Gap Identification between Bootcamp Programs and Industrial Needs Utilizing Text Mining

Muhammad Arief Ardyansyah*and Ignatius Luddy Indra Purnama
Department of Industrial Engineering, Universitas Atma Jaya Yogyakarta, Yogyakarta, Indonesia

Email: 235612662@students.uajy.ac.id, luddy.indra@uajy.ac.id

*Corresponding author

ABSTRACT

This paper aims to identify the gaps between the bootcamp program and industrial needs using text mining techniques. The case studies focus on bootcamp programs for full-stack laravel vue.js developers, and uiux designers. The data utilized includes curriculum or syllabi from the boot camps and industrial requirements gathered from online job portals, particularly job descriptions from Indeed.com. The analysis revealed a gap of 30% between the bootcamp curriculum and industrial needs for full-stack Laravel vue.js developer, and 20% between the bootcamp curriculum and industrial needs for uiux designer. Based on this identification, alternative solutions were proposed to enhance the curriculum or syllabus. The results of the usability test are OK level. It is indicated that satisfactory outcomes, suggesting that the proposed improvements could help make bootcamp programs more responsive to the evolving needs of the related industry.

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1. INTRODUCTION

The conclusion of the COVID-19 pandemic has triggered significant shifts in the global business landscape. Declining economic stability has led to increased layoffs, particularly in Indonesia (Thalib et al., 2024). Restrictions on in-person interactions have also transformed traditional work culture, moving from office-based settings to remote alternatives such as work-from-home (WFH) and work-from-anywhere (WFA) arrangements (Widjaja et al., 2021). This transformation has amplified the role of technology in professional settings, fostering the emergence of new digital professions that align with business objectives. Careers such as software development, web development, content creation, and digital marketing have become increasingly in demand as companies undergo digital transformation (Yoshio, 2021).

Evolving workplace conditions have created opportunities for the development of educational technology (EdTech) solutions that focus on career preparation, particularly in vocational fields. These initiatives equip digital talents with the necessary skills to enter and thrive in technology-driven job markets (Alfitri et al., 2023). One of the most prominent EdTech solutions is the bootcamp program, designed to provide career preparation services that address the growing need for digital skills. Interactive, two-way learning processes

allow participants to engage directly with mentors, improving career readiness for aspiring digital professionals (Humairoh & Pinandito, 2023). Addressing rising open unemployment rates in Indonesia has become a pressing concern. Data from the Indonesian Central Bureau of Statistics (BPS, 2024) indicates an increase in unemployment among academy or diploma graduates, rising from 171,897 in August 2023 to 173,846 in February 2024. Similarly, university graduate unemployment has grown from 787,973 to 871,860 during the same period. Ensuring that bootcamp curricula align with industry demands is crucial in mitigating these labor market challenges (Koerniawaty, 2018).

Efforts to ensure that bootcamp materials are relevant to industrial needs can be achieved by utilizing data from job portal websites to explore industrial requirements. This information is described through job vacancies, aligning with what each company needs to achieve its business objectives. The era of big data and text mining techniques can assist in uncovering insights that can be used to evaluate businesses, particularly in addressing business challenges. Text mining is capable of processing high-quality information from text. Additionally, text mining can be employed to analyze information, including sentiment analysis of sentences, very quickly, facilitating the acquisition of quality information (Hermawan et al., 2023). This study aims to design a framework to identify the gap between the bootcamp products described by the curriculum or syllabus material topics and the industrial needs described by the keywords with the highest frequency from job description datasets collected using web scraping techniques and subsequently analyzed using text mining methods.

2. LITERATURE REVIEW

2.1. Text Mining

In the digital era, unstructured data such as text generated from job portal platforms is one of the most potential sources of information (Bisane, 2024) This text includes job descriptions, job seeker profiles, and company reviews, which, when properly analyzed, can provide significant insights for decision-makers (Laheba & Ai, 2021). By utilizing text analysis of unstructured data can be transformed into meaningful information for various needs, such as improving job training curriculum or developing employee competencies in accordance with industrial needs (Bae et al., 2023). One of the most commonly used approaches in text analysis is text mining (Mihalcea, 2008). This process allows users to extract patterns and important information from complex text (Kobayashi et al., 2018). By processing text data using text mining, organizations can understand labor market trends, sought-after skills, and the company's need for certain qualifications (Ilijoski & Popeska, 2018). This technique not only helps in strategic decision-making but also allows for more effective management of human resources (Fareri et al., 2020).

The methods commonly applied in text mining include lexicon-based and term frequency-inverse document frequency (TF-IDF) approaches (Qaiser & Ali, 2018). The lexicon-based approach uses a predefined list of words to identify a specific sentiment or category in the text (Moussa et al., 2020). Meanwhile, TF-IDF helps determine the importance of a word in each document relative to the entire document set (Qaiser & Ali, 2018). The combination of these two methods is very useful in analyzing text data to evaluate the effectiveness of the job training curriculum, especially used to analyze job descriptions to identify gaps between the existing competencies standard and the competencies needed in the jobs (Nasim et al., 2017). The application of lexicon-based and TF-IDF methods in the field of Human Resource Analytics has shown various benefits (Wang et al., 2020). In evaluating the curriculum, this method can help identify relevant topics and required competencies based on the analysis of job descriptions on job portal platforms (Mohanamani & Latha, 2023). In addition, the results of the analysis can provide specific recommendations to improve the curriculum so that it is more aligned with the needs of the industry. This provides a more targeted solution to answer the challenges of the ever-evolving jobs (Han et al., 2020).

Compared to other methods, lexicon-based and TF-IDF have several advantages that make them proven in text analysis (Srivastava et al., 2022). The lexicon-based approach allows for more intuitive interpretation of results because it directly refers to a specific word list (Taboada et al., 2011), whereas TF-IDF provides the flexibility to tailor the analysis to specific data without the need for intensive data training like in machine learning-based methods (Rizinski et al., 2024; Srivastava et al., 2022). Additionally, both methods are relatively faster to implement and require lower computing resources, making them an efficient solution for processing large amounts of text data (Rizinski et al., 2024). All these advantages, lexicon-based and TF-IDF, are ideal choices for unstructured text data to uncover insights (Wang et al., 2020), especially in supporting strategic decision-making in the field of human resource analytics.

2.2. Bootcamp Program

In the massive of rapid technological development, job preparation is no less important than formal education, especially in the field of digital professions such as Web Developers (Ananta et al., 2023). Formal education provides a strong theoretical foundation, but the job field often demands more specific technical skills and is ready to be applied (Esmail & Khan, 2024; Amish, 2024; Verhaest & Omey, 2013). Professions such as Web Developers require skills that are constantly updated along with the development of the technology used, so a practical approach in preparing for themselves is very crucial for job seekers (Golchevskiy & Yermolenko, 2023; Kruglyk & Osadchyi, 2015). One of the programs that offers effective job preparation solutions is the bootcamp program. Bootcamps are intensive training programs designed to help participants acquire specific skills in a short period of time. The program usually focuses on practical aspects, such as the development of real projects, so that participants can immediately apply the knowledge gained (Hendricks & Edwards, 2024;

Santos et al., 2024). In the context of job seekers, boot camps are an attractive option because they can bridge the gap between the theories learned in formal education and the skills required by industry (Dzvapatsva et al., 2023; Hodgson, 2024).

The success of the bootcamp program is supported by its various advantages over traditional job preparation programs. First, bootcamps offer more focused and in-depth training in a relatively short period of time (Santos et al., 2024). Second, project-based teaching methods provide hands-on experience that is relevant to daily work (Thayer & Ko, 2017). Third, these programs are often designed to involve industry practitioners, so that the curriculum used is more relevant to the needs of the labor market (Kaynak, 2024). With all these advantages, bootcamps are a strategic choice for job seekers who want to accelerate their transition to the workforce (Arbeit et al., 2019). However, to ensure the quality of the bootcamp program, one of the indicators that needs to be considered is the suitability of the curriculum used with the needs of the industry (Smith et al., 2020). This can be identified through the analysis of job descriptions available on online job portals (Santos et al., 2024). The description reflects the skills most needed by the company, so it can be a guide in designing the right material topic. Using this data, bootcamp programs can ensure that their graduates have the skills that match the market demands (De Mauro et al., 2018).

Because changes in the digital world of work are happening very quickly, periodic evaluation and improvement of the curriculum is a necessity that must be done (Taylor-Beswick, 2023). A curriculum that is responsive to industry trends will provide added value for bootcamp participants and increase their competitiveness in the job market (Mahardhani et al., 2023). This evaluation is not only important to ensure that the material taught remains relevant, but also to maintain the sustainability of the bootcamp program as a superior solution in preparing a competent workforce (Hendricks & Edwards, 2024).

The bootcamp program not only serves as an alternative and support for formal education, but also as a strategic partner for the industry in producing a workforce that is ready to face the challenges of the world of work. Through continuous evaluation and adjustment of the curriculum, the bootcamp program can continue to make a significant contribution in building adaptive and innovative human resources, especially in the field of digital professions, such as Web Developers (Ling & Chiang, 2022).

2.3. Industrial Needs

Knowing the needs of the industry is an important strategic step for education service providers to create graduates who are ready to work (Moore & Morton, 2017). Industrial needs include a wide range of competencies, technical skills, and professional values expected of workforce candidates (Spanjaard et al., 2018). By understanding these needs, educational institutions can design a more relevant curriculum and learning methods, so that their graduates not only have theoretical knowledge, but also practical skills that fit the demands of the job field (Januzaj et al., 2024). This provides significant benefits for both educational institutions, industry, and the graduates themselves. In the context of vocational education for job preparation, understanding the needs of the industry plays an important role in reducing the unemployment rate (Azman et al., 2020; Subiyantoro et al., 2023). Vocational education is designed to produce a workforce with special skills, but if the curriculum is not in accordance with the needs of the industry, graduates will have difficulty getting a job (Somantri & Pramudita, 2024). Designing a curriculum based on industrial needs, vocational education can prepare graduates who are in accordance with the expected qualifications (Esmail & Khan, 2024). This approach not only qualifies graduates but also helps create a more productive and efficient workforce ecosystem (Rosina et al., 2021).

The aspects of industrial needs can be reviewed from various sides, such as technical skills (hard skills), interpersonal skills (soft skills), and performance expectations (Tulsi & Poonia, 2015). In addition, the needs of the industry also include the technology used, the expected work culture, and the latest trends and innovations (Khan et al., 2022). All these aspects can be identified through collaboration between education service providers and industry players, as well as by utilizing data available from external sources, such as job market reports and industry trend analysis (Amante & Fernandes, 2023). In the era of digital technology, the existence of online job portals has a significant impact on understanding the needs of the industry (Brancatelli et al., 2020). The job description dataset available on this online job portal can be accessed according to the job position you are looking for, such as Web Developer, so it can provide in-depth insight into the skills, technology, and experience needed according to current conditions in the field (Litecky et al., 2010). Analyzing job description data using methods such as text mining and natural language processing, education providers can identify labor market trends more quickly and accurately (Mbah et al., 2017; Zhang, 2024). This allows education providers to be more responsive to changing industrial needs (Fortino & You, 2022).

The relationship between industrial needs and curriculum evaluation is becoming increasingly important in creating quality digital talent (Marlapudi & Lenka, 2024; Pelaez-Sanchez et al., 2024). Curriculum evaluation based on industrial needs data helps ensure that educational programs are always relevant to labor market developments (Mahardhani et al., 2023). In the context of digital professions such as Web Developers, the evaluation of the educational curriculum is important because, as time goes by, technology continues to undergo version updates (López-Pimentel et al., 2021). Aligning the curriculum toward market needs, educational institutions can produce competent and highly competitive graduates while supporting future technology-based economic growth (Soto & Habib, 2024).

3. PROPOSED FRAMEWORK

The initial stage of this research is to conduct a field study to find out the actual conditions and limitations that are owned, then continue with the preparation of a problem formulation to determine the main problem to be solved through this research. The next step is in the form of data collection in the form of curriculum/syllabus data obtained from case studies, and also job vacancy data processed using web scraping techniques using R software with libraries in the form of rvers.

The preparation stage is carried out by data cleaning. The data that has been collected is then cleaned to be ready for text mining analysis. The first step is to carry out data preprocessing in general, such as removing punctuation, excess spaces, and checking stopwords to eliminate suffixes or conjunctions (connectors) in order to minimize bias during the text mining analysis process. Furthermore, the process of correcting the word less standard becomes standard with the slang rule. After that, it is followed by the tokenization process to cut sentences into words per line, making it easier to process text mining later.

At the analysis stage, the text mining method was carried out to determine the frequency of words that often appear, so that they can be used to interpret the dataset into business insights in the context of this research, in the form of identifying industrial needs in the field of work in accordance with case studies. Furthermore, it is checked whether the findings are representative in describing the needs of the industry related to certain fields of work; if not, it will return to the data cleaning process to improve the condition of the dataset, which is then analyzed again by text mining. If the results of the keyword extraction are considered representative, the next stage is to perform a structured gap analysis. This is carried out by comparing the set of industrial need keywords extracted through text mining techniques from job description datasets with the curriculum or syllabus content of the bootcamp program. Each keyword is assessed and classified into one of three categories: Appropriate (covered by more than one curriculum topic), Achieved (covered by exactly one topic), and Needs Improvement (not covered at all). The degree of curriculum alignment is then expressed as a percentage, calculated by dividing the number of keywords that fall into the Appropriate and Achieved categories by the total number of identified industrial keywords. This gap fulfillment percentage provides a transparent and replicable indicator of how responsive the bootcamp syllabus is to current industrial demands. Furthermore, keywords that are classified as Needs Improvement highlight specific content areas that may require future syllabus enhancements. After that, a usability test was carried out on users to find out the extent of the usability of the gap identification framework between industrial needs and bootcamp programs that could be used by users. The System Usability Scale or SUS questionnaire (Bangor et al., 2008) included the following items:

1) I think I would frequently use this framework to evaluate how well bootcamp curricula respond to industrial needs described in job postings on online job portals.
2) I found the framework unnecessarily complex for use in business organizations.
3) I thought the framework was easy to use for business organizations.
4) I think I would need assistance from a technical person to use this framework.
5) I found the concepts and stages in this framework well integrated.
6) I found inconsistencies throughout the stages of this framework.
7) I imagine most business organizations would learn to use this framework very quickly.
8) I found this framework impractical for identifying gaps between industrial needs and bootcamp curricula.
9) I felt very confident using the framework.
10) I needed to learn a lot before I could effectively use this framework.

The scoring followed the standard SUS calculation method:

1) For odd-numbered items, the score contribution is X−1.
2) For even-numbered items, the score contribution is 5−X.

The value of X is the Likert scale response (1 to 5). The sum of the adjusted scores is then multiplied by 2.5 to yield the final SUS score (out of 100).

In the final stage, the conclusions of the research that has been carried out, suggestions for the next research, and gratitude to stakeholders who support this research are carried out. (Figure 1).

4. CASE STUDY

The case study used in this study is contained in the bootcamp program for the field of work as a full-stack Laravel and Vue JS developer. This is based on research (Markow & Sederberg, 2020) that the software developer field is in the order of demand for a high number of candidates. In addition, the field of software developers has a significant development every time (Bessen, 2018). Therefore, the curriculum or syllabus needs to be responsive in considering the needs of the industry; it is necessary to evaluate the gap level to ensure that the curriculum or syllabus remains relevant. After that, to assess the practical applicability of the proposed framework in evaluating curriculum-industry alignment, a usability test was conducted using the System Usability Scale (SUS) instrument. This standardized tool enables the evaluation of a system's ease of use, clarity, and overall acceptability from the perspective of end users.

The test involved five participants from the Curriculum Research Division of PT. XYZ, consisting of 3 staff members, 1 internship participant, and 1 curriculum manager. All participants were actively engaged in curriculum analysis and development, making them highly relevant to the intended user group of the proposed framework. Participants were instructed to access the framework document, review the methodology section, and simulate its use by following the provided

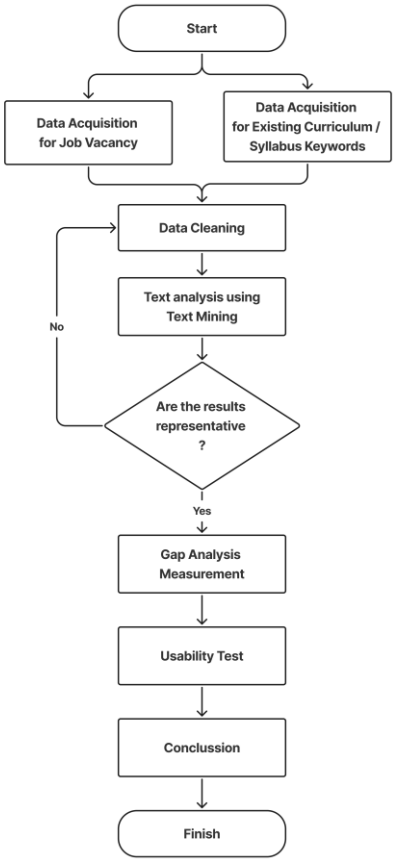

Figure 1. Research Methodology

Table 1. Example of an extracted dataset

...	title	Company name	Location	Job description	...
...	Laravel Developer	PT. ABC	Bandung	We are looking for an experience...	...
...	Web Developer	PT. XYZ	Sleman	Candidate must possess...	...
	.....	...	...	...	...

syntax and steps to complete the gap analysis process between a sample bootcamp syllabus and industrial job description data. Upon completion, they confirmed the task and proceeded to fill in a 10-item questionnaire adapted from the SUS instrument.

5. RESULTS AND DISCUSSIONS

The data collection process using data scraping with job position parameters in the form of a full-stack Laravel developer managed to obtain a dataset of 281 data points as of September 24, 2024, with the dataset format according to Table 1. The dataset was then preprocessed to eliminate suffixes and meaningless words using the stopwords technique and the help of the tm library in R Studio software. Identification of keywords for industrial needs with text mining can be found in Figure 2, 20 keywords can be used as a reference in measuring the gap between education institution such as EdTech products in the form of bootcamps and industrial needs in related fields of work in the form of: experience, development, code, PHP, team, design, knowledge, Laravel, software, company, strong, understanding, applications, skills, interview, database, programming, developer, web, and application.

The keywords of the industrial needs that have been identified are then interpreted using TF-IDF so that the results are obtained as shown in Figure 3. For example, for the keyword experience, it can be known that the keywords related to the word are experience, previous, strong, shared, experienced, user, experienced, proven, demonstrated, and including, so that it can be interpreted as: 1. Candidates have experience in the related field of work, at least having participated in an internship program and have a portfolio so that they are active in carrying out good personal branding, which is indicated by having references from other professionals. 2. Candidates have a strong understanding of career paths in the related work field.

The gap identification assessment process is by comparing the keywords of industrial needs that have been identified and interpreted to the syllabus or curriculum from the case study, namely the bootcamp program in the form of a full stack of Laravel and Vue JS

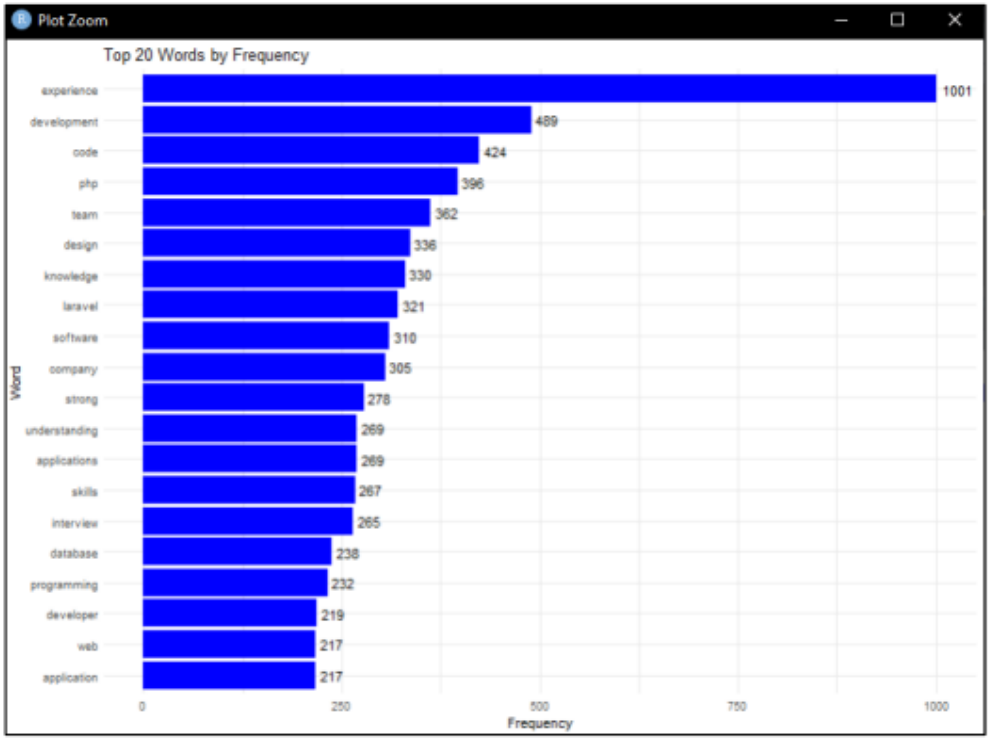

Figure 2. The result of job description keyword using text mining for Laravel and Vue JS Developer

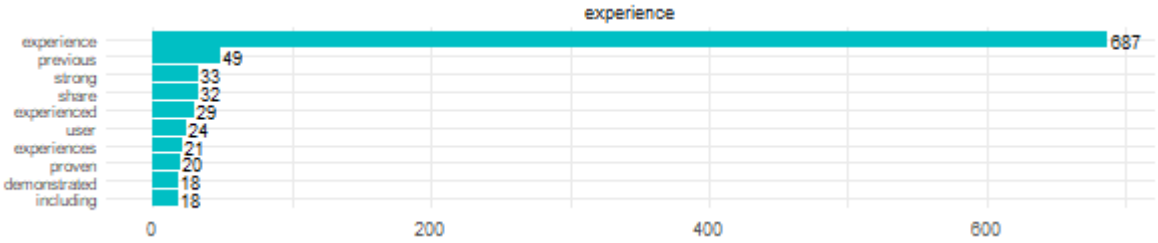

Figure 3. The result of industrial needs keyword interpretation using tf-idf for Laravel and Vue JS Developer

developer, the results are obtained in Figure 4, that 7 keywords of industrial needs match the syllabus of the bootcamp program, 2 keywords of industrial needs that are achieved with the syllabus of the bootcamp program, and 1 keyword for industrial needs that need improvement. Furthermore, for keywords with the achieved and need improvement categories, proposed improvements will be given so that the bootcamp program can be more relevant according to industrial needs.

Another aspect we are assessing is the data collection process for the UI/UX Designer bootcamp program. Using web scraping based on job position parameters for "UI/UX Designer", we successfully obtained a dataset comprising 75 entries as of June 5, 2025. The dataset was then preprocessed to eliminate suffixes and meaningless words using the stopwords technique and the help of the tm library in R Studio software. Identification of keywords for industrial needs with text mining can be found in Figure 5, 11 keywords can be used as a reference in measuring the gap between education institution such as EdTech products in the form of bootcamps and industrial needs in related fields of work in the form of: design, experience, user, product, skills, uiux, research, ability, team, understanding, and, tools.

The keywords of the industrial needs that have been identified are then interpreted using TF-IDF so that the results are obtained as shown in Figure 6. For example, for the keyword ability, it can be known that the keywords related to the word are communication, collaboration, skills, design, analysis, excellent, learning, creativity, executions, and including, so that it can be interpreted as: 1. The candidate must possess strong communication, collaboration, and analytical skills to work effectively in cross-functional teams and accurately execute design solutions. 2. The candidate must demonstrate creativity, a strong desire to learn, and mastery of design skills that support excellent work quality and adaptability to change.

No.	Keyword Kebutuhan Industri	Intepretation	Kurikulum / Silabus Program Bootcamp										Status	Proposed Improvement
			Career Preparation (Private Class)	Fundamental WebDev	Bootstrap	Freelance & Project Management	Git	MySQL	php	Vue JS	Laravel 10	Final Task		
1	experience	1. Candidates have experience in the related field of work, at least having participated in an internship program and have a portfolio so that they are active in carrying out good personal branding, which is indicated by having references from other professionals. 2. Candidates have a strong understanding of career paths in the related work field.	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Approriate	-
2	applications	The candidate has solved real business problems or case studies with responsive website-based solutions.	☑	☐	☐	☑	☐	☐	☐	☐	☐	☑	Approriate	-
3	development	1. the candidate understands the software development life cycle (SDLC). 2. Candidates have insight into the type of website architecture (monolithic, microservice, etc.).	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Need Improvement	Further consideration is needed in adding material topics related to various software architectures so that they can optimally support business needs.
4	code	Candidates have an understanding and mastery of the SOLID and OOP paradigms in Programming.	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	Achieved	Further consideration is needed in adding material topics related to the SOLID paradigm so that it can equip participants in adapting to certain programming standards at each company.
5	php	Candidates master website programming in PHP	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	Approriate	-
6	team	1. Candidates are able to collaborate with the Development Team using Software Version Control (SVC) tools. 2. Candidates master techniques in project management such as agile-scrum.	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐	Approriate	-
7	design	1. Candidates understand the concept of slicing from visual design (UI Design) results to website formats. 2. Candidates have the ability to design database schemas well.	☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	Approriate	-
8	knowledge	1. Candidates have basic knowledge in the field of programming algorithms for developing websites. 2. Candidates have the ability to develop personal potential in the related field of work. 3. The candidate has good time and project management skills. 4. Candidates have a match between the characteristics of the field of work related to personal potential	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	Approriate	-
9	laravel	Candidates are able to develop websites using the Laravel framework with MVC and REST API concepts.	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	Approriate	-
10	database	1. Candidates have mastered the design and implementation of databases to support the web apps they develop and have insight into the latest database technology. 2. The candidate understands the proper use of sql and nosql database technologies.	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	Achieved	Further consideration is needed in adding material topics related to considerations in using SQL or NoSQL technology in accordance with the scalability of the website to be developed.
												Gap Percentage	30.00%	

Figure 4. The gap identification framework worksheet for Laravel and Vue JS Developer

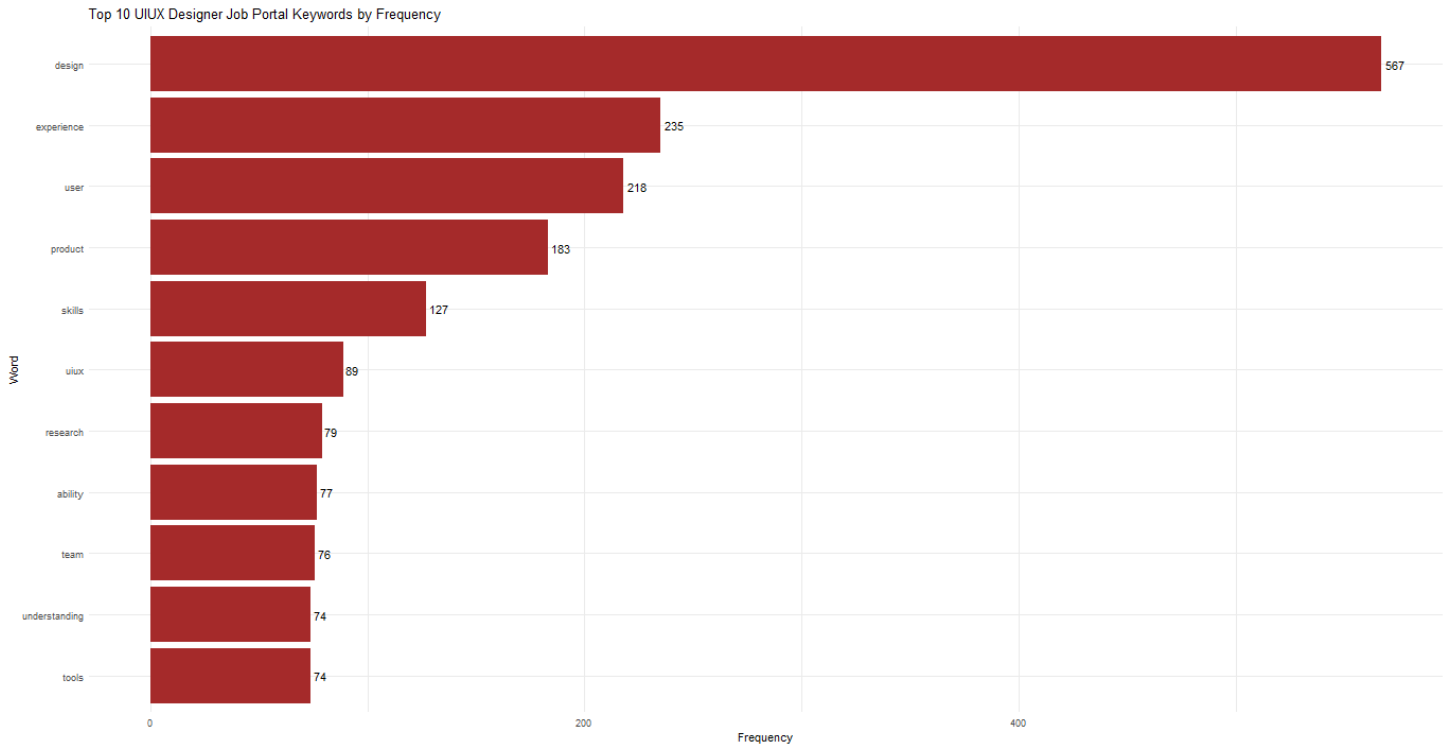

Figure 5. The result of job description keyword using text mining for UIUX Designer

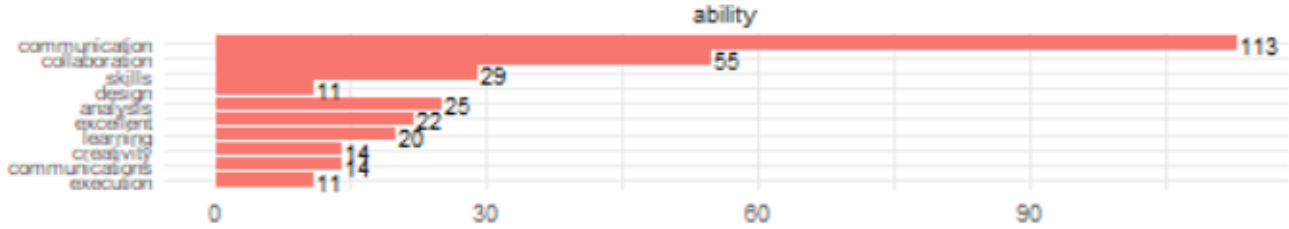

Figure 6. The result of industrial needs keyword interpretation using tf-idf for UIUX Designer

No.	Industrial Need Keywords	Interpretation	The Curriculum or Syllabus of Bootcamp Program											Status	Proposed Improvement
			Career Preparation (Private Class)	Fundamental UIUX Design	Design Thinking & User Research	Emphatise Stage	Define Stage	Ideate Stage	Basic Prototyping (Figma)	Advance Prototyping (Figma)	Usability Testing & Design Validation	Final Project	Final Test		
1	design	1. Candidates have the ability to design digital interface designs that include web and mobile platforms, with a focus on responsiveness and consistent user experience. 2. Candidates master wireframe and prototype creation, and are able to translate system requirements into functional and graphically attractive application visual designs.	☐	☑	☐	☐	☐	☑	☑	☑	☐	☐	☐	Appropriate	-
2	experience	1. Candidates have experience working on projects in designing and testing user interfaces that focus on usability, accessibility, and intuitive interactions for users. 2. Candidates are able to manage efficient user flows and support the creation of optimal user experiences through a user-centered design approach.	☐	☐	☑	☐	☐	☐	☐	☐	☑	☑	☐	Appropriate	-
3	user	1. Candidates have a deep understanding of user behavior, goals, and interactions, and are able to apply them in a user-centric design process. 2. Candidates are skilled in managing usability testing and interpreting user feedback, supported by strong interpersonal and design system skills.	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	Appropriate	-
4	product	1. The candidate plays an active role in the development of digital products by ensuring that the designed features have a high level of usability and are in accordance with user needs. 2. The candidate has an understanding of the product management process, including testing, interface design, and contribution to the preparation and implementation of product roadmaps.	☐	☐	☑	☐	☐	☐	☐	☐	☐	☑	☑	Appropriate	-
5	skills	1. Candidates have mastered technical skills in the form of usability testing, prototyping, and the use of design software/tools to produce effective and user-friendly solutions. 2. Candidates have excellent communication and collaboration skills, and demonstrate excellent work performance in a multidisciplinary team.	☐	☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	Appropriate	-
6	team	1. Candidate is able to collaborate effectively in cross-functional teams by prioritizing clear communication, accepting constructive feedback, and good interpersonal skills. 2. Candidate is accustomed to working in an agile environment and is able to maintain team alignment through strong visual contributions and excellent work performance.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Need Improvement	Further consideration is needed in adding material topics related to information system project management such as SCRUM in order to be better prepared to face an agile environment.
7	uiux	1. Candidates have a strong understanding of ui/ux principles with a focus on user experience and needs-oriented design. 2. Candidates are proficient in using tools such as Figma to create prototypes that pay attention to usability and overall interface aesthetics.	☐	☐	☑	☑	☐	☐	☑	☑	☐	☐	☐	Appropriate	-
8	research	1. Candidates are able to conduct user research with qualitative and quantitative methods through interviews, surveys, and other methods to gain relevant insights in the design process. 2. Candidates have good analytical and interpersonal skills and are able to process data into data-driven findings to support design decision-making based on user needs.	☑	☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	Appropriate	-
9	ability	1. Candidates have good communication, collaboration, and analytical skills to work effectively in cross-functional teams and execute design solutions appropriately. 2. Candidates demonstrate creativity, high enthusiasm for learning, and mastery of design skills that support excellent quality work results and are adaptive to change.	☑	☐	☐	☐	☑	☑	☐	☐	☐	☑	☑	Appropriate	-
10	understanding	1. Candidates have a deep understanding of user needs and data-driven insights to produce relevant and impactful design solutions. 2. Candidates are able to interpret feedback, understand business needs, and contribute to continuous product iteration, including designing solutions based on minimum viable products (MVP).	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Need Improvement	1. Further consideration is needed in adding material topics related to considerations in studying qualitative and quantitative data analysis methods. 2. Need to add discussions related to digital product management with the Product Life Cycle so that products can be managed sustainably.
Gap Percentage														20.00%	

Figure 7. The gap identification framework worksheet for UIUX Designer

Table 2. The results of validation by a professional using an interview

Aspect	Full Stack Laravel & Vue.js Developer	UI/UX Designer
Years of Experience	3–5 years	1–2 years
Curriculum Relevance	Generally relevant; however, it requires updates such as replacing Bootstrap with Tailwind CSS for better customization.	Largely relevant; updates needed on tools (e.g., latest features in Figma and richer user research).
Soft Skills & Career Preparation	Final task reflects practical skills; career preparation builds industrial readiness.	Final task serves as a benchmark for design solutions; career prep introduces real workplace scope.
Applicable Skills	Git, SDLC, database management, Vue.js, and Laravel are directly applicable in industry contexts.	User research, design thinking frameworks (Double Diamond, Design Sprint), prototyping in Figma.
Identified Gaps in Curriculum	Bootstrap is outdated; Tailwind CSS and Jira should be included for styling and project tracking.	Lacks deep user research methods; needs tools that support automated insights like Maze.co.
Feasibility of 3-Month Duration	Realistic: 2 months for learning, 2 weeks for the final task, 2 weeks for career preparation.	Possible, but 4–6 months is more ideal for readiness and multiple portfolio development.
Additional Technologies Suggested	Tailwind CSS, Jira	Maze.co and other automated usability testing tools
Ideal Bootcamp Duration	Approximately 3 months	4–6 months
Modules Needing More Time	Final task—challenges emerge during implementation that require time to resolve.	Final project—should allow 3–4 weeks per project, depending on research depth and design complexity.

The gap identification assessment process is by comparing the keywords of industrial needs that have been identified and interpreted to the syllabus or curriculum keyword from the case study, namely the bootcamp program in the form of UIUX Designer, the results are obtained in Figure 7, that 8 keywords of industrial needs match the syllabus of the bootcamp program and 2 keyword for industrial needs that need improvement. Furthermore, for keywords with the need for improvement categories, proposed improvements will be given so that the bootcamp program can be more relevant according to industrial needs.

The asynchronous interviews conducted with two industry practitioners for a Full Stack Laravel & Vue.js Developer with 3–5 years of experience and a UI/UX Designer with 1–2 years of experience, it can be seen on Table 2 and concluded that the designed bootcamp curriculum is generally relevant to current industry demands, yet several critical updates are necessary to enhance its practical alignment and effectiveness.

Firstly, regarding the aspect of curriculum relevance, both experts acknowledged that the core materials sufficiently address the fundamental competencies required in their respective fields. However, they highlighted the need for specific updates. For the Full Stack Developer track, it was suggested that Bootstrap should be replaced with Tailwind CSS to provide better customization and alignment with modern front-end practices. In the UI/UX Designer track, the experts recommended regular updates to cover the latest features in Figma and the incorporation of richer user research methods to better reflect real-world design processes. Secondly, in terms of soft skills development and career preparation, both experts agreed that the final task is effective in simulating real-world projects and serves as an important benchmark for assessing practical competence. Moreover, the career preparation component is seen as valuable for introducing participants to the actual scope of workplace demands, including portfolio development and adapting to industry workflows. Thirdly, in terms of skills applicability, the Full Stack Developer emphasized the importance of mastering Git, the Software Development Life Cycle (SDLC), database management, Vue.js, and Laravel, all of which are directly applicable in current industry contexts. Meanwhile, the UI/UX Designer highlighted the significance of user research, applying design thinking frameworks such as Double Diamond and Design Sprint, and proficiency in prototyping using Figma. Fourthly, the interviews revealed several gaps within the curriculum that should be addressed to maintain relevance. The developer track requires the inclusion of Tailwind CSS as a replacement for Bootstrap and the addition of project tracking tools such as Jira. On the other hand, the UI/UX Designer track would benefit from deeper coverage of advanced user research techniques and the integration of tools that support automated usability insights, such as Maze.co. Fifthly, regarding the feasibility of the bootcamp duration, the Full Stack Developer considered the proposed three-month schedule to be realistic, allocating two months for intensive learning, two weeks for the final task, and two weeks for career preparation. However, the UI/UX Designer suggested that a longer period of four to six months would be more appropriate, especially to accommodate deeper user research and the development of multiple portfolio projects.

Lastly, the experts noted that certain modules may require additional time allocation, particularly during the

final project stage, where implementation challenges often arise that necessitate further refinement and iteration. Specifically, the UI/UX Designer recommended allocating three to four weeks per final project to ensure adequate depth in research and design complexity.

The usability test was carried out to review how feasible the framework can be used as an alternative in evaluating bootcamp programs to suit the needs of the industry in related fields of work, so that it can contribute to answering the challenges faced, namely the unemployment rate in Indonesia can be minimized properly, and the EdTech business by offering bootcamp programs can contribute optimally. Based on the calculation using the system usability scale in Figure 8. The average SUS score across five participants was 52, which falls within the "OK" usability category based on standard benchmarks. Participants reported that the framework was conceptually clear and relevant to their work. However, some noted that the manual implementation of the syntax requires technical familiarity, suggesting future improvement through digital tool integration. These results indicate that the framework shows initial promise for practical use, particularly among users with basic technical literacy. Its potential can be further enhanced through automation or platform-based deployment, making it more accessible to non-technical curriculum research divisions, so the framework can be used as an alternative method in evaluating bootcamp programs periodically, so that it can be responsive in reviewing industrial needs.

There are several limitations of this study, such as the current framework effectively identify the gaps between bootcamp curriculum and industrial needs based on existing job description datasets; its nature remains static, relying on one-time data collection. In rapidly evolving technology sectors, this static approach may lead to outdated recommendations if not periodically updated. To enhance its relevance and responsiveness, future development of the framework should incorporate a dynamic monitoring mechanism that captures real-time or near-real-time shifts in industry trends and emerging technologies. This could involve the integration of automated data pipelines using scheduled web scraping or connecting to public APIs to regularly retrieve updated job descriptions from online portals such as Indeed, LinkedIn, JobStreet, etc. The integration of continuous data collection with automated text mining processes would enable the framework to adapt dynamically to emerging keyword patterns and shifts in skill demand. This dynamic approach not only strengthens the framework's long-term applicability but also supports ongoing curriculum refinement, ensuring that training content remains aligned with current and future labor market needs. Such enhancements would allow educational institutions and EdTech providers to move from a reactive to a proactive curriculum design strategy, empowering them to anticipate and respond to industry changes with greater agility. Although the current study does not implement a fully automated system, a feasible intermediate step for future applications involves the use of structured spreadsheet databases to store and manage analysis results over time. By documenting each iteration of curriculum-industry gap assessments in spreadsheets organized by date, job role, and keyword frequency. Stakeholders can observe longitudinal patterns and adjust training content accordingly. This low-cost and accessible method offers a practical entry point toward more robust dynamic monitoring, especially for small-scale institutions or early-stage EdTech providers seeking to establish a data-driven curriculum development process.

The current framework is its primary emphasis on technical competencies such as programming languages, frameworks, and database systems extracted from job description datasets. However, non-technical competencies, including problem-solving, communication, and collaboration, are equally critical in professional environments, particularly in cross-functional digital roles such as UI/UX Designers and Full Stack Developers. Although such soft skills are often implicit and not directly stated as keywords in job postings, the bootcamp curricula examined in this study include career preparation components designed to address these competencies. These components cover aspects such as interview readiness, personal branding, teamwork, and presentation skills, all of which foster broader employability beyond technical proficiency. Furthermore, with the inclusion of the UI/UX Designer track in the case study, the importance of human-centered design thinking and cross-disciplinary collaboration becomes even more evident. Future enhancements of the framework could involve the formal integration of non-technical keyword categories or semantic mapping techniques to better capture soft skill elements embedded in job descriptions. This would enable a more holistic curriculum-industry alignment that reflects the multifaceted expectations of the digital workforce.

In addition to proposed longitudinal studies, preliminary indicators of program satisfaction can be observed from public feedback platforms. For instance, the bootcamp program under study currently holds a 4.8-star average rating on Google Reviews, reflecting generally positive perceptions among alumni and participants regarding the training experience. While such reviews offer insight into learner satisfaction and perceived value, they are inherently subjective and do not capture the long-term career impact of the curriculum. Therefore, future research is encouraged to complement this qualitative feedback with longitudinal tracking of alumni career outcomes, enabling a more evidence-based assessment of how well curriculum enhancements translate into real-world job readiness and performance.

6. CONCLUSION

The results of the gap identification between the bootcamp program and industrial needs revealed a gap value of 30% for the Full Stack Laravel Vue JS Developer Bootcamp Program. To address this gap, several solution alternatives for improvement have been suggested, including updating the bootcamp syllabus to incorporate the Object-Oriented Programming (OOP) paradigm in the coding keywords. Additionally, it is recommended to include topics on website architecture types to better support business needs and to expand the database

materials to include NoSQL technologies. This enhancement aims to provide a more comprehensive understanding of database technology in accordance with the scalability requirements of the websites that will be developed. In addition, the identified gap between the bootcamp program and industry requirements for the UI/UX Designer track was found to be approximately 20%. To address this gap, several improvement strategies have been proposed. These include considering the addition of topics related to information system project management, such as SCRUM, to better prepare participants for working in agile environments. It is also recommended to include materials covering qualitative and quantitative data analysis methods, which would strengthen participants' research capabilities. Furthermore, integrating discussions on digital product management and the Product Life Cycle is suggested to enable graduates to manage products more sustainably.

Furthermore, the results of the usability test conducted with stakeholders fell within the "OK" category. This indicates that the framework can be considered a viable tool for evaluating the bootcamp program during the Minimum Viable Product (MVP) stage.

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