# Competency Gap Analysis of Mechanical Engineering Education Graduates to the Job Needs of the Digital Era: Evidence from a Survey Study

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## ABSTRACT

The rapid transformation of the labor market driven by Industry 4.0 and Society 5.0 has increased the demand for graduates who possess not only technical expertise but also employability skills that align with workplace expectations. Consequently, higher education institutions are required to continuously evaluate the relevance of graduate competencies to support curriculum improvement. This study aims to analyze the competency gap between graduates of the Bachelor's Program in Mechanical Engineering Education at Universitas Negeri Surabaya and the competencies required in the workplace using tracer study data. A quantitative descriptive approach was employed using secondary data from the 2025 institutional tracer study involving 53 graduates. Seven competency dimensions were evaluated: ethics, field-specific expertise, English proficiency, information technology skills, communication, teamwork, and self-development. Descriptive statistics, Gap Analysis, Importance Performance Analysis (IPA), and the Wilcoxon Signed Rank Test were applied to assess competency alignment and identify priority areas for curriculum enhancement. The results reveal relatively small competency gaps, ranging from −0.09 to −0.28, indicating that graduates' competencies are generally aligned with labor market requirements. IPA results show that no competency falls within the high-priority improvement quadrant, while ethics, communication, teamwork, and self-development are positioned in the "Keep Up the Good Work" quadrant. However, the Wilcoxon Signed-Rank Test identifies significant differences in field-specific expertise ($p = 0.005$), communication ($p = 0.002$), teamwork ($p = 0.012$), and self-development ($p = 0.022$), suggesting that these competencies require further strengthening. This study demonstrates that integrating Gap Analysis, Importance Performance Analysis, and the Wilcoxon Signed-Rank Test provides a comprehensive framework for evaluating graduate competency alignment beyond conventional tracer study indicators. The findings offer practical implications for evidence-based curriculum development, continuous quality improvement, and strengthening the alignment between higher education outcomes and industry needs.

**Keywords:** Graduate Competency, Tracer Study, Gap Analysis, Importance–Performance Analysis, Employability Skills, Mechanical Engineering Education

## INTRODUCTION

The transformation of the labor market in the era of the Fourth Industrial Revolution (Industry 4.0) and Society 5.0 has fundamentally reshaped the competency requirements for higher education graduates. Employers no longer seek graduates who possess only strong academic knowledge; instead, they increasingly demand a balanced combination of technical competencies and employability skills. The rapid advancement of digitalization, industrial automation, artificial intelligence (AI), and smart manufacturing systems has intensified the need for professionals who are not only technically competent but also capable of adapting to technological changes, collaborating effectively, communicating professionally, and solving complex problems. Consequently, higher education institutions, particularly those offering vocational and engineering education, are expected to ensure that the competencies embedded in their curricula remain aligned with the evolving needs of the labor market (Vázquez-Villegas & Borrego, 2026).

Despite continuous curriculum reforms aimed at strengthening the relevance of higher education to industrial demands, numerous studies have reported that skills mismatch remains a persistent global challenge (Löfgren et al., 2022; Sivunen & Laitinen, 2019). This mismatch extends beyond technical competencies and encompasses communication skills, teamwork, digital literacy, critical thinking, creativity, and lifelong learning abilities. These findings suggest that the quality of higher education should not merely be assessed by graduation rates but also by the extent to which graduates' competencies correspond to employers' expectations (Cheng & Hahm, 2019).

A similar phenomenon has been observed in vocational education. Previous studies have identified several factors contributing to competency gaps between graduates and industry requirements, including the slow adaptation of curricula to technological developments, limited practice oriented learning experiences, insufficient collaboration between higher education institutions and industry, and the inadequate integration of technical and soft skills within the learning process. As a result, many graduates require substantial workplace adaptation before meeting the competency standards expected by employers (Abhari, 2025).

Within engineering education, these challenges become even more complex due to the rapid evolution of manufacturing technologies and industrial practices. Engineering graduates are expected not only to master discipline specific technical knowledge but also to demonstrate proficiency in information technology, professional communication, teamwork, and ethical conduct. Therefore, evaluating the alignment between graduate competencies and labor market expectations has become an essential component of continuous quality improvement in higher education. Such evaluations provide empirical evidence for improving outcome based education (OBE) curricula by identifying competencies that require further enhancement and those that already satisfy industry expectations (Spöttl & Windelband, 2021).

One of the most widely adopted approaches for evaluating graduate relevance to labor market needs is the tracer study. Beyond providing information on graduate employment rates, job waiting periods, initial salaries, and employment sectors, tracer studies also assess the extent to which competencies acquired during higher education correspond to those required in professional practice. Consequently, tracer studies have become an important instrument for quality assurance in higher education and for monitoring graduate performance indicators across many countries (Huangfu & Chang, 2026).

However, tracer study research conducted over the past five years has predominantly focused on descriptive indicators such as graduate employability, employment waiting periods, income levels, and occupational distribution. Although these indicators provide valuable information regarding graduates' transition into the labor market, they offer limited insights into which competencies remain insufficient to meet industry expectations. As a result, the recommendations generated by many tracer studies tend to be general and provide limited guidance for curriculum improvement or instructional enhancement.

Furthermore, studies investigating competency gap analysis within vocational education remain relatively scarce, particularly in engineering education programs that prepare graduates for dual career pathways as vocational teachers and engineering professionals. Most previous studies have examined either graduates' competency levels or the perceived importance of competencies independently, without systematically analyzing the gap between the competencies possessed by graduates and those required by employers. Such gap analysis is essential because it enables higher education institutions to identify competency areas that should be prioritized for curriculum development while recognizing competencies that already meet industry expectations.

The Bachelor's Program in Mechanical Engineering Education at Universitas Negeri Surabaya possesses unique characteristics because its graduates are prepared not only to become vocational educators but also to pursue careers in manufacturing industries, engineering services, and other technical professions. Consequently, graduates are expected to demonstrate a broader spectrum of competencies than those required in conventional academic programs. This distinctive characteristic necessitates a comprehensive evaluation of graduate competencies to ensure that the curriculum continues to respond effectively to labor market demands.

This study utilizes tracer study data collected from graduates of the Bachelor's Program in Mechanical Engineering Education at Universitas Negeri Surabaya to analyze the gap between graduates' self perceived competencies and the competencies required in the workplace. The competencies examined include ethics, discipline specific expertise, English proficiency, information technology skills, communication, teamwork, and self development, representing the core competency dimensions assessed in the program's tracer study instrument.

# LITERATURE REVIEW

### *1.1.Graduate Employability and Competency Based Education*

Graduate employability refers to graduates' ability to obtain, maintain, and advance their careers through a combination of knowledge, skills, attitudes, and the capacity to adapt to the changing demands of the labor market. Contemporary perspectives on employability extend beyond employment outcomes alone and emphasize the alignment between graduates' competencies and industry requirements. In vocational education, graduate employability has become a key indicator of institutional effectiveness in preparing graduates whose competencies remain relevant to technological advancements and evolving workforce needs. Consequently, higher education institutions are increasingly expected to produce graduates who are not only employable but also capable of sustaining long term career development in dynamic professional environments (Huangfu & Chang, 2026).

Competency Based Education (CBE) has emerged as a learning approach that places competency attainment at the center of the educational process. Unlike traditional content based approaches, CBE emphasizes learners' ability to demonstrate measurable competencies that can be effectively applied in professional practice. These competencies encompass both technical competencies (hard skills) and generic competencies (soft skills), including communication, collaboration, problem solving, leadership, and digital literacy. Such competencies have become increasingly important in response to the rapid digital transformation and technological disruption associated with Industry 4.0 and Society 5.0, where graduates are expected to possess multidisciplinary capabilities and continuously update their knowledge and skills (Marnewick, 2020).

A growing body of research indicates that employers increasingly value technical and non technical competencies with nearly equal importance during recruitment and career development. Although graduates may possess adequate academic knowledge, deficiencies in communication, teamwork, adaptability, critical thinking, and lifelong learning often contribute to the employability gap between higher education outcomes and labor market expectations. Therefore, higher education curricula should integrate technical expertise and employability skills in a balanced manner to prepare graduates who are capable of competing in an increasingly globalized and technology driven labor market. Such an integrated competency framework is also consistent with the principles of Outcome Based Education (OBE), which emphasize measurable learning outcomes that directly reflect workplace expectations and support graduates' long term employability.

### *1.2.Tracer Study as a Graduate Evaluation Instrument*

Tracer study is an evaluation instrument used to examine graduates' transition from higher education to the labor market. The information generated includes employment status, job waiting period, initial salary, job relevance to the field of study, and graduates' perceptions of the competencies acquired during their education. These data provide valuable feedback for higher education institutions in evaluating curriculum effectiveness and the quality of the teaching and learning process.

In recent years, tracer studies have evolved from merely reporting graduate statistics into a strategic instrument for supporting Outcome Based Education (OBE) quality assurance systems. Information regarding the alignment between graduates' competencies and labor market requirements enables higher education institutions to continuously improve their curricula, thereby strengthening the linkage between higher education and industry needs (Junior et al., 2023).

However, most tracer study research continues to focus on employability indicators such as employment rates, job waiting periods, and graduates' initial salaries. Analyses of competency gaps between graduates and industry requirements remain relatively limited, resulting in recommendations that often fail to provide specific priorities for competency development. This condition creates an opportunity to further develop tracer studies as a more comprehensive instrument for competency evaluation.

### *1.3.Competency Gap and Link and Match*

The concept of a competency gap refers to the difference between the competencies possessed by graduates and those required by the labor market. The smaller the gap, the higher the level of alignment between higher education outcomes and industry needs. Conversely, a larger gap indicates a mismatch between the learning process in higher education and the rapid evolution of technology and labor market demands (Schildkamp, 2019).

In vocational education, the competency gap is closely associated with the concept of link and match, which emphasizes the alignment between educational institutions and the business and industrial sectors. Previous studies have identified several major factors contributing to this gap, including the slow pace of curriculum revision, limited industry based learning experiences, weak collaboration with companies, and insufficient integration of technical and generic competencies. Furthermore, the rapid advancement of digital technologies has accelerated changes in industry competency requirements, often outpacing the curriculum revision cycle in higher education institutions.

For engineering education programs, the competency gap has broader implications because graduates are prepared not only to become professionals in the industrial sector but also to serve as future vocational educators. Therefore, evaluating competency gaps provides an essential foundation for designing curricula that can produce graduates with pedagogical, professional, social, and technological competencies that are aligned with the evolving needs of the labor market.

### *1.4.Gap Analysis in Competency Evaluation*

Gap Analysis is an analytical approach used to identify the discrepancy between the current condition (current performance) and the desired condition. In educational research, this method has been widely applied to evaluate service quality, curriculum effectiveness, and the alignment of graduate competencies with stakeholder expectations. The fundamental principle of Gap Analysis is that development priorities are determined based on the magnitude of the difference between graduates' competency levels and the importance of those competencies as perceived by employers or other stakeholders.

In the context of tracer studies, Gap Analysis enables researchers to identify competencies that already meet labor market expectations as well as those that require further improvement (Reddy et al., 2023). Competencies with the largest negative gap represent the highest priority for curriculum enhancement, whereas competencies with smaller gaps indicate that the learning process has successfully met industry expectations. Compared with descriptive analysis alone, this approach provides more actionable insights by establishing clear priorities that can be directly translated into curriculum improvement initiatives.

In addition to assessing the degree of competency alignment, the results of Gap Analysis can be further extended through Importance Performance Analysis (IPA), which classifies each competency into quadrants representing priorities for improvement, areas to maintain, or competencies that may be receiving excessive emphasis. The integration of these two approaches provides a robust empirical basis for evidence based decision making in the development of industry driven curricula.

## METHODOLOGY

This study employed a quantitative descriptive research design using secondary data obtained from the 2025 Tracer Study Report of the Bachelor Program in Mechanical Engineering Education, Universitas Negeri Surabaya. The tracer study serves as an institutional evaluation instrument designed to monitor graduates'

transition into the labor market and to assess the relevance of higher education outcomes to workplace demands. Unlike conventional tracer studies that primarily report graduate employment indicators, this study reanalyzed the tracer study dataset to identify competency gaps between graduates' competencies and workplace expectations as an empirical basis for curriculum evaluation and continuous quality improvement.

The data analyzed in this study were derived from the official tracer study conducted among graduates of the Bachelor Program in Mechanical Engineering Education who participated in the 2025 survey. According to the tracer study report, a total of 53 graduates completed the questionnaire, representing graduates with diverse employment conditions, including employed graduates, graduates pursuing further study, and graduates seeking employment. Besides collecting information on graduate employment status, waiting period for obtaining the first job, salary level, job relevance, and learning experiences during university, the tracer study also assessed graduates' perceptions regarding their competencies and the competencies required in their current workplaces.

The present study focused on seven competency dimensions assessed in the tracer study, namely ethics, field specific expertise, English proficiency, information technology skills, communication skills, teamwork, and self development. Each competency was measured from two perspectives: the level of competency possessed by graduates upon completing their studies and the level of competency required in their current workplace. These paired measurements enabled a direct comparison between educational outcomes and labor market expectations, providing a comprehensive assessment of competency alignment.

Data analysis was conducted in three sequential stages. First, descriptive statistics were employed to summarize the mean scores of graduates' competencies and workplace required competencies for each competency dimension. This analysis provided an overview of graduates' competency profiles and the expectations of the labor market. Second, Importance Performance Analysis (IPA) was performed to determine priorities for curriculum improvement. In the IPA framework, graduates' competency levels were treated as the performance dimension, whereas workplace required competency levels represented the importance dimension. The mean values of both dimensions were used as the intersection point to construct the IPA matrix, classifying each competency into four quadrants: Concentrate Here, Keep Up the Good Work, Low Priority, and Possible Overkill. This analysis facilitates the identification of competencies requiring immediate attention as well as competencies that have met workplace expectations.

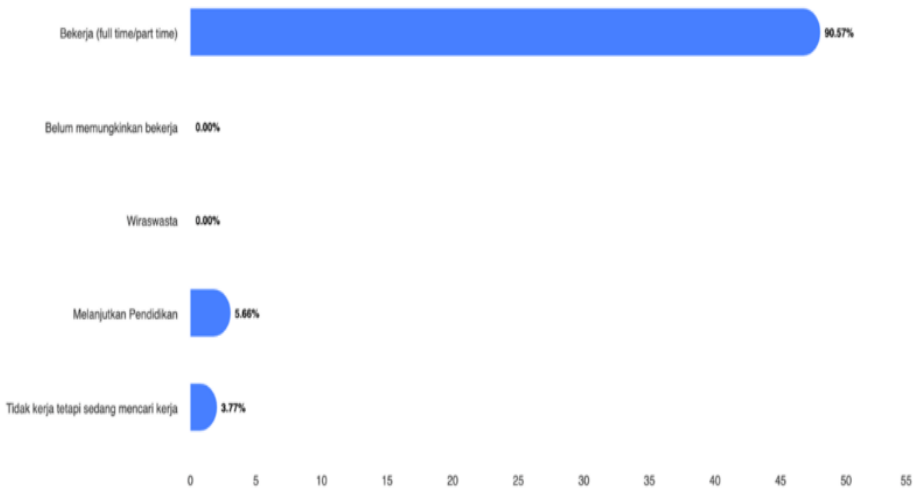
To examine whether the differences between graduates' competencies and workplace required competencies were statistically significant, inferential statistical analysis was subsequently conducted. Prior to hypothesis testing, the normality of the paired differences was assessed using the Shapiro–Wilk test. When the normality assumption was satisfied ($p > 0.05$), the Paired Sample t-test was employed to compare the mean scores of graduates' competencies and workplace required competencies. Conversely, if the normality assumption was violated ($p \leq 0.05$), the Wilcoxon Signed Rank Test was applied as the non parametric alternative for paired observations. All statistical analyses were conducted using a significance level of 0.05. The combination of IPA and paired comparison tests enabled this study to identify not only the magnitude of competency gaps but also the statistical significance of those gaps, thereby providing stronger empirical evidence for curriculum evaluation.

Because this study utilized secondary data collected through the institutional tracer study, no additional data collection was undertaken. The tracer study questionnaire was developed based on the standardized national tracer study instrument used by Indonesian higher education institutions, ensuring consistency in the measurement of graduate outcomes and competencies.

## RESULT

The alumni tracking report (tracer study) of the Mechanical Engineering Education Undergraduate Study Program shows that the majority of graduates are very well absorbed in the formal employment sector, where as many as 48 alumni have succeeded in getting jobs relevant to their field of expertise.

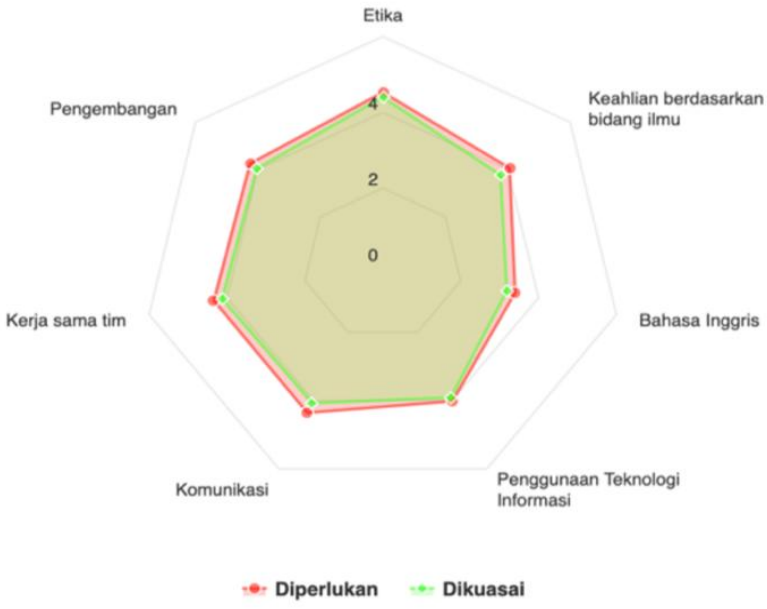
**Figure 1. Current Employment Status of Mechanical Engineering Education Graduates**




Based on the detailed graph regarding the current activity status of respondents of Mechanical Engineering Education Bachelor's degree alumni, the absolute majority of graduates are in the Working category (full time/part time) namely 48 alumni (90.57%). In addition, there are 3 alumni (5.66%) who chose the academic route by Continuing Education to a higher level. Meanwhile, alumni who are in the transition phase of Not working but looking for work were recorded at only 2 alumni (3.77%). For the status category Not yet possible to work and Self Employed, both showed a figure of 0 alumni (0.00%). This specific data confirms that the majority of graduates have been absorbed productively in the professional world and further education institutions immediately after completing their studies.

*1.5.Gap Analysis*

**Figure 2. Comparison of Graduates' Competencies and Workplace Competency Requirements**




Based on the Alumni Competency Graph that evaluates the alignment between the level of importance in the world of work (Required) and the level of mastery of graduates (Mastered), the results of the tracer study indicate a very high and balanced level of alignment (link and match) in all aspects of ability. Of the seven components assessed namely Ethics, Expertise based on scientific fields, English, Use of Information Technology, Communication, Teamwork, and Development the Ethics aspect occupies the highest position with a score approaching the maximum point of 4, followed strongly by the Communication and Teamwork aspects and

Expertise in scientific fields. Although the English aspect is on the lowest curve compared to other competency points, the graph visually shows that the gap between industry needs and alumni mastery in all lines is very small, even almost perfectly overlapping in the Use of Information Technology aspect. This proves that the provision of curriculum materials and soft skills provided by the Mechanical Engineering Education Undergraduate Study Program has succeeded in optimally meeting the qualification standards and expectations demanded by the world of work.

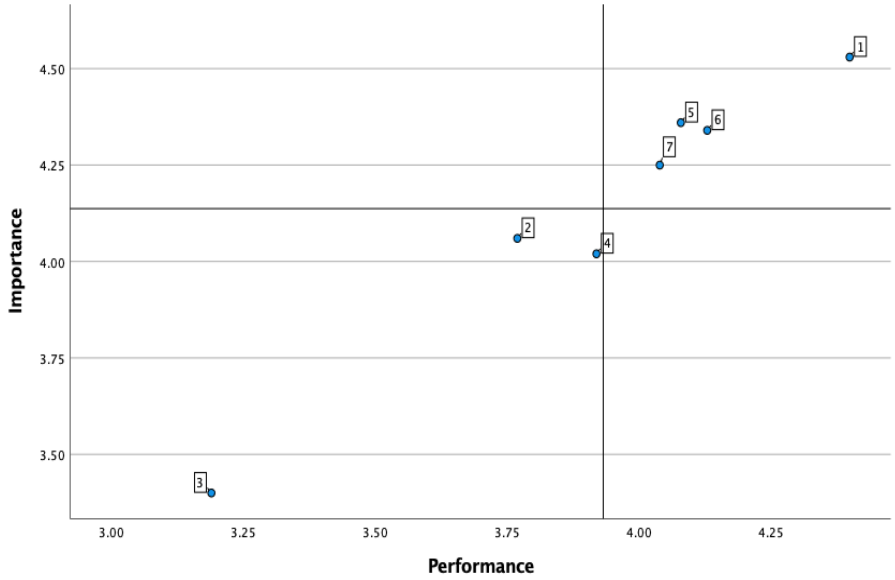
*1.6.IPA Analysis*

**Table 1. Gap Analysis of Graduate Competencies Based on Importance and Performance Scores**

| Code | Competence | Importance | Performance | Gap |
|---|---|---|---|---|
| 1 | Ethics | 4.53 | 4.40 | -0.13 |
| 2 | Expertise in Field of Study | 4.06 | 3.77 | -0.28 |
| 3 | English Proficiency | 3.40 | 3.19 | -0.21 |
| 4 | Information Technology Skills | 4.02 | 3.92 | -0.09 |
| 5 | Communication Skills | 4.36 | 4.08 | -0.28 |
| 6 | Teamwork | 4.34 | 4.13 | -0.21 |
| 7 | Self development | 4.25 | 4.04 | -0.21 |

Based on Table X, all competencies have a negative gap value, indicating that the competency level possessed by graduates (performance) is still slightly lower than the competency expected by graduate users (importance). The resulting gap is relatively small, ranging from -0.09 to -0.28, so in general the suitability of graduate competencies with the needs of the world of work can be said to be good. Ethics competency obtained the highest importance (4.53) and performance (4.40) values with a gap of -0.13, indicating that graduates have met user expectations in terms of professionalism and integrity. Conversely, Expertise based on the field of science and Communication has the largest gap (-0.28), indicating the need for improvement in both competencies to better suit the demands of the world of work. English, Teamwork, and Development competencies each have a gap of -0.21, indicating a need for improvement although the gap is still relatively low. Meanwhile, Use of Information Technology has the smallest gap (-0.09), indicating that graduates' digital competencies have approached the level of competency expected by graduate users.

**Figure 3. Importance Performance Analysis (IPA) Matrix of Graduate Competencies**




Based on Figure 3, the majority of competencies fall into Quadrant II (Keep Up the Good Work), namely Ethics (1), Communication (5), Teamwork (6), and Development (7). These competencies have equally high

levels of importance and mastery, and therefore should be maintained as a strength of the Mechanical Engineering Education Undergraduate Program.

The Use of Information Technology (4) falls near the intersection of the quadrants, with a level of mastery nearly equal to its importance. This indicates that graduates' digital competencies align with the needs of the workforce and are sufficient to maintain.

Meanwhile, Expertise by Field of Study (2) falls into Quadrant III (Low Priority), indicating that both the importance and mastery of this competency are relatively lower compared to the other competencies. Similarly, English (3) falls into Quadrant III. Although not a top priority according to the perceptions of graduate users, this competency still requires attention to increase graduate competitiveness in an increasingly global job market.

Overall, the IPA results indicate that there are no competencies in Quadrant I (Concentrate Here). This indicates that no competencies were deemed highly important but had a low level of mastery. Thus, the competencies of graduates of the Mechanical Engineering Education Undergraduate Program generally meet the needs of graduate users, although improvements in academic expertise and English language skills are still needed to support graduate quality.

*1.7.Comparative Analysis of Graduate Competencies*

**Table 2. Wilcoxon Signed Rank Test Results for Graduate Competencies**

| Code | Competency | Z | Asymp. Sig. (2-tailed) | Decision |
|---|---|---|---|---|
| 1 | Ethics | -1.941 | 0.052 | Not Significant |
| 2 | Expertise in Field of Study | -2.785 | 0.005 | Significant |
| 3 | English Proficiency | -1.877 | 0.060 | Not Significant |
| 4 | Information Technology Skills | -1.291 | 0.197 | Not Significant |
| 5 | Communication Skills | -3.128 | 0.002 | Significant |
| 6 | Teamwork | -2.524 | 0.012 | Significant |
| 7 | Self development | -2.294 | 0.022 | Significant |

Based on the Wilcoxon Signed Rank Test results in Table X, there is a significant difference between the level of competency required by the workplace (importance) and the competency possessed by graduates (performance) in four competencies: expertise based on scientific fields ($Z = -2.785$; $p = 0.005$), communication ($Z = -3.128$; $p = 0.002$), teamwork ($Z = -2.524$; $p = 0.012$), and development ($Z = -2.294$; $p = 0.022$). These results indicate that graduate competencies in these four aspects still do not fully meet the competency levels expected by graduate users.

Conversely, competencies in ethics ($p = 0.052$), English ($p = 0.060$), and use of information technology ($p = 0.197$) did not show a significant difference between the level of competency possessed by graduates and that required in the workplace. Thus, these three competencies are considered to have a relatively good level of suitability with the needs of graduate users.

*1.8.Relationship with Wilcoxon and IPA results*

**Table 3. Integration of Gap Analysis, IPA, and Wilcoxon Signed Rank Test Results**

| Competency | Importance | Performance | Gap | Z | p-value | Interpretation |
|---|---|---|---|---|---|---|
| Ethics | 4.53 | 4.40 | -0.13 | -1.941 | 0.052 | No significant difference |
| Expertise in Field of Study | 4.06 | 3.77 | -0.28 | -2.785 | 0.005 | Significant difference |

| | | | | | | |
|---|---|---|---|---|---|---|
| English Proficiency | 3.40 | 3.19 | -0.21 | -1.877 | 0.060 | No significant difference |
| Information Technology Skills | 4.02 | 3.92 | -0.09 | -1.291 | 0.197 | No significant difference |
| Communication Skills | 4.36 | 4.08 | -0.28 | -3.128 | 0.002 | Significant difference |
| Teamwork | 4.34 | 4.13 | -0.21 | -2.524 | 0.012 | Significant difference |
| Self development | 4.25 | 4.04 | -0.21 | -2.294 | 0.022 | Significant difference |

The Wilcoxon test results support the findings of the Importance Performance Analysis (IPA). In the IPA analysis, expertise based on science and communication had the largest gap (−0.28), and these two competencies were also shown to have a statistically significant difference. Furthermore, teamwork and development, which had a gap of -0.21, also showed a significant difference. Conversely, although ethics, English, and the use of information technology still had a negative gap, the difference was not statistically significant, so the level of graduate competence in these three aspects can be considered relatively appropriate to the needs of the workplace.

## DISCUSSION

The results of the Importance–Performance Analysis (IPA) and the Wilcoxon Signed Rank Test indicate that, in general, the competencies of graduates of the Mechanical Engineering Education Undergraduate Program align with the needs of the workforce. This is demonstrated by the relatively small gap across all competencies, ranging from -0.09 to -0.28. Furthermore, there are no competencies in Quadrant I (Concentrate Here) of the IPA matrix, meaning there are no competencies with a high level of importance but a very low level of mastery. This finding indicates that the learning process has been able to produce graduates with competencies relevant to the needs of graduate users (OECD, 2025).

However, the Wilcoxon Signed Rank Test results indicate a significant difference between required competencies and the competencies possessed by graduates in the areas of expertise based on scientific fields, communication, teamwork, and development. These four competencies still have a lower level of mastery than the competency levels expected by the workforce. This finding suggests that although the gap is relatively small, improving the quality of learning in these competencies is still necessary to ensure optimal work readiness for graduates. Expertise by field of study shows the largest gap and significant differences (Jackson, 2015). These results indicate that the workplace expects graduates to have a deeper mastery of technical competencies aligned with developments in industrial technology. In mechanical engineering education, technical competency relates not only to theoretical mastery but also to the ability to operate modern equipment, solve technical problems, and apply practical skills according to industry standards. Therefore, strengthening project based learning, increasing laboratory practice, and collaborating with the business and industrial worlds are relevant strategies to narrow this gap (Chen & Yang, 2019; Jackson, 2015).

Communication competency also shows significant differences. This indicates that graduate users increasingly emphasize the importance of the ability to convey ideas, prepare technical reports, deliver presentations, and communicate effectively in a multidisciplinary work environment. In line with the development of modern industry, communication skills have become a key competency supporting individual success in collaborative work and in solving problems in the workplace (Succi & Canovi, 2020).

The study also shows significant differences in teamwork and self development competencies. These findings demonstrate that the workplace demands not only technical competency mastery but also the ability to work in a team, adapt to change, and maintain a motivation to continuously learn. Rapid technological change encourages graduates to develop lifelong learners, so the curriculum needs to provide more collaborative learning experiences, group project completion, and activities that encourage independent learning (Teng et al., 2019; Tomlinson, 2017).

Conversely, competencies in ethics, English, and information technology utilization did not show a significant difference between graduates' competency levels and workplace needs. This finding indicates that graduates have achieved a level of competency that is relatively aligned with user expectations in these three areas. Specifically, in the competency in information technology utilization, the smallest gap indicates that the integration of digital technology into the learning process has had a positive impact on graduates' digital readiness. Meanwhile, the ethics competency, which received the highest importance and performance scores, demonstrates that professionalism, responsibility, and integrity have become key strengths for graduates of the Mechanical Engineering Education Undergraduate Program.

Overall, the results of this study confirm that graduate quality is well aligned with the needs of graduate users. However, curriculum improvements still need to focus on strengthening technical competencies within specific fields of study, communication skills, teamwork, and self development. This strengthening is expected to narrow the competency gap and increase graduates' competitiveness in facing the increasingly complex and technology driven world of work.

## CONCLUSION

This study examined the competency gap between graduates of the Bachelor's Program in Mechanical Engineering Education at Universitas Negeri Surabaya and workplace competency requirements using tracer study data. The findings indicate that graduates' competencies are generally well aligned with labor market expectations, as reflected by relatively small competency gaps and the absence of competencies in the highpriority improvement quadrant of the Importance–Performance Analysis (IPA). However, the Wilcoxon SignedRank Test identified significant gaps in discipline specific expertise, communication, teamwork, and self development, indicating that these competencies should become priorities for curriculum enhancement.

The integration of Gap Analysis, Importance Performance Analysis, and the Wilcoxon Signed Rank Test provides a more comprehensive evaluation framework than conventional tracer studies by identifying specific competency priorities for improvement. The findings offer practical evidence for strengthening outcome based curricula and reinforcing the link and match between higher education and industry needs. Future studies should involve multiple institutions and employers to obtain broader insights into graduate competency alignment across vocational and engineering education.

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