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ИССЛЕДОВАНИЕ ЭФФЕКТИВНОСТИ МОДЕЛИ ИНТЕГРИРОВАННОГО ОБУЧЕНИЯ НА РАБОЧЕМ МЕСТЕ(WIL) ДЛЯ ОБЪЕДИНЕНИЯ УСИЛИЙ ПРАВИТЕЛЬСТВА, ОБРАЗОВАНИЯ И ПРОМЫШЛЕННОСТИ В ПОДГОТОВКЕ ИНЖЕНЕРНЫХ КАДРОВ

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Никто из нас не остается равнодушным к проблемам высшего образования, поскольку образование является частью экономики и жизни. Одним из важнейших аспектов является подготовка инженерных кадров, которая играет жизненно важную роль в успехе различных отраслей промышленности. Однако этот процесс сложен и включает в себя множество заинтересованных сторон с различными интересами и приоритетами. Кроме того, становится очевидной растущая значимость разрыва между высшим образованием и промышленностью, поскольку многие выпускники с трудом находят работу в выбранной ими области. В данной исследовательской работе предлагается комплексная модель реформирования системы высшего образования, учитывающая интересы и мотивации всех заинтересованных сторон, включая образовательные учреждения, промышленность и правительство. Предлагаемое решение предполагает внедрение интегрированной с работой программы обучения и внедрение схемы финансового стимулирования для научно-исследовательских отделов внутри компаний. Этот инклюзивный подход направлен на поддержку успешного трудоустройства выпускников инженерных специальностей, стимулирование роста промышленности и содействие общему развитию экономики.

Ключевые слова: Индикатор типа Майерса-Бриггса, модели машинного обучения, инструментарий естественного языка.

INVESTIGATING THE EFFECTIVENESS OF WORK-INTEGRATED LEARNING MODEL IN CONNECTING GOVERNMENT, EDUCATION AND INDUSTRY IN TRAINING ENGINEERING PERSONNEL

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Research in the field of personality prediction is aimed at identifying and understanding subtle differences in behavioral tendencies, cognitive patterns and emotional manifestations of a person. This study uses a wide range of methods, such as psychological assessments, behavior observations, and advanced computer modeling, to predict and identify a person's unique personality traits. Using the Natural Language Toolkit (NLTK), text data from messages is processed and converted into numerical characteristics suitable for analysis using machine learning. The main purpose of this study is to determine the type of personality of a person based on the Myers-Briggs type indicator (MBTI) based on his posts on social networks, using a combination of psychological knowledge and computational methods. This approach involves analyzing and categorizing the distinctive features and characteristics corresponding to each MBTI category. By integrating machine learning models with text analysis, this work aims to improve understanding of human behavior and promote the application of machine learning in predictive personality assessment. The findings are expected to make significant contributions to the fields of psychology and personalized applications driven by artificial intelligence, contributing to a deeper understanding of individual behaviors and personality profiling.

Keywords: Myers-Briggs type indicator, machine learning models, natural language toolkit.

Introduction

This study pertains to the interdisciplinary area of Educational Sciences and Engineering Education, with a strong emphasis on the integration of practical work experiences within academic settings. It explores the nexus between higher education, industry, and government in training engineering personnel, an area critical to both economic development and technological advancement. The relevance of the problem addressed in this article is significant, as it highlights a critical gap in higher education systems—specifically the disconnect between the skills taught in universities and the requirements of the industry. This gap often leaves graduates unprepared for the demands of their respective fields, impacting their employability and career progression. The study explores how work-integrated learning (WIL) programs can bridge this gap, ensuring that graduates are better prepared to enter the workforce, which in turn supports economic growth and innovation across industries. This alignment is increasingly critical as industries evolve rapidly, requiring a workforce that is adaptable, skilled, and ready to meet emerging challenges. This research paper aims to address this problem by examining the relevance of implementing a Work Integrated Learning (WIL) program. To substantiate the issue, a survey(https://forms.gle/G51w7QbrcK9n69jS9) was conducted among alumni groups from various universities and individuals aged 30 and above, comparing their experiences. The survey focused on factors such as employment in their field, the relevance of their university education to their current job, additional education or training pursued, and the impact of work experience on job prospects.The survey results revealed that 50 percent of respondents believed that their universities or colleges could not adequately prepare them for the labor market, while the other half disagreed with this opinion. Interestingly, in Figure 1 a higher percentage (73.5%) of respondents indicated that they could only find employment after receiving additional education or training to be qualified for work in their industry. This finding highlights the importance of continuous learning and the need for educational programs to align with industry requirements. When asked about the impact of prior work experience, such as internships or cooperative programs, on finding a position in their field, 73.5% of respondents reported a positive influence, while 26.5% had a negative experience. These results indicate that work-integrated learning, such as internships and cooperative programs, can be beneficial in facilitating career opportunities and should be integrated into higher education programs.

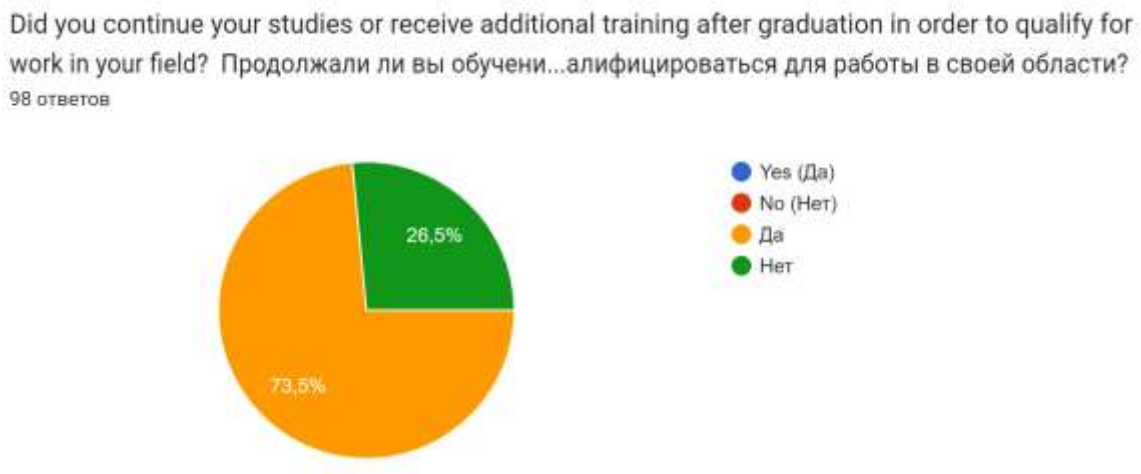

Figure 1 – Respondents job offer percentage diagram after retraining programs.

Furthermore, the survey revealed that many individuals (57.8%) had to work in positions unrelated to their field due to a lack of available vacancies in their area. This suggests that businesses often prefer to hire middle-level employees rather than junior-level individuals, creating challenges for recent graduates. Addressing this discrepancy and finding ways to bridge the gap between education and industry expectations is essential for creating a more favorable employment landscape for graduates. By incorporating these survey findings and considering the interests and perspectives of industry and government stake- holders, this research aims to contribute to the enhancement and optimization of work-integrated learning programs. The findings indicate a need for more internships and training programs to facilitate employment in individuals' specialties after graduation. Moreover, employers' expectations often surpass the scope of university curricula for undergraduates, hindering graduates' employability. Notably, the preceding generation (over 35) demonstrates higher employment rates in their respective fields compared to the younger generation. With the understanding that higher education should adapt to meet industry demands, this research paper explores the implementation of a WIL program as a potential solution. By bridging the gap between academia and industry through practical experiences and industry-specific training, graduates can enhance their employability and meet the higher expectations of employers. This research aims to shed light on the challenges faced by graduates and provide recommendations to improve the alignment between education and industry, fostering a workforce equipped with the necessary skills to thrive in their chosen fields.

Literature review

Numerous studies have examined the impact of work-integrated learning (WIL) programs and their influence on various aspects of education and employability. Research conducted by C.Smith (2012) [1] explored the outcomes of implementing WIL programs in engineering education, highlighting the positive effects on students' acquisition of practical skills, industry knowledge, and professional development. Similarly, D.Jackson et al. (2015) [2] investigated the influence of WIL on graduates' employability, revealing a significant correlation between work experience gained through internships or cooperative programs and improved job prospects in their chosen field as shown in Figure 2.

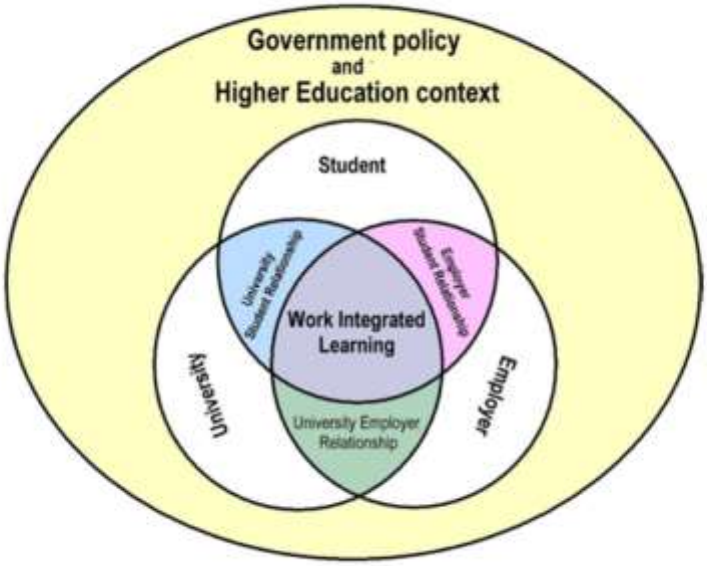

Figure 2 – Relationship between WIL stakeholders.

However, it is essential to acknowledge the potential limitations and challenges associated with WIL programs. J.Orrell [3] identified a few areas of concern, such as the varying quality of work experiences provided to students, the need for effective mentorship and supervision, and the potential mismatch between the skills acquired during WIL and the evolving demands of the industry. These findings emphasize the importance of designing and implementing WIL programs that align with industry expectations and provide students with relevant, up-to-date skills.

Moreover, research by Vailasseri and Long (2021) [4] delved into the effectiveness of integrating theoretical coursework with practical experiences, highlighting the importance of creating a cohesive learning environment that fosters the application of knowledge gained through classroom instruction. They found that a well-designed WIL program can bridge the gap between theory and practice, enhancing students' understanding and preparing them for the challenges of the professional world. To further strengthen the argument for the implementation of WIL programs, it is crucial to consider the perspectives of employers. A study by West and Stirling [5] explored employers' perceptions of graduates who had participated in WIL programs, revealing a positive impact on their employability and readiness for the workplace. Employers appreciated the practical skills, problem-solving abilities, and adaptability demonstrated by these graduates, underscoring the value of WIL in developing industry-relevant competencies. But, this study draws attention to the importance of feedback in WIL partnerships and how it can influence student learning and the success of WIL programs. The authors propose an approach to formalizing feedback in WIL partnerships, which includes the development of shared understandings, the establishment of feedback structures, and the utilization of feedback to support ongoing learning and improvement. [6]

Additionally, studies have examined the interests and perspectives of industry and government stakeholders in relation to work-integrated learning (WIL) programs. Wood, Zegwaard and Fox-Turnbull [7] investigated industry perspectives on WIL programs in engineering, emphasizing the importance of aligning programs with industry needs. Dean (2020) [8] explored government support for WIL, considering policy considerations and implications for fostering collaboration. Furthemore,

the authors [9] describe the methodology of the study, which involved interviews with students, faculty, and industry partners to explore their experiences with WIL. The study identified several benefits of WIL, including increased student engagement, improved practical skills, enhanced employability, and stronger industry partnerships. However, the authors also noted some challenges, such as managing student workload and maintaining consistency in the quality of WIL experiences. Hansen and Rostiyanti examined the alignment of WIL programs with industry needs, highlighting the benefits of effective collaboration between stakeholders. These studies contribute to understanding the interests of industry and government stakeholders and provide insights into strategies for enhancing the relevance and effectiveness of WIL programs. [10]

Purpose and objectives of the study

The primary aim of the study is to develop and evaluate a comprehensive work-integrated learning model that effectively connects government, education institutions, and industry to enhance the training and employability of engineering personnel.

Objectives of the study:

1. To assess the current state of engineering education in relation to industry needs and identify key gaps in skills and knowledge among graduates.
2. To design and implement a work-integrated learning program that incorporates the interests and motivations of all stakeholders, including educational institutions, industry, and government.
3. To propose policy recommendations and strategies for integrating fiscal stimulation measures to support research and development efforts within companies, further enhancing the effectiveness of WIL programs.

Methods and Materials

In this paper, we model a schema to address the goal of reforming the higher education system by integrating the work-integrated learning model with fiscal stimulation of research and development (R&D). To conduct the research on the effectiveness of the integrated work-integrated learning model and its impact on company efficiency, a mixed-methods approach was utilized in a case study of retraining programs as a small simulation of WIL. This involved surveys administered to two distinct groups: graduates who completed the program and local workers who observed the program’s implementation. The surveys aimed to gather data on various aspects of the program’s effectiveness and its implications for the industry. We will get a result by following the steps shown in Figure 3.

We outline the process of constructing the survey questions used in our research. We began by identifying the specific areas of interest that we wanted to measure, such as job satisfaction, training effectiveness, and career growth. Subsequently, we carefully crafted clear and concise statements, each focusing on a particular aspect of interest. These statements aimed to elicit respondents’ opinions and attitudes towards the retraining program. To ensure consistency and ease of interpretation, we opted for a 5-point Likert scale for all the questions. This scale provided respondents with options ranging from ”Strongly Disagree” to ”Strongly Agree,” allowing them to express their viewpoints effectively. Importantly, we maintained a balanced scale by incorporating an equal number of positive and negative response options. By following these steps, we established a well-constructed Likert

scale survey. This approach provided a clear framework for participants to convey their thoughts and enabled us to gather valuable data on the effectiveness of the retraining program.

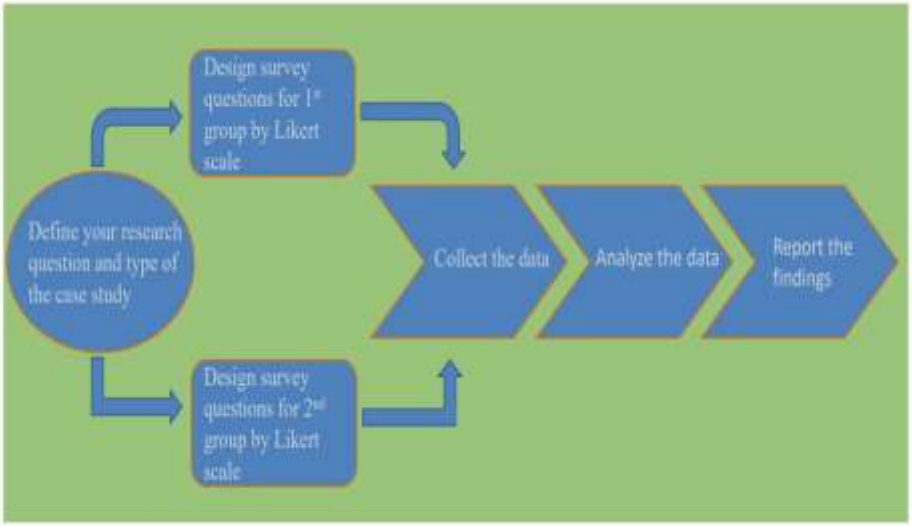

Figure 3 – Methodology flow

To gather the necessary data for this research, separate surveys were administered to the graduates (https://forms.gle/v99DwJ3pgCRxkET19) of the ”Jusan Singularity” program and the local workers (https://forms.gle/aQS6cmjYu4ZXCMaK7) of the company. The surveys were distributed electronically using an online survey platform. Participants were provided with a unique link to access the survey. The survey responses were collected anonymously to ensure confidentiality and encourage honest feedback. Participants were instructed to respond to each question using the provided Likert scale, indicating their level of agreement or preference. Upon completion, the survey responses were automatically recorded and stored in a secure database. Systematic approach was followed to analyze the collected survey data. The survey responses were collected and organized into a structured format, such as a spreadsheet as shown in Figure 4 and Figure 5. Each response option was assigned a numerical value to facilitate quantitative analysis.

As we analyzed the data using descriptive statistics, we followed a series of steps to identify trends and patterns. By examining the mean values of each question, we were able to observe the most commonly chosen response options, providing us with an overview of the overall trend in the data. Our findings revealed that participants consistently leaned towards certain responses, indicating a discernible pattern in their opinions. Furthermore, we looked closely at the standard deviation to assess the spread of the responses. Through this analysis, we discovered that the data points were relatively tightly clustered, suggesting a high level of agreement among the participants. This reinforced the presence of a clear pattern in their collective responses. During our analysis, we also identified a few outliers, which were responses that significantly deviated from the majority. These outliers were carefully examined to gain a deeper understanding of the underlying factors influencing participant perspectives. Although they were minimal in number, they provided valuable insights into the diversity of opinions within the surveyed population. By comparing the results of different questions, we were able to uncover intriguing relationships and correlations. For instance, we

observed a strong positive correlation between participants' perceived job satisfaction and their satisfaction with work life balance. This connection highlighted the importance of maintaining a healthy work-life balance in fostering overall job satisfaction.

During our research, we utilized an online z-test calculation application to analyze the data and compare the responses of the graduates and the local workers.

Программы переподгот	Такие программы полез	Ваши технические навь
5	5	1
4	3	4
4	4	4
5	1	5
5	3	4
5	5	1
4	2	4
4	3	5
4	4	4
5	3	5
5	4	5
5	3	3
4,205882353	3,441176471	4,117647059
0,8449282474	1,10621321	1,037616905
	3,921568627	
	1,050094522	

Figure 4 – Result of Local Workers.

Ранее были ли у вас пр	Считаете ли вы, что пос	Как вы оцениваете в целом программы перепод	
2	4	4	
3	3	4	
5	2	4	
5	3	5	
2	4	4	
4	4	5	
5	5	5	
3	5	4	
4	5	5	
4	5	5	
5	4	4	
3	2	3	
3,894736842	3,789473684	4,210526316	3,964912281
1,100239208	0,9763280055	0,7132825035	1,100239208

Figure 5 – Result of Graduates of retraining program.

The purpose of the z test was to determine if there were any significant differences between the two groups in terms of their perceptions and experiences. And we got p-value result as 0.023. Also, constructed Likert diagram as shown in Figure 6.

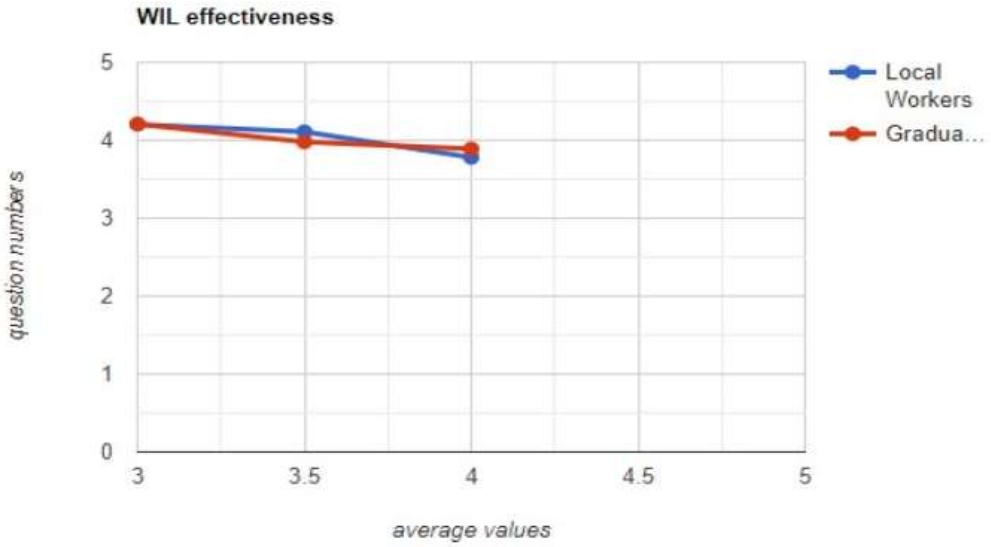

Figure 6 – Line Graph of effectiveness.

Discussion of results

Based on the survey results and analysis, it is evident that retraining programs, have proven to be effective for both students and the industry as a whole. The data shows a positive impact of the program in bridging the gap between education and the labor market. Graduates who participated in the program reported improvements in their technical skills and expressed satisfaction with their work in the industry.

However, the survey also revealed some challenges regarding the interests and benefits of the industry. While the program was successful in addressing hiring process issues, there is a need for further integration of work-integrated learning (WIL) principles. WIL aims to combine theoretical education with practical work experience, and it requires industry involvement in providing mentors, resources, and project spaces for students to apply their knowledge in real world settings.

To enhance the effectiveness of WIL, a proposed solution is to integrate it into the fiscal stimulation of research and development (R&D) initiatives. By doing so, the government can incentivize industries to actively participate in WIL programs by offering financial support and incentives. This collaboration between WIL and fiscal stimulation methods would create a symbiotic relationship, benefiting both students and industry.

The expected result of this integration is a well-structured collaboration between educational institutions, students, and industry partners. The government's fiscal stimulation of R&D would encourage industries to allocate resources towards WIL programs, ensuring the availability of mentors, equipment, and dedicated spaces for students to engage in meaningful projects. This collaboration would not only improve the educational experience for students but also contribute to the innovation and growth of industries.

By presenting this expected result as a schema of collaboration as shown in Figure 7 between WIL and fiscal stimulation methods, it becomes clear that the integration of these approaches can address the limitations identified in the survey results. It provides a framework for nurturing talent,

fostering industry-academic partnerships, and driving innovation through practical learning experiences.

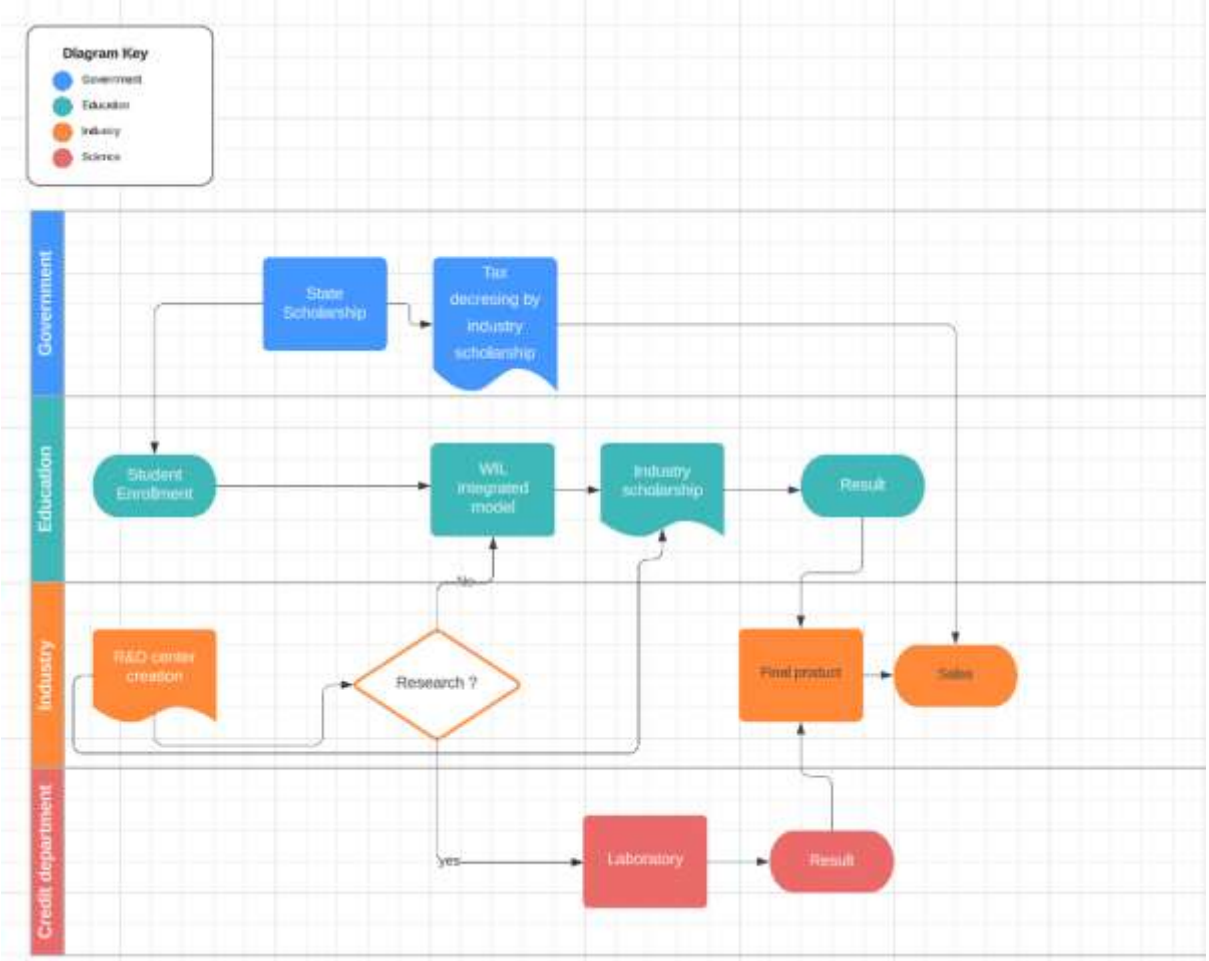

Figure 7 – WIL collaboration with Government fiscal stimulation.

Conclusion

This comprehensive approach is proposed to facilitate the smooth transition of engineering graduates into the workforce, foster industry growth, and contribute to overall economic development. The survey results indicate no significant difference in satisfaction levels between the two survey groups, suggesting that work-integrated learning (WIL) can serve as a partial substitute for traditional methods. By addressing the limitations of WIL, we propose a collaborative integration with a fiscal stimulation model inspired by the UK scheme. This model establishes a mutually beneficial collaboration among industry, education, and government. Industry provides real projects or research opportunities to students and offers them scholarships. Students then develop these projects and deliver results to the industry, which subsequently produces and contributes taxes from their products to the government. The government, in turn, reduces taxes by an amount equivalent to the scholarships provided by the industry to the students. As a result, this approach stimulates economic growth, fosters scientific advancements, and ensures students become highly skilled specialists in the future.

In addition to these research directions, we also plan to extend our focus on the practical implications of our work. This includes developing a well-improved and compatible curriculum design based on the schema derived from our results. Furthermore, we will strive to calculate the exact amounts of productions and tax in order to provide a clear illustration of the benefits and implications of our proposed approach. By pursuing these avenues, we aim to contribute to the advancement of the field and offer valuable insights for educational and economic planning.

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