014.
3. FID is statistically significantly lower per SLIM (49.24545455 ± 153.491871861 milliseconds) than per FLASK (14369.67142857± 19210.301900605 milliseconds), t (16) = -2.518, p=.023.
4. INP is statistically significantly lower per SLIM (256.88888889 ± 297.037221760 milliseconds) than per FLASK (43653.33333333 ± 48659.210592309 milliseconds), t (13) = -2.728, p=.017.

While the Table 5 shows the results of independent sample t-tests for each web performance metric to compare the means of Slim and Flask micro-frameworks.

1. CLS has significant differences between Slim and Flask, with Flask performing better in layout stability.
2. FID and INP has significant differences between Slim and Flask, with Slim performing better than Flask.

LCP has no significant differences between Slim and Flask.

3.3. Results of assessing the learning curve and community support of web frameworks

This chapter present the survey results from 61 respondents to understand resources they used to learn web frameworks and their perspective about community support of each web framework. Based on the following results, it is highlighted that Laravel is the most widely used web framework comparing to Django, Slim and Flask.

According to respondents' responses, the most preferred learning recourses are online tutorials and ChatGPT while the official documentations and courses remain important. The community forums and GitHub Copilot have lower utilization. This is shown in the figure 4.

Although the usage of community forums is low in this study, in the following are the respondents results regarding how active the community of each framework is. Based on study results, Flask is most moderate active comparing to Laravel, Django and Slim.

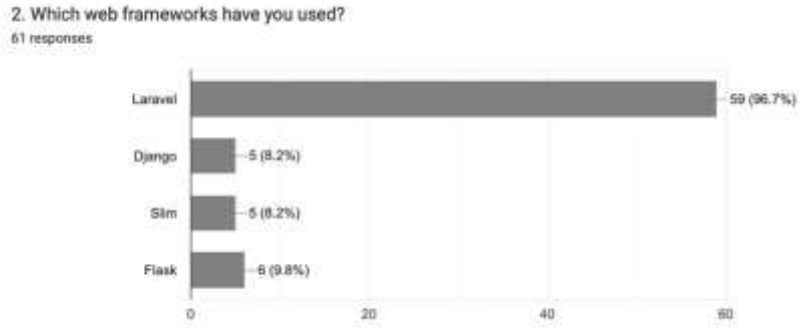

Figure 2 *Web frameworks usage by respondents*

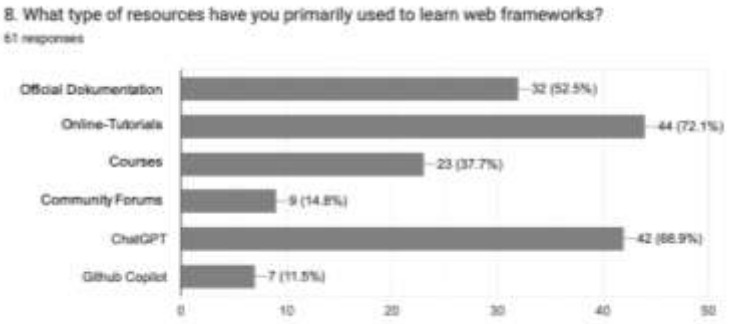

Figure 3 *Type of resources used to learn Web framework*

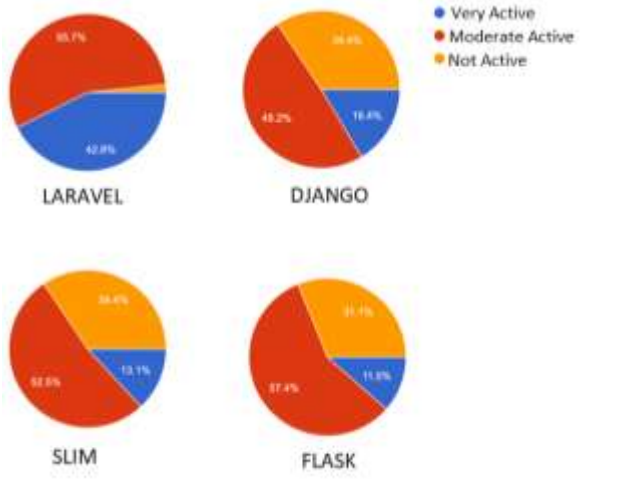

Figure 4 *How active is the web frameworks community in providing support and resources*

While, in the following subsection are the **discussion** per each result of research objectives.

3.4. Discussion per comparing number of jobs posting on LinkedIn per web frameworks

Based on the results in figure 1 about job postings on LinkedIn for frameworks across regions, the findings reveal that PhP frameworks such as Laravel and Slim dominate in the European Union, while python frameworks such as Django and Flask dominate in the United States. Also, Kosovo country located in Southeast Europe, prefer PhP frameworks which preference is aligned with European trends. Based on these findings, technology adoption and employment demands are influenced by industry preferences, educational curricula and economic conditions. Developers that tend to gain skills align with regional demands can use these findings in their learning decision making. Moreover, these findings have implication for developers worldwide because they understood the regional demands for frameworks such as Laravel, Django, Slim and Flask, this helps them to make informed decision about their learning path based on regional preferences for employment. Also, these findings influence the decision making of policymakers and educators on incorporating the in-demand technologies into academic program based on their regions. For instance, Kosovo Higher Education institution can add the PhP web frameworks in their curricula to benefit their students in their preparing for employment in European region, but also, they can add the python web frameworks if their students want to benefit in their preparing for online employment in United States.

Based on conducted research, prior studies have not addressed the job market demands per web frameworks as are treated in this study. Govinda, K. at al. (2024) and Johnson, Michael A. at al. (2020) have investigated the platform LinkedIn for job searching, professional network and personal branding in general but not specific for web frameworks [3, 4]. Thus, this study bridges the gap

through LinkedIn data by offering the insights into technological learning skills demand by employers across regions. Choosing the LinkedIn platform as data source in this study is aligned with the following authors da Motta Veiga at al. (2020) and Orgad Shani (2024) who, emphasized the platform role in job search success because it is widespread use among organizations and professionals for studying global job market trends [5, 6].

Unlike the above authors, the authors, Govinda, K. at al. (2024) highlighted that LinkedIn recommendations my lead to biases which potentially influence the importance of job posting in certain regions per certain frameworks [7].

This could be a limitation in this study based on this research. Therefore, for future research, can be treated the job market trends across additional platforms like Indeed and Glassdoor, comparing with LinkedIn findings because there is limited research that address it.

3.5. Discussion per evaluation of web frameworks' performance

The results of performance of CRUD application developed using Laravel, Slim, Django, and Flask emphasized how the choice of web frameworks impact the critical aspects of web application performance. This study is focused on Google's Core Web Vitals' metrics such as: Largest Contentful Paint (LCP), Cumulative Layout Shift (CLS), First Input Delay (FID), and Interaction to Next Paint (INP). According to Dobbala, M.K. at al. (2022) and Vepsäläinen, J. at al. (2024) these metrics affect outcomes of business, engagement and experience of user [8, 9].

Considering the results of performance, the Laravel consistently performed better than Django through demonstration of faster loading times. This result is supported also by Dobbala, M.K. at al. (2022) where highlighted that a web application that takes more than 3 seconds to load is more likely to abandon by users which impact the maintenance of engagement [8]. While Django perform better in visual stability with minimal layout shifts during loading which make it ideal for web application that requires user interface consistency. Based on research of author Edgar, M., 2024 the unexpected shifts in web application layout can frustrate users if they are actively engaged with content therefore visual stability is important. Also, Flask offers more stable layout comparing to Slim [10].

Furthermore, the performance of Slim related to responsiveness (FID, INP) is better than performance of Flask because it has quicker response time. The responsiveness according to the authors Vepsäläinen, J. at al. (2024) and , N. at al. (2022) is very important and this is the reason that Google has replaced FID with INP [9, 11].

These findings are significant in real-world implications about framework selection because it helps developers to select web frameworks based on projects needs, for instance, if developer need to develop a project with fast-loading performance should choose Laravel, while if they want visual stability should select Django. This is support also by previous research were highlighted that web framework should be chosen aligned with project needs and regular testing of Web Vital metrics [8, 9].

During research conducted related to research objectives in the context of existing research, it because evidence that there is limited research that address the web framework performance metrics using google web vitals, even, the Google Web vitals is prominent as key indicator of web application performance. This gab underscore for further investigation especially can be investigated the performance of mobile application per google web vital metrics and adding newer web frameworks which could provide insights into emerging trends in web application performances.

3.6. Discussion per assessing the learning curve and community support of web frameworks

This chapter discuss the survey results which provide valuable insights into the web frameworks' learning resources and community support, which are aligned with the third objective of this study.

Through the findings of this study is highlighted that the Laravel web framework is most used by respondents, with 96.7% of usage, then the most used is Flask. Through evaluation of these respondents' responses about learning curve, the online tutorials and ChatGPT are the most used resource for learning web frameworks, while the official documentations and courses remain as primary resources. The interesting findings is about GitHub Copilot were only 11.5% of respondents use it, which indicate that it is more perceived for code generation than learning fundamental concepts.

According to del Pilar Salas-Zárate et al. (2015) the effective learning resource is directly correlated with necessity of best practices of web framework development. [12]. Also, the Hasnain and Ullah (2023) highlighted that ChatGPT facilitates learning by addressing programming challenges, debugging issues, and library navigation [13]. Additionally, Vlachopoulos and Makri (2019) underscores the importance of interactive learning

environments, further supporting the adoption of AI and digital learning tools [14]. While the community form usage is also least utilized resources with 14.8%, which reflect a shift from traditional discussion to learning based on AI and online tutorials. Furthermore, when assessing the activity level of Communities of Laravel, Django, Slim and Flask Framework, the most active community based on respondents' responses percentage were Flask Community but if we compare the number of respondents that use the Laravel framework, the Laravel Community is more active and accessible. However, Reynolds et al. (2021) emphasize the role of online communities in professional development, suggesting that the decline in traditional forums may impact collaborative learning and pedagogical evolution [15]. These studies support our study regarding the learning curve of web frameworks and community support.In the future, based on our findings is encouraged the diversity of web frameworks adoption from students, developers, policymakers and educators because the dominance is in Laravel.Also, it is encouraged to update learning materials with focus on developing interactivity through AI Tools, online tutorials, real-world examples in official documents.

4. Conclusions

This study provides a comparison of four popular web frameworks such as Laravel, Django, Slim and Flask offering the valuable insights into the regional demand for web frameworks as reflected in job posting in LinkedIn, measuring against Google's Core Web Vitals: LCP, CLS, FID, and INP per CRUD application, analyzes survey data on learning resources and community engagement.

The analysis of job postings on LinkedIn revealed significant regional variations, with Laravel and Slim dominating in Europe, while Django and Flask are more commonly sought after in the United States. This underscores the influence of regional economic conditions, educational curricula, and industry preferences on the adoption of web technologies. Developers can leverage these insights to align their learning paths with market demands, ensuring their skills are relevant to the geographical region in which they seek employment.Performance testing, using Google's Core Web Vitals, demonstrated that Laravel offers superior loading performance, Django excels in visual stability, and Flask provides better responsiveness compared to Slim. These results can help developers choose the right framework based on specific project needs, such as prioritizing fast loading times, visual consistency, or responsiveness.The assessment of learning resources and community support indicated a shift towards online tutorials and AI-driven tools, such as ChatGPT, as primary learning resources, with traditional community forums seeing reduced engagement. This shift suggests the growing role of AI tools and digital learning platforms in shaping the future of web development education.

The study contributes to existing literature by addressing gaps related to web framework performance, learning resources, and regional job market trends. By providing data-driven recommendations, this research assists developers, students, educators, and policymakers in making informed decisions about framework selection, learning, and curriculum development. Moving forward, further research could explore additional frameworks, investigate long-term trends in framework adoption, and assess the evolving role of AI tools in learning and development within web application frameworks.Ultimately, this study reinforces the significance of selecting the appropriate web framework based on job market demand, performance requirements, and ease of learning, ensuring that developers and students are well-equipped for success in the rapidly evolving web development landscape.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
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Appendixes

1. Dataset of job position on LinkedIn per web frameworks

In the following is shown the link of dataset with collected data about opened job position on LinkedIn per web frameworks Laravel, Slim, Django and Flask:

https://docs.google.com/spreadsheets/d/1Wt0XQR432wOu0Wd7UCn8aglcmGB2hv4V/

2. Dataset of collected data about measurements

In the following is shown the link of dataset with collected data about measurements of web frameworks of developed crud by Laravel, Slim, Django and Flask:

https://docs.google.com/spreadsheets/d/1v01cUHRNPHgFXCbM32XdgH29fN_ypZM6/

3. Collected data through survey

The survey collected data for this research can be accessed on request to corresponding author.