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Assessing AutoCAD Competence and Employer Attitudes Towards Graduate Employability in the Malaysian Civil Engineering Industry

Muhammad Hazim Farizal[1], Nurdalila Saji[1]*

[1] *Department of Civil Engineering Technology, Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia, Hab Pendidikan Tinggi Pagoh, KM 1, Jalan Panchor, 85600 Panchor, Johor, Malaysia*

*Corresponding Author: nurdalila@uthm.edu.my
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Abstract

The research demonstrates the global digitization of the civil engineering industry demands a highly technically proficient workforce. It is to assess the Computer-Aided Design (CAD) knowledge of Technical and Vocational Education and Training (TVET) civil engineering graduates and evaluate employer perceptions regarding AutoCAD skills as an entry-level job requirement. A quantitative, cross-sectional survey was deployed, targeting the rapidly developing infrastructure sector of Southern Johor. Using purposive and stratified sampling, the study involved 151 participants, comprising 78 TVET graduates (51.7%) and 73 industry practitioners (48.3%). Scale reliability was strong, achieving a Cronbach's Alpha of 0.842 across 27 items. The findings demonstrated a highly significant correlation between industry hiring criteria and the necessity for industry-academia collaboration ($r = 0.953$, $p < 0.001$, $df = 149$), as well as between graduate AutoCAD skills and employer productivity standards ($r = 0.832$, $p < 0.001$, $df = 149$). The research concludes that employers view applied AutoCAD proficiency not merely as an asset, but as a critical operational prerequisite. To bridge the existing skills gap, the study recommends that civil engineering firms and TVET institutions establish formal collaborations to integrate real-world project workflows and BIM ready curricula, thereby enhancing graduate employability and supporting Malaysia's transition toward Industry 4.0.

1. Introduction

The global civil engineering industry is experiencing rapid digital transformation, necessitating a highly technically savvy workforce. Technical and Vocational Education and Training (TVET) serve as a vital mechanism for elevating workforce quality and developing skills that meet the rigorous demands of modern industries. In Malaysia, TVET is recognized as a strategic pathway to enhance graduate employability, particularly within heavily applied technical fields such as civil engineering [1], [2].

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The element of engineering applications and technology is at the forefront of this shift. AutoCAD remains the foundational drafting tool for 2D detailing, shop drawing generation, and spatial discipline coordination in both consultant and contractor workflows. Digital drafting competence is no longer optional; it is the baseline for modern civil engineering applications. Despite this, educational approaches in TVET centers vary significantly. Some institutions offer limited exposure to real-world project standards or utilize obsolete software versions, resulting in inconsistent digital competence among graduates [3]–[5]. While AutoCAD is widely taught, research indicates that the depth of instruction and the integration of actual industry practices remain uneven across institutions [6].

This variance has direct implications for graduate employability. Employers consistently emphasize that digital drafting skill is a mandatory prerequisite and a distinct competitive advantage during recruitment [7], [8]. However, a persistent gap remains between academic preparation and industry expectations [9], [10]. According to the Graduate Tracer Study by the Ministry of Higher Education, while 87.6% of Malaysian graduates are employed, the employment rate for TVET graduates is slightly lower at 84%, highlighting the ongoing challenge of aligning technical training with immediate market needs [11]. The Department of Statistics Malaysia reported a labor force participation rate of 70.9% and an unemployment rate of 3.0%. Construction activity rose by 11.8% year over year, indicating a healthy demand for civil engineering skills [12]. Yet, this growth is accompanied by systemic underemployment, pointing to inefficiencies in skill utilization.

Industry specific assessments from the Construction Industry Development Board [13] reveal that digital tools such as AutoCAD and Civil 3D function as gatekeeping requirements for early career engineers. Employers note that recent graduates often struggle with applied engineering workflows, including revision control, layer management, and external references (Xrefs) skills vital for progressing into broader Building Information Modelling (BIM) environments. Consequently, companies have increased onboarding costs. This highlights a clear operational mismatch between the sector's technical expectations and current TVET curricula.

Such constraints create a research gap in systematic alignment of regional training with commercial requirements. Thus, in this study the main selection criterion for entry level positions is investigated: Employer attitudes towards AutoCAD competence. The specific objectives are: To assess the level of knowledge of CAD in TVET civil engineering graduates and the expectations of employers. To propose practical mechanisms for collaboration between engineering firms, technical colleges and developers for the improvement of employability of graduates.

The exact commercial value placed on AutoCAD skills whether viewed as a mandatory operational baseline or an auxiliary asset remains under documented in regional contexts, creating a gap in aligning training with commercial expectations. Therefore, this study investigates employer attitudes toward AutoCAD competence as a primary selection criterion for entry-level positions. The specific objectives are:

1. To assess the level of CAD knowledge among TVET civil engineering graduates against the technical expectations of employers.
2. To propose practical mechanisms for collaboration between engineering firms, technical institutions, and developers to improve graduate employability.

2. Methodology

This research utilizes a quantitative, cross-sectional survey design to systematically examine the relationship between AutoCAD competence, employer expectations, and the employability of civil engineering TVET graduates. The research is geographically delimited to the Southern Region of Johor, Malaysia, focusing heavily on the high-growth industrial and infrastructure corridors of Johor Bahru, Iskandar Puteri, and Pasir Gudang.

The target population consists of recent civil engineering TVET graduates (2022–2025) trained in AutoCAD, alongside industry professionals (project managers, hiring managers, and senior engineers) operating in Southern Johor. Purposive sampling was utilized to ensure all respondents had direct experience with AutoCAD or technical recruitment processes. Stratified sampling was then applied to divide respondents into two balanced strata: graduates and employers.

A minimum sample size of 151 respondents was determined using the Krejcie and Morgan (1970) sample size determination criteria. primary data collection yielded a total validated sample of N = 151 respondents. The final sample distribution comprised 78 TVET graduates (51.7%) and 73 industry professionals (48.3%), providing a robust empirical baseline for comparative analysis. Data was collected via a structured 27-item online survey deployed through Google Forms. Prior to full implementation, a pilot study with 20 respondents was conducted to verify the clarity and structural validity of the instrument. The pilot analysis yielded a highly reliable Cronbach's Alpha value of 0.973, confirming its suitability for primary data collection.

3. Results and Discussion

3.1 Reliability and Descriptive Analysis

The primary scale reliability test for the formal dataset ($N = 151$) achieved a Cronbach's Alpha value of 0.842 across all 27 items, confirming high internal consistency. Descriptive statistics highlighted several critical trends:

- **Graduate Skills Confidence:** Graduates displayed high confidence in baseline execution. Statement B8 ("I can complete drafting tasks within workplace deadlines") scored the highest mean at 4.51 (SD = 0.503), followed closely by Statement B7 ("Ability to read engineering drawings and project specifications") with a mean of 4.49 (SD = 0.503).
- **Employer Attitudes:** Employers firmly equate CAD proficiency with immediate operational readiness. Statement C5 ("AutoCAD competence contributes to increased workplace productivity") and Statement C10 ("AutoCAD competency is an indicator of graduate readiness") both received maximal mean scores of 4.82 (SD = 0.385).
- **Skills Mismatch & Collaboration:** Statement D5, which measures the discrepancy between institutional training and actual workplace drafting standards, yielded a mean of 3.53 (SD = 1.326), confirming a recognized operational skills gap. Consequently, respondents strongly supported collaboration, with Statement E4 ("Companies should give feedback on the drafting skills needed") scoring 4.25 (SD = 0.995).

Table 1: Demographic profile of the respondents (N = 151)

Demographic Variable	Classification	Frequency	Percentage (%)
Respondent Category	TVET Graduates	78	51.7
	Employers/Industry Professionals	73	48.3
Gender	Male	87	57.6
	Female	64	42.4
Age Group	Under 20 years	35	51.7
	20-25 years	58	38.4
	26-30 years	39	25.8
	Above 30 years	19	12.6
Highest Qualification	Certificate	50	33.1
	Diploma	24	15.9
	Bachelor's Degree	59	39.1
	Other:	18	11.9
Institution Type	Universities	40	26.5
	Community Colleges	40	26.5
	Polytechnics	34	22.5
	Vocational Colleges	19	12.6
	Other:	18	11.9
Employment Status	Employed	57	37.8
	Self-employed	58	38.4
	Unemployed	36	23.8
Current Position	CAD Drafter/Draftperson	76	50.3
	Empoyer/Industry Professional	50	33.1
	Civil Engineering Technician	21	13.9
	Site Supervisor/Site Engineer	4	2.7
Years of Experience	Less than 1 year	78	51.7
	1-3 years	36	23.8
	4-6 years	19	12.6
	More than 6 years	18	11.9

(1)

Organization Type	Construction Contractors	55	36.4
	Civil Engineering Consultancies	52	34.4
	Property Developers	19	12.6
	Infrastructure Companies	18	11.9
	Other:	7	4.7
AutoCAD Usage Frequency	Daily	52	35.8
	Weekly	37	24.5
	Ocassionally	38	25.2
	Rarely	18	11.9
	Never	4	2.6
Certified CAD Training	Yes	109	72.2
	No	42	27.8

3.2 Inferential Correlation Analysis

Pearson Correlation analysis (df = 149) revealed highly significant positive relationships between all main study variables at the $p < 0.01$ level (2-tailed). AutoCAD Competence of TVET Graduates and the Importance of Hiring Criteria demonstrated a strong positive correlation ($r = 0.832$, $p < 0.001$). Furthermore, Graduate Employability and Job Readiness significantly correlated with Industry-Academia Collaboration ($r = 0.826$, $p < 0.001$). The strongest overall correlation was observed between the Importance of Hiring Criteria and Industry-Academia Collaboration ($r = 0.953$, $p < 0.001$).

3.3 Multiple Regression and Criticial Analysis of Statistical Findings

A multiple linear regression model was deployed to test the predictive power of the independent variables on Industry-Academia Collaboration across the N = 151 dataset. The model summary revealed an exceptionally strong multiple correlation coefficient ($R = 0.998$) and an Adjusted R^2 of 0.996, with a standard error of 0.617. The overall regression model remained statistically significant ($F(2, 148) = 4486.344$, $p < 0.001$).

Critical Analysis of the Model:
While the regression and correlation values (Adjusted $R^2 = 0.996$; $r = 0.953$) demonstrate a definitive alignment between employer expectations and digital competency requirements, such exceptionally high values warrant careful critical interpretation. This near-unanimous consensus can be directly attributed to the purposive sampling strategy deployed within the localized, heavily industrialized corridor of Southern Johor. The 151 respondents represent a highly specialized cohort operating under rigid, standardized industry codes where expectations for CAD proficiency are universally agreed upon. Furthermore, there may be inherent overlapping variance (multicollinearity) between survey constructs measuring "Employer Attitudes" and "Hiring Criteria," as these concepts are intrinsically linked in recruitment practices. While these findings emphatically validate the core hypothesis that AutoCAD competence drives employability in future studies should expand the geographic scope and utilize Variance Inflation Factor (VIF) diagnostics to ensure broader generalizability across less standardized regions.

4. Conclusion

This study establishes that employers in the civil engineering sector view applied AutoCAD skills not merely as an administrative asset, but as a critical, non-negotiable component of workplace readiness and productivity. While descriptive data shows that TVET graduates are confident in their baseline drafting abilities, inferential analyses across the 151 respondents reveal a distinct operational gap between academic exercises and the demands of modern engineering workflows (such as BIM integration and revision control). Bridging this gap requires formalized, strategic collaboration between TVET institutions and civil engineering firms. By aligning institutional curricula with active commercial standards, Malaysia can effectively enhance graduate employability and accelerate its transition toward Industry 4.0 and sustainable infrastructure development.

5. Recommendations

Based on the empirical findings, the following mechanisms are proposed to bridge the operational gap between TVET training and the Malaysian civil engineering industry:

1. **Curriculum Modernization**: TVET institutions must transition from teaching isolated software commands to delivering project-based engineering modules. Syllabi should strictly integrate

industry best practices, including advanced layer management, Xref coordination, and fundamental BIM environments.

2. **Faculty Upskilling**: Technical instructors should undergo compulsory industrial attachments to ensure their instructional capabilities remain aligned with the latest commercial design codes and software releases.
3. **Industry-Academia Partnerships**: Civil engineering consultancies and developers should form active advisory panels with regional TVET networks to dictate emerging technical needs. Work-Based Learning (WBL) should be expanded through structured internships that expose students to live project deadlines.
4. **Policy and Resource Allocation**: Public authorities should establish a standardized national technical certification for CAD/BIM competency to normalize graduate quality. Capital must be allocated to upgrade institutional hardware and software licenses within key economic zones like Southern Johor.

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