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DISCREPANCY IN EDUCATIONAL MATERIALS BETWEEN HIGHER EDUCATION INSTITUTIONS AND THE REQUIREMENTS OF THE PROFESSIONAL WORKFORCE IN THE JOB MARKET

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Abstract: The rise of ICT specialists in the computer field due to Industry 4.0 is notable, particularly in Indonesia's e-commerce and technology-driven markets. This study explores the demand for qualified informatics engineering professionals, focusing on their ICT and English language skills. Employing a qualitative phenomenological case study design, the research gathered data through semi-structured interviews with informatics engineering specialists and employers. It also scrutinized an English lesson program at a polytechnic in Indonesia through interviews with key figures and document analysis. The study identifies two key findings: demand emphasizes the critical role of reading skills, especially in programming languages and technology documentation, while supply reveals a gap between higher education materials and workplace requirements. The curriculum appears to neglect English proficiency, hindering graduates' performance. Consequently, the study advocates for higher education reform, urging institutions to align their programs with industry demands. Collaboration between government, universities, and industry stakeholders, especially at the regional level, is proposed to bridge the gap and enhance the preparedness of informatics engineering graduates for the evolving industry landscape. The findings underscore the importance of creativity and originality in technology creation, urging institutions to adapt swiftly to the dynamic informatics engineering landscape.

Keywords: Industry 4. Demand, Supply, English Proficiency, Skills Professionals

INTRODUCTION

In the contemporary landscape, the demand for jobs in the computer field is experiencing a notable surge. According to Fayer et al. (2017), the computer field ranks highest among STEM (Science, Technology, Engineering, and Mathematics) occupations, constituting 45 per cent of the nearly 8.6 million STEM jobs recorded in May 2015, making up 6.2 per cent of U.S. employment. Projections indicate a sustained increase in computer-related occupations until 2024, with an estimated growth rate of 12.5 per cent (Selwyn, 2019) (Fayer et al., 2017) (Zhao, 2016).

Beyond the quantitative growth, the computer field is expected to yield over one million job openings between 2014 and 2024, reflecting replacements due to substantial job losses. Industry 4.0 anticipates the creation of two million recent occupations, particularly in computer science, mathematics, electronics, and information technology. This sentiment is echoed by the World Economic Forum (2016), which projects a substantial workforce increase, notably in the Information and Communication Technology industry group, which aligns with the shared perspectives of Fayer et al. (2017) on the escalating demand for ICT specialists, particularly in fields closely associated with Industry 4.0, such as programming, software development, Artificial Intelligence, and mobile development (Ssekamanya & Eken, 2018) (T. R. Wahyuni & Monika, 2017).

This study focuses on informatics engineering specialists, a subset of ICT professionals, as they are intricately linked to Industry 4.0. With five majors in the computer field in Indonesia, informatics engineering or computer science stands out due to its emphasis on skills relevant to Industry 4.0, including program development, software engineering, robotics, and Artificial Intelligence.

Examining Indonesia's economic landscape in the first quarter of 2020, a notable 2.97 per cent growth in GDP was observed, with the information and communication business sector contributing significantly. The ILO (2019) affirms the correlation between ICT growth, e-commerce, and digital services, indicating a rising demand for ICT specialists. Highlighting the local context, Indonesia witnessed the hiring of 980,000 workers in the ICT sector in 2018, with 500,000 specializing in ICT. Notably, digital start-ups like Tokopedia, Go-Jek, and Bukalapak played a pivotal role in this surge, with Indonesia ranking fifth globally in the number of start-ups (N. T. Wahyuni, 2016) (Riyana, 2009).

Consequently, Indonesia emerges as a robust market for ICT, particularly with a burgeoning digital start-up ecosystem. The rise of dec acorns, unicorns, and centaurs in the Indonesian start-up scene underscores the country's optimistic outlook in the ICT sector. However, the question remains: Can Indonesia's higher education institutions adequately equip the workforce with the requisite ICT skills and English language proficiency?

A disturbing reality unfolds in the field, particularly among informatics engineering specialists, where several challenges, notably in language proficiency, cast doubt on the seamless application of these skills. A preliminary investigation revealed a noteworthy concern expressed by three informatics engineering graduates from distinct Indonesian universities during interviews conducted on April 4, 2019. They consistently encountered challenges with English, a language intricately woven into computer instructions and programming languages, even in non-English-speaking countries like Indonesia.

Moreover, insights from four English lecturers gathered during personal communications on July 2, 2019, shed light on the occasional confusion faced by educators in aligning instructional materials with workplace needs. This problem underscores the significance of a need analysis before crafting materials to bridge the gap between classroom instruction and workplace demands.

Motivated by these challenges, this study aims to comprehensively explore the phenomenon of specific English skills essential for informatics engineering human resources. It seeks to contribute to the existing literature by addressing a critical gap. A lack of research focuses on the English requirements for informatics engineering specialists in Industry 4.0.

While previous studies in Indonesia, such as those conducted by Baso (2014) and Araminta & Halimi (2015), touched on English language skills in the workplace, they were not tailored to informatics engineering specialists. They lacked a specific focus on the Industry 4.0 era. Baso's study, for instance, delved into the English language proficiency of Indonesian graduates, recommending a re-evaluation of internal standards to meet company requirements. In the engineering sector, Araminta & and Halimi (2015) emphasized the mandatory nature of English proficiency for engineers but noted a lack of significant emphasis on English language learning(Lase, 2019).

Beyond Indonesia, research in Thailand by Rajprasit et al. (2014) highlighted inadequacies in language skills for novice engineers. Roshid & Chowdhury (2013) explored the case of Bangladeshi graduates in the Australian job market, emphasizing the influence of English language skills on employment prospects. In Saudi Arabia, Fahad & and Alfehaid (2011) evaluated an English for Specific Purposes (ESP) course for health science students, identifying limitations in curriculum and teaching materials.

In contrast, this study uniquely evaluates whether higher education institutions can furnish informatics engineering human resources with satisfactory English proficiency. Furthermore, it aims to identify the specific English skills requisite for informatics engineering graduates functioning as specialists in their employment. Lastly, the study endeavours to uncover discrepancies between classroom English materials and the specific English language used practically in the professional

realm. This distinctive focus will contribute valuable insights to academia and industry, ensuring the alignment of educational practices with the dynamic needs of Industry 4.0.

This collection of studies offers a comprehensive exploration of Industry 4.0 and the current trend of automation and digitalization in industries. Beginning with Hariharasudan & Kot's (2018)scoping review, the literature analysis identifies gaps related to Digital English, Education 4.0, and Industry 4.0. Flynn et al. (2017) delve into the potential impact of Industry 4.0 on U.K. employment demographics, highlighting the need for an adaptive education system. Fonseca provides insights into Industry 4.0's dimensions and benefits, emphasizing the transformative potential and acknowledging challenges such as job displacement. Gokalp et al. (2017) introduce a conceptual framework for leveraging big data in Industry 4 to simplify its integration into enterprises. Rojko (2017) presents the background and overview of Industry 4.0, examining its components and the readiness of German companies. Lastly, Ing Tay et al. (2018) provide an overview of Industry 4.0, defining its components and discussing government initiatives globally. Together, these studies offer a multifaceted understanding of the challenges, potentials, and implications of Industry 4.0, ranging from education and employment to technological integration and global initiatives (Saljö, 2010).

Sume's (2018)work in Turkey explores the transformative impact of Industry 4.0 on occupations and employment, emphasizing the potential for mass unemployment robots and digitized processes to replace jobs. Supriyatn (2019) delves into the challenge Islamic Religious Colleges faced in Indonesia during the 4.0 Industrial Revolution, advocating for necessary reforms to produce competent human resources capable of thriving amidst disruption. Jeevitha & and Ramya (2018)explore the evolution of smart factories through Industry 4.0, emphasizing the flexible, individualized, and interconnected nature of production systems. Thomas et al. (2016) focus on the importance of English workplace communication skills in Bahrain, shedding light on the need for a broader approach to language training incorporating specialized discourse and generic employability skills. Nimasari (2018)conducts an ESP needs analysis for Informatics Engineering students, addressing ten specific areas of English language use (Lim & Zhao, 2018). This collective body of research provides a multifaceted understanding of the challenges, opportunities, and transformative effects associated with Industry 4.0 and the role of English language skills in navigating this dynamic landscape.

Chatzikyriakou & Zafiri (2019)explore the role of needs analysis in the Greek private sector, shedding light on how teachers become aware of their students' needs and integrate this awareness into course and syllabus design. Yana (2016) focuses on identifying students' needs in learning English speaking, providing valuable insights for developing speaking syllabi. Together, these studies

offer a rich tapestry of perspectives on needs analysis in English language education, encompassing critical approaches, practical implementations, and cultural considerations, setting the stage for a comprehensive exploration of the nuances and challenges of this critical aspect of language teaching.

METHODS

This study utilized a qualitative phenomenological case study design. This method was chosen to capture the genuine experiences and perspectives of participants, specifically informatics engineering specialists and employers, providing a comprehensive understanding of the English skills essential for the Industry 4.0 context in Indonesia. The fusion of phenomenology with case study design facilitated the exploration of intricate human experiences and the underlying structure of the phenomenon under study.

Data Collection Procedure

The data collection process involves the utilization of two instruments: interviews and document analysis. Semi-structured interviews were chosen to capture participants' insights, including informatics engineering specialists, company representatives, the head of informatics engineering at the Polytechnic, English lecturers, ongoing students, and the head of quality assurance at that Polytechnic (a member of curriculum designers). The following tables are the demographic data of the interviewees.

Table 1. Demographics data of informatics engineering specialists (graduates)

Code	Gender	Age	Workplace	Scope of Company	Working years	Job
P1	Male	24	The service and IT consultant	Multi-national company	0-1 years	A programmer
WD	Male	24	The software development and IT consultant	National Company	0-1 years	A website developer
MLD	Male	23	The software development and IT consultant	National Company	0-1 years	A mobile developer
P2	Male	25	A government office	Regional Office	Two years	A programmer

**Note: The study encompassed various job roles within the informatics engineering field to ensure a comprehensive understanding of the English skills needed.*

Table 2. Demographics data of employers (companies)

Company	Code	Type of company	Scope of Company	Job or position
Company 1	BAS	IT consultant	Multi-national	Business Analyst Staff
Company 2	MD	IT consultant	National	The CEO
Company 3	SM1	IT-based logistics company	Multi-national	Section manager
Company 4	SM2	Datacenter infrastructure and consultant	Multi-national	Section manager
Company 5	SM3	Internet service provider	National	Section manager

Table 3. Demographics data of English lecturers

Code	Gender	Working years	Area of Expertise	Educational Background	Lecturer Status
L1	Female	Two years	English	Master (S2) of English Education	Non-permanent lecturer
L2	Female	Four years	English	Doctoral (S3) of Linguistics	Non-permanent lecturer

Table 4. Demographics data of the head of the informatics engineering department and the head of the quality assurance division

Code	Gender	Working years	Educational Background
H	Male	Six years	Master (S2) of information system
Q	Female	Six years	Master (S2) of Public Health

Table 5. Demographics data of ongoing students

Code	Gender	Semester
S1	Male	8
S2	Male	4
S3	Male	4

All interviews were conducted in Indonesian, as the participants found it more comfortable expressing themselves in that language. The mode and location of the interviews were determined based on the preferences of the interviewees. Some interviews were conducted face-to-face, while others took place over the phone, which could be a video or audio call to accommodate geographical distances. On average, each interview session lasted between 30 minutes to over 1 hour. Triangulation was achieved by collecting data from various sources, including informatics engineering specialists,

company representatives, the head of informatics engineering at the Polytechnic, English lecturers, ongoing students, and the head of quality assurance at the Polytechnic, who also served as a member of the curriculum design team.

The study also delved into various documents integral to the teaching process, including syllabi and lesson plans. This document analysis aimed to unveil classroom English materials and assess their alignment with industry needs. This method contributes to a comprehensive understanding of English language instruction within the informatics engineering curriculum.

Data Analysis Procedure

In conducting the data analysis, this study followed a five-step framework, encompassing data preparation and organization, exploration and coding, theme formation, interpretation of findings, and validation of results. After collecting data through semi-structured interviews, audio recordings were transcribed verbatim in Indonesian and translated into English. Subsequently, the researchers immersed themselves in the transcriptions, reading them multiple times to gain a comprehensive understanding. This study amalgamated codes with related value or meaning into major themes, interpreting findings using insights from previous studies. Triangulation, involving data collection from informatics engineering specialists, company representatives, the head of informatics engineering, English lecturers, ongoing students, and the head of quality assurance, contributed to constructing a coherent justification for the identified themes.

RESULTS AND DISCUSSIONS

Findings

Findings from demand sides

Theme 1: Potential Impacts of Industry 4.0 on Jobs

Based on the data analysis, this study summarized theme one, as presented in Table 6 below.

Table 6. Summary of Theme 1

Impact Types	Information Sources
Positive impact	BAS, MD, SM1, SM2
Negative impact	SM3 & H

Note: BAS: Business Analyst Staff, SM: Section Manager, MD: Managing Director/CEO,

H: Head of Informatics Engineering Specialists Department

Table 6 above shows two effects of Industry 4.0 on informatics engineering specialists' jobs. Those are positive and negative impacts. The explanations of those two impacts are as follows.

Positive Impact of Industry 4.0 on Informatics Engineering Specialists' Jobs

In an interview with Company 1, the Business Analyst Staff (BAS) initially downplayed the impact of Industry 4.0 on informatics engineering specialists. Still, it later emphasized its significant influence, especially in the context of Blockchain technology. The BAS highlighted the growing tech literacy among company owners and expressed interest in adopting IoT (Internet of Things), underscoring the crucial role of informatics engineering specialists in implementing and supporting these technologies. According to the MD/CEO of Company 2, the demand for informatics engineering specialists is rising rapidly due to technological advancements, and specialists play a pivotal role in bridging the gap between market requirements and evolving technologies. The MD emphasized the need for specialists to conduct independent research to stay ahead of technological developments. Additionally, the M.D. shared unexpected responsibilities, collaborating with higher education institutions to align informatics engineering department curricula with industry needs. Both SM1 from Company 3 and SM2 from Company 4 concurred that Industry 4.0 simplifies informatics engineering specialists' jobs and enhances employment opportunities in the IT sector.

Negative Impact of Industry 4.0 on Informatics Engineering Specialists' Jobs

Contrastingly, SM3 of Company 5 expressed concerns about Industry 4.0, noting that the increased automation of processes could lead to significant job reductions. Additionally, the head of the informatics engineering department, during an interview, highlighted the negative implications of rapid Artificial Intelligence (AI) advancements. He envisioned a future challenge for informatics engineering specialists, where AI could potentially replace the need for human programmers. He stated,

> "If AI continues to develop rapidly, there might be facilities, like Google, that can directly create applications without a programmer. This could lead to labour reductions for informatics engineering specialists."

This dual perspective provides a comprehensive view of both the positive and negative impacts of Industry 4.0 on the roles and responsibilities of informatics engineering specialists.

Theme 2: English Skills are Important for Performing Informatics Engineering Specialists' Jobs in Industry 4.0 Era

Theme 2 will contribute to answering research question 2, related to the informatics engineering specialists' experiences in using English in their jobs. Table 7 below is the summary of the findings.

Table 7. Summary of Theme 2

The Importance of English Skills	Information Sources
Important	P1, WD, MLD, P2, BAS, MD, SM2, SM3, SM4, & H
Not important	NONE

Note: WD: Web Developer, MLD: Mobile Developer, P: Programmer, BAS: Business Analyst Staff, SM: Section Manager, MD: Managing Director/CEO, H: Head of Informatics Engineering specialistsDepartment

These findings were from three groups of respondents, including informatics engineering specialists, companies, and the head of the informatics engineering department. After analyzing the data gathered from participants, this study finally identifies that all the respondents agreed that English is essential for informatics engineering specialists' jobs. The following are the explanations.

Insights from Informatics Engineering Specialists

Insights from informatics engineering specialists revealed varying perspectives on the importance of English in their roles. While one participant (P2) initially downplayed its significance, further exploration uncovered its crucial role in tasks like reading technical documentation and error messages for application development. Another participant, WD, echoed a similar sentiment, emphasizing English's importance for understanding bug-fixing tutorials and utilizing plugins in web development. In contrast, P1 and MLD underscored the paramount importance of English in dealing with international clients, daily work activities, and programming-related communication within the company. This diversity of perspectives highlights English proficiency's nuanced and essential role in specific aspects of an informatics engineering specialist's job, influencing their ability to comprehend technical resources and communicate effectively globally.

Perspectives from Companies

All participating companies (n=5) emphasized the crucial role of English for informatics engineering specialists. BAS, a business analyst in a multinational IT consultant company, rated its importance at nine on a scale of 1 to 10, which underscores the high significance of English in a global business context. M.D., the CEO of a national IT consultant company, emphasized the importance of reading skills over speaking skills for his company. While not urgent, English proficiency remains essential, acknowledging the limited scope of his company's operations.

In an international IT-based logistics company, SM1 highlighted the necessity of English for effective collaboration within a diverse team comprising members from various countries. SM2,

managing a data centre infrastructure and consultant company, emphasized English usage in product introductions to clients.

Conversely, SM3, representing a national company in internet services and IT solutions, accentuated the importance of English for operating computers. Even though devices could be set to Indonesian, SM3 stressed the ideal preference for English settings.

Insights from the Head of the Informatics Engineering Department

The head of the Informatics Engineering department, drawing from industry focus, affirmed the significance of English. Given that top-tier IT industries are predominantly foreign-owned, he stressed the industry's requirement for English-speaking informatics engineering specialists.

In summary, the consensus across informatics engineering specialists, companies, and the department head affirms the importance of English proficiency in the field. Whether for global collaborations, accessing technical resources, or industry demands, English remains an integral skill for informatics engineering specialists across varied professional contexts. The exploration of specific English language skills and their relative importance will be further examined in the subsequent theme.

Theme 3: English Skills Needed for Informatics Engineering Specialists in Industry 4.0 Era in Indonesia

Theme 3 belongs to the key finding of this study since it answers the main question of this study, "How do informatics engineering specialists experience using English on their job?". The participants' lived experiences regarding the phenomenon were asked to get the answer since it belongs to a phenomenological study. After analyzing the data, this study summarized theme three, including making codes and themes.

Table 8. Summary of Theme 3

English Skills Needed	Information Sources
Listening skill	P1, WD, BAS, & SM2
Speaking skill	P1, BAS, SM1, SM2, & SM3
Reading skill	P1, WD, MLD, P2, BAS, MD, SM1, SM2, & SM3
Writing skill	P1, BAS, & SM1

Note: WD: Web Developer, MLD: Mobile Developer, P: Programmer, BAS: Business Analyst Staff, SM: Section Manager, MD: Managing Director/CEO

Table 9 above shows that from employees' (informatics engineering specialists') and employers' (companies') point of view, generally, all English skills (listening, speaking, reading, and writing skills) are needed. Yet, reading skills are the most needed skills for informatics engineering specialists. The following is the explanation of each skill. It explains from the most needed to the less needed one.

Table 9. The Summary of Activities of Informatics Engineering Specialists that Required English Skill

Listening skill	Speaking skill	Reading skill	Writing skill
▪ Watching the tutorial on YouTube (bug fixing tutorials) ▪ Understanding what clients talk about. ▪ Listening to boss and colleagues ▪ Listening to the team presentation ▪ Understanding product presentation training	▪ Joining a selection process (interview) ▪ Dealing or communicating with clients ▪ Taking part in exhibitions abroad. ▪ Coordinating with informatics engineering specialists' team ▪ Communicating with a boss who is a foreigner. ▪ Communicating with colleagues who are foreigners. ▪ Doing a team presentation. ▪ Dealing with developers from overseas to develop the projects. ▪ Having a relationship with company officials overseas.	▪ Reading instructions on the computer ▪ Reading error messages when developing programs, applications, software, or websites ▪ Reading some codes or terms in programming languages ▪ Reading technology documentation, tutorials, or manuals. ▪ Reading chats and e-mails. ▪ Reading the literature. ▪ Reading computer tools.	▪ Writing job reports, letters for leaves of absence, etc. ▪ Writing messages on WhatsApp chat. ▪ Writing e-mails.

Findings from the supply sides

Theme 4: English Language Taught in Higher Education Institutions

The study scrutinized the types of English delivered in these institutions to bridge the gap between the English required in the workplaces of informatics engineering specialists and the English taught in higher education institutions. The findings are summarized in Table 10, which delineates the types of English taught, and Table 11 presents the form of skills imparted.

Table 10. Summary of Theme 4

The Types of English Taught	Information Source
General English	P1, WD, MLD, P2, S1, S2, & S3, L1
English Specific Purposes (ESP)	S2, L1 & L2

Note: WD: Web Developer, MD: Mobile Developer, P: Programmer, S: Student, L: Lecturer

Based on responses from informatics engineering specialists and current students, a consistent theme emerges, with participants P1, W.D., MLD, and P2 noting the receipt of general English materials during their studies, suggesting a lack of tailored instruction for informatics engineering specialists. However, S2, a current student, provided a contrasting perspective, reporting exposure to general English and English for Specific Purposes (ESP) during the second and third semesters. In evaluating the helpfulness of English subjects for their jobs, participants P1, MLD, and P2 found it beneficial. However, G2 considered the contribution minimal, suggesting junior and senior high school materials were more helpful. Notably, all three informatics engineering specialists (P1, WD, and MLD) unanimously reported the absence of additional English programs outside the classroom, proposing improvements such as extended learning duration, motivational examples, and a focus on speaking skills. Conflicting accounts from English lecturers (L1 and L2) raise questions about alignment between the perspectives of informatics engineering specialists, current students, and instructors, emphasizing the need for further scrutiny of documents like syllabi and lesson plans in subsequent sections to validate findings.

Theme 5: English Skills Taught on Campus

The examination findings of the English skills imparted on campus are summarized in Table 11, providing insights into the variety of skills covered.

Table 11. Summary of Theme 5

English Skill Taught	Information Source
Listening skill	S3, L1 & L2
Speaking skill	S1, S2, & S3
Reading skill	S1, S2, & S3
Writing skill	S1, S2, & S3, L1 & L2

To discern the specific English skills highlighted by lecturers, interviews were conducted with current students and English lecturers in the informatics engineering department at the Polytechnic. Insights from students revealed variations in the English skills they encountered during their studies. S1 emphasized exposure to speaking, reading, and writing English materials, noting the diverse content used in reading practices, occasionally extending beyond informatics technology. Similarly,

S2 shared experiences in speaking, reading, and writing English, observing shifts in emphasis across semesters towards real-world applications, such as presentations in English. In contrast, S3 recalled comprehensive exposure to all English skills throughout higher education, initially focusing on writing in the first semester, followed by a balanced integration of writing, reading, and listening practices in subsequent semesters. This diversity in experiences highlights the multifaceted approach to English skills within the informatics engineering curriculum.

Results from the Supply Side: Document Analysis

Syllabi Overview

The study program meticulously crafted the syllabi, integral components guiding the teaching process. The lecturers formulate lesson plans and coursebooks using this structured approach, aligning with the predefined syllabi. The English curriculum unfolds over three semesters—English 1, English 2, and English 3, each bearing distinct emphases on language proficiency. The curriculum strategically unfolds, emphasizing writing skills in the initial semesters and transitioning to focusing on speaking skills in the final semester, which underscores the program's emphasis on cultivating both writing and speaking proficiencies among students, aligning with the dynamic needs of the informatics engineering field.

Lesson Plan Analysis

In analyzing lesson plans following the scrutiny of syllabi, this study meticulously examines the plans created by two English lecturers, aiming to assess their alignment with predefined course objectives. Lecturer 1, responsible for semesters 1 and 2, focuses on writing skills, closely mirroring the syllabus and addressing learning objectives, such as constructing various sentence types in English. Meanwhile, data from Lecturer 2 for semester 3 reveals a comprehensive approach. The plan progresses from enhancing writing skills, including grammar exercises, to developing reading skills related to informatics vocabulary and seminar texts. Additionally, a holistic strategy integrates speaking skills through role-play and group presentations, fostering critical thinking. The lesson plan also encompasses listening skills, engaging students in reading comprehension, and journal text evaluation. Notably, including vlog creation adds multimedia, enhancing speaking skills and articulating information technology engineering knowledge. This multifaceted approach ensures students acquire a versatile set of competencies vital for effective communication in the dynamic field of Informatics engineering.

Discussion

The discussion unfolds by addressing each research question based on the study's significant findings, thereby validating the attainment of its predefined objectives. Research Question 1: How does Industry 4.0 impact informatics engineering specialists' employment, and what skills are crucial for them in this era? In the Indonesian context, the study underscores the anticipated positive impacts of Industry 4.0 on informatics engineering jobs, aligning with the global trend. The prospect of creating new job opportunities is particularly significant for Indonesia's burgeoning Information and Communication Technology (ICT) sector. As a country with a growing tech ecosystem, Indonesia stands poised to witness substantial job growth, especially within the dynamic landscape of Industry 4.0. The discussion acknowledges the potential for increased employment rates, which could significantly contribute to the nation's economic development.

The study's findings align with those of Grenčíková et al. (2020), who explored the influence of Industry 4.0 on job creation in small and medium-sized enterprises (SMEs) and family businesses in Slovakia. Grencˇíková et al.'s research highlighted the rapid evolution of job structures due to the Fourth Industrial Revolution, emphasizing the need for adaptive responses to Industry 4.0 challenges. While their focus was on the Slovak Republic, the overarching theme of Industry 4.0's impact on job structures provides a valuable comparative framework for the current study in the Indonesian context. Both studies echo the anticipated positive impacts of Industry 4.0 on job creation, recognizing the potential for new opportunities, particularly in countries like Indonesia and Slovakia, where the Information and Communication Technology (ICT) sector plays a pivotal role in economic development. The shared emphasis on the need for flexible responses to Industry 4.0 challenges aligns with the proactive measures advocated for in the current study.

Integrating Artificial Intelligence (AI) in Industry 4.0 in the Indonesian labour market raises valid concerns about potential job displacement. The discussion delves into the nuanced implications of AI technology for roles traditionally performed by informatics engineering specialists in Indonesia. As a developing nation embracing technological advancements, Indonesia grapples with the dual narrative of opportunities presented by AI and the apprehensions surrounding job security. The study contextualizes these concerns within Indonesia's specific organizational structures and labour market dynamics.

While the positive impacts on employment opportunities are evident, the discussion emphasizes the uncertainties surrounding job displacement within the Indonesian context. The dynamics of this impact are intricately tied to the nation's socio-economic fabric, navigating factors such as workforce adaptability, government policies, and the resilience of local industries. The discussion delves into

the interplay of these variables, offering insights into how Indonesia's informatics engineering sector may navigate the evolving landscape of Industry 4.0.

The discussion on the uncertainties surrounding job displacement within the Indonesian context aligns with the findings presented in the OECD report by Quintini & Venn (2013). They provide comprehensive evidence on job displacement and its consequences for workers across 14 countries, shedding light on the cyclical nature of job displacement and its impact on earnings, skills, and working arrangements.

In summary, the connection between the discussion on job displacement in the Indonesian context and the OECD report enhances understanding of the global patterns and consequences of job displacement, providing valuable insights into potential policy considerations and the broader implications for workers in different countries, including Indonesia.

By situating the study within the specific nuances of Indonesia, this discussion not only broadens the understanding of the impacts of Industry 4.0 but also provides a more nuanced view of how these global trends translate within the country's unique socio-economic and technological landscape. The current study's emphasis on situating the examination within the specific nuances of Indonesia concerning the impacts of Industry 4.0 aligns with research by Awaluddin et al. (2022). Both studies contribute to comprehending Industry 4.0 dynamics within Indonesia's unique socio-economic and technological landscape (Manyika et al., 2017). While the current study broadens the understanding of Industry 4.0 impacts, highlighting nuances within the socio-economic and technological context, Awaluddin et al.'s research complements this by exploring the role of economic globalization, internet users, and mobile phone customers in Indonesia, ultimately striving to accelerate digitalization in response to Industry 4.0 competition (Frenz, 2022) (Ibidapo, 2022) (Zhang et al., 2021).

Related to the second research question, this study provides insights into the experiences shared by informatics engineering specialists and companies. In the Indonesian landscape, the study sheds light on the experiences of informatics engineering specialists, highlighting the indispensable role of English proficiency. The findings resonate with the global acknowledgement of English as a linchpin for effective communication in the workplace. For Indonesian graduates and company representatives alike, the emphasis on English skills, particularly reading proficiency, echoes the sentiments observed in industries worldwide. This condition underscores the universal recognition of English as a critical skill, aligning with the broader trends in the globalized job environment (Nayyar, 2015).

Within the specific context of Indonesia, the study elucidates that reading skills emerge as the cornerstone for informatics engineering specialists, which is particularly crucial when deciphering

complex error messages during programming tasks. The practice of navigating English-language forums and tutorials for troubleshooting underlines the practical importance of robust reading skills in the day-to-day responsibilities of Indonesian informatics engineering specialists. The unanimous acknowledgement of the indispensability of English, with a specific focus on reading skills, accentuates the centrality of language proficiency in the professional landscape of Indonesia's informatics sector.

The current study, emphasizing the pivotal role of reading skills for informatics engineering specialists in Indonesia, aligns with Mahbub's (2018) research, which investigates the English language needs of vocational school students in the Indonesian context. The focus on the criticality of reading skills in deciphering error messages during programming tasks, as highlighted in the current study, resonates with Mahbub's exploration of students' perceptions of their English learning needs. Together, these studies provide valuable insights into the specific language requirements in the educational context of Indonesia, particularly within the informatics sector.

As Industry 4.0 continues to evolve in Indonesia, the ability to navigate English-language resources becomes pivotal for informatics engineering specialists. The study underscores the practical significance of reading skills in deciphering evolving technological landscapes, troubleshooting challenges, and staying abreast of the latest advancements, which contextualizes the need for a robust English curriculum in higher education, providing Indonesian graduates with the linguistic tools necessary to navigate the demands of their profession effectively.

The current study underscores the vital role of English-language skills for informatics engineering specialists in Indonesia amid the evolving landscape of Industry 4.0, aligning with Chaka's (2019) scoping review on skills for the fourth industrial revolution. Both studies offer insights into the multifaceted nature of Industry 4.0 preparation. Chaka's review highlights generic soft skills like communication and creativity, which are crucial for navigating Industry 4.0's demands in Indonesia. Additionally, both studies' emphasis on programming skills underscores the technological aspects. This connection enriches our understanding of the comprehensive skill set, encompassing language proficiency, soft skills, and technical competencies, essential for professionals preparing for Industry 4.0 challenges and opportunities(David H & Dorn, 2013).

By delving into the specifics of English proficiency within Indonesia's informatics engineering sector, this study not only aligns with global perspectives but also enriches the understanding of how language skills are integral to the professional fabric of the country. The emphasis on reading skills, in particular, resonates with the unique challenges and opportunities presented by Indonesia's Industry 4.0 landscape.

In answering research question 3, this study addresses the quality of informatics engineering human resources regarding English proficiency during the Industry 4.0 era. Within the Indonesian context, addressing the quality of informatics engineering human resources in terms of English proficiency unveils a notable trend. The study's central findings bring forth a concerning reality: informatics engineering specialists in Indonesia often grapple with a significant vocabulary and analytical skills deficit that impedes adequate English comprehension. This finding echoes the sentiments expressed by participant P1, who candidly acknowledges challenges in reading and listening to tutorials attributed to an insufficient vocabulary (Barclay & Schmitt, 2018).

The identified vocabulary deficit carries cascading effects, prominently impacting critical reading abilities essential for comprehending error messages during program development. This nuanced insight provides a specific lens into the challenges faced by informatics engineering specialists in Indonesia, emphasizing that linguistic limitations can impede their core competencies, particularly in deciphering intricate technical information.

The study illuminates a pronounced mismatch between the demands of the industry and the English proficiency levels of informatics engineering specialists in Indonesia. The varying reading abilities among professionals underscore the complexity of language-related challenges within the sector. This mismatch is not merely a linguistic concern; it is a misalignment that directly affects the ability of the workforce to meet the rigorous demands of Industry 4.0.

Interviews with employers serve as a corroborating voice, with a significant majority expressing dissatisfaction (four out of five) with the English proficiency of their informatics engineering employees. This discontent highlights a palpable gap between industry expectations and professionals' observed quality of English skills. In Indonesia's dynamic landscape of Industry 4.0, this discrepancy underscores the urgency for higher education institutions to undertake comprehensive reforms. Emphasizing English language instruction becomes imperative not only to address immediate workforce challenges but also to align educational outcomes with the evolving needs of the industry.

The study paints a vivid picture of the linguistic challenges of informatics engineering specialists in Indonesia. This nuanced understanding is pivotal for shaping targeted educational interventions to bridge existing gaps and equip the workforce with the requisite English proficiency to thrive in the Industry 4.0 era.

In addressing research question 4, this study explores strategies for Indonesian higher education institutions to cultivate qualified human resources for informatics engineering specialists, explicitly focusing on English proficiency. The investigation assesses the effectiveness of current English

education in meeting the needs of informatics engineering graduates and identifies areas requiring improvement to align educational outcomes with industry expectations. Examining lesson plan documents reveals commendable coverage of all language skills—listening, speaking, reading, and writing—ensuring holistic language proficiency development among informatics engineering students. However, a critical observation emerges regarding the limited time allocation for English for Specific Purposes (ESP) within the informatics engineering domain. With only five meetings over three semesters, the current curriculum fails to prepare graduates for the nuanced language demands of their future workplaces. The study underscores a crucial gap in the introduction of ESP materials, particularly related to domain-specific vocabularies in computer-related terminology, suggesting the need for substantial curriculum reforms to ensure graduates are linguistically equipped for the practical demands of the industry.

CONCLUSION

In conclusion, the study identifies the existing gaps. It emphasizes the urgency for proactive measures, calling for a transformative curriculum overhaul to empower informatics engineering graduates with the linguistic competence necessary for success in their professional journeys within the dynamic landscape of Industry 4.0 in Indonesia.

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