

Industries Assessment of Competency-Based Training effectiveness in Equipping Students of Tamale Technical University with Desired Competencies

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Abstract: The study utilised a descriptive survey to investigate Industry Supervisors' perceptions regarding the effectiveness of Competency-Based Training (CBT) programme in equipping students with industry-relevant competencies. The data was collected from industry supervisors (27) who actively supervised students during the 2022 Industrial attachment session. The results revealed that out of the 19 industry-desired competencies examined, students were assessed to be competent in 15 areas, with mean scores of 2.5 and above. Students demonstrated high levels of competency in "possessing theoretical agricultural knowledge," attaining a mean score of 2.64. Pearson Product Moment Correlation (PPMC) computed at $p < 0.05$, indicated that certain demographic characteristics of industry supervisors, such as age, experience, education, and sex, can influence how they assess students' competencies in specific areas. The study recommends for the development of tailored training programmes to strengthen competencies in areas where students demonstrated lower proficiencies in critical thinking, networking, ICT skills, and adaptability.

Keywords: industry supervisors, Competency based training, industrial attachment, industry desired competencies, competency, world of work.

1.0 Introduction

Competency-Based Training (CBT) is a dynamic and learner-centred approach to education and skill development that focuses on the mastery of specific abilities or competencies rather than the traditional model of time-based learning (Fouad, & Singh, 2017). In this methodology, learners progress at their own pace, demonstrating their proficiency in predefined skills or knowledge areas before moving on to more advanced tasks. This tailored approach ensures that individuals acquire the practical skills and knowledge necessary for success in their chosen field, making Competency-Based Training a highly effective and adaptable method of education in today's rapidly evolving professional landscape (Rothwell, & Graber, 2016).

2.0 Historical Context of Competency-Based Training

Competency-Based Training (CBT) emerged as a response to the limitations of traditional education models, particularly in vocational and technical fields (Bowen, et al. 2017). Its roots can be traced back to the mid-20th century when there was a growing recognition of the need for more practical and job-specific training.

After World War II, there was a significant demand for skilled workers to support the post-war economic boom. This led to the development of vocational education programmes focused on specific job skills. The behaviourist theories of learning, which emphasised observable behaviours and reinforcement, influenced the development of competency-based approaches. This perspective placed importance on the mastery of specific skills (Rothwell, & Graber, 2016).

The 1980s and 1990s saw the rise of Outcome-Based Education (OBE), a precursor to CBT. OBE emphasised clearly defined learning outcomes and the assessment of student proficiency in achieving those outcomes. As industries began evolving at a faster pace, there was a growing need for individuals to continuously update their skills. Competency-Based Training gained traction as a means to provide more flexible and adaptable learning experiences.

The proliferation of digital technology and e-learning platforms facilitated the implementation of CBT, allowing for personalised, self-paced learning experiences. Online assessments and simulations became integral components. In recent decades, there has been a concerted effort to align CBT programmes with industry-recognised standards and certifications. This ensures that learners are equipped with the specific skills and knowledge demanded by employers (Dubois, & Rothwell, 2017).

Competency-Based Training has gained popularity worldwide as a means to address skills gaps and enhance workforce readiness (Dubois, & Rothwell, 2017). Many educational institutions and training programmes have incorporated CBT elements into their curricula. Ayariga, (2013) called on public universities

to restructure their programmes to produce skilled and job-ready individuals who can contribute effectively to the workforce and support economic development in the country.

Governments and educational accrediting bodies in various countries have started to endorse and regulate Competency-Based Training programmes, recognising their effectiveness in preparing individuals for the demands of a rapidly changing job market. Wang, (2019) submitted that, Competency-Based Training continues to evolve in response to advances in technology, changes in the nature of work, and the increasing need for individuals to acquire specific, job-relevant skills efficiently and effectively. It stands as a pivotal paradigm shift in education, focusing on measurable outcomes and the practical application of knowledge and skills (Bowen, et al. 2017).

3.0 Competency Based Training in Ghana

Competency-Based Training (CBT) in Ghana is an educational approach that focuses on developing specific skills, knowledge, and abilities required for a particular job or profession. It emphasises hands-on learning and practical application of skills rather than just theoretical knowledge (Wang, 2019). CBT is designed to align education with the needs of the workforce and industry, ensuring that graduates are well-prepared for their chosen careers.

In Ghana, CBT has gained prominence as a means to address the skills gap and enhance employability. The approach involves defining clear learning outcomes and competencies that students are expected to achieve by the end of their training. These competencies are often aligned with industry standards and are regularly updated to reflect evolving job requirements (Fouad, & Singh, 2017). CBT programmes in Ghana typically incorporate practical training, simulations, and workplace experiences to provide learners with real-world exposure. Assessment methods focus on evaluating a student's ability to perform specific tasks and demonstrate the required competencies.

4.0 Technical University Education in Ghana

Technical University Education in Ghana refers to tertiary education institutions that offer specialised training and education in technical and vocational fields. These institutions were formerly known as Polytechnics until the passage of the Technical Universities Act, 2016 (Act 922), and as amended by the Technical Universities Act 2019 (Act 974) which elevated them to the status of universities. These universities are dedicated to providing education and training in technical, applied, and vocational fields. They offer programmes in areas such as engineering, applied sciences, business, information technology, and related disciplines. They emphasise practical and hands-on learning. Students engage in laboratory work, workshops, and industrial attachments to gain practical experience in addition to theoretical knowledge.

Technical universities collaborate closely with industries, businesses, and other stakeholders to ensure that their programmes are aligned with the needs of the job market. This helps to produce graduates who are well-prepared for the workforce (Amankwa, 2011). The curriculum is designed around specific competencies and learning outcomes. Students are assessed on their ability to perform tasks and demonstrate the required skills and knowledge. There is an emphasis on student-centred approaches to teaching and learning. This includes interactive teaching methods, project-based learning, and opportunities for student engagement in research and community service.

Technical universities in Ghana are increasingly engaged in research activities to address industry challenges and contribute to national development. They conduct applied research that often has direct practical applications. Graduates from technical universities have opportunities for further studies, including pursuing advanced degrees at the master's and doctoral levels. There are also mechanisms in place for credit transfers and articulation agreements with other higher education institutions. These universities in Ghana are regulated by the National Council for Tertiary Education (NCTE) to ensure quality education and compliance with established standards.

5.0 NUFFIC Project

The Netherlands Foundation for International Cooperation (NUFFIC) initiated a project called Strengthening Agricultural Engineering Education and Training at Universities for Rural Development and Poverty Reduction (SAEET) to pilot competency-based training (CBT) in selected universities. The main aim was to strengthen the Agricultural Engineering programme with the goal of enhancing education and training for rural development, food security, and poverty reduction in Ghana. The specific objectives included designing and implementing a student-centred, competency-based teaching methodology and curriculum aligned with labour market demands, as well as providing training opportunities for students and staff to develop relevant skills and knowledge.

Tamale Technical University in northern Ghana was among the pioneer institutions chosen for the CBT programme, specifically focusing on the agricultural engineering programme. The programme aimed to contribute to rural development and poverty reduction in collaboration with and for the benefit of Tamale Technical University. Over the past ten years, the agricultural engineering department has been graduating students who have undergone a hands-on CBT programme.

A skills gap analysis conducted before the programme's launch revealed a significant lack of student interest in the agricultural engineering programme (NUFFIC, 2006). To make studying agriculture more appealing, students needed to be encouraged and motivated by demonstrating potential employment opportunities, both in governmental and non-governmental organisations. Graduates were expected to work as service providers, workshop managers, or in similar positions in Agricultural Mechanisation Centres. Therefore, a crucial step in the University's strategy development was conducting a thorough assessment of future job prospects for graduates to seamlessly integrate into the workforce.

Additionally, it was noted that competency-based training offered an excellent opportunity to align education with students' professional development in the working environment (NUFFIC, 2004). However, there was concern among stakeholders that the current curriculum did not adequately address the demands of the job market, and failed to distinguish graduates from similar Bachelor's degree programmes at traditional universities. The perception that entry requirements for universities were lower than those for traditional universities contributed to the misconception that Technical university graduates were inferior. Additionally, agriculture and engineering were viewed as having lower status and garnering less interest compared to sectors like business administration and information and communication technology (NUFFIC, 2006).

These issues led to a significant decline in enrolment in the agricultural engineering programme, highlighting the urgent need for a major overhaul of the course. Therefore, the introduction of CBT at all levels was seen as a partial solution to the problem (NUFFIC, 2004). While there was only partial understanding among stakeholders of the radical changes involved in transitioning from the traditional education system to the CBT model, there was overwhelming recognition of the need for change. Flexibility and adaptability among education officials and teaching staff were noted, and it was agreed that while many stakeholders may not yet fully grasp the extent of the changes, it wouldn't pose a major obstacle to project implementation (NUFFIC, 2007).

6.0 Problem Statement

The NUFFIC Competency-Based Training project was implemented in 2005 in selected universities in Ghana. The curriculum developed during this project has been integrated into the training of Agricultural Engineering students. In January 2014, the National Board for Professional and Technician Examination (NAPTEX) issued a directive for all departments in universities to adopt the competency-based approach in training their students. Research on the effectiveness of this programme has yielded varying results. While there is no known study that has found the programme to be ineffective in imparting practical skills, Marguerite (2014) reported that it is effective. NUFFIC (2008) and Amankwah (2011) also suggested that a long-term evaluation of CBT is necessary to identify areas that may require adjustments to better meet industry needs. The skills expected by industries and those assumed to be gained from Universities seem to fall short when compared to the competencies needed for on-the-job performance (Obeng et al., 2013). A tracer study conducted by Boahin et al. (2010) found that 28% of University graduates pursue further professional training after completing their programmes. Additionally, 33% of business programme graduates, along with 25% of engineering and applied arts graduates, and 19% of science and technology graduates engage in further training. However, there has not been any known evaluation conducted to establish its effectiveness in providing students with the competencies needed by industry. It is in the light of this that, this study sought to elicit the perspectives of industry supervisors on the effectiveness of CBT in equipping students with the desired competencies.

7.0 Objectives of the Study

The study sought to:

- describe the demographic characteristics of the participating industry supervisors;
- determine students' competency levels during industrial attachment training as assessed by supervisors at the industry level;
- determine the relationship between the demographic characteristics of industry supervisors and students competency levels during industrial attachment

8.0 Methodology

This study utilised a descriptive survey methodology to examine the impact of Competency-Based Training (CBT) on the acquisition of necessary competencies by agricultural engineering students for the world of work. The choice of this methodology was influenced by limitations in other research designs, such as experimental designs requiring control and manipulation of conditions, the time and cost involved in longitudinal studies, and the limited generalisability of case studies (Bryman, 2004). Additionally, survey research is widely employed in education and various research areas due to its flexibility, efficiency, and the generalisability of results (McMillan, 2004).

The study's population comprised all supervisors in organisations who oversaw students during the industrial attachment session from July to September 2022. Industry supervisors were selected for the study because they play a crucial role in mentoring, supervising, and assessing students during the industrial attachment period. All 27 supervisors who supervised students within that period were part of the study because of their experience in mentoring students and their willingness to accept them.

The research instruments used for the study were a combination of questionnaires and interviews. This approach was chosen due to time constraints and the need to collect a substantial amount of information. The questions on supervisors' demographic characteristics and perceived competencies were developed by the researcher with input from lecturers and industry supervisors.

To ensure the validity of the questionnaire and questions, a pilot test was conducted with five industry supervisors and ten former students. A retest was also undertaken with an expert in the field of evaluation, training, development, and curriculum design to further validate the instruments. Content validity was established through expert judgment, as recommended by Gay & Airasian (2000).

The first set of data collected through questionnaires focused on supervisors' demographic characteristics, including sex, age, type of industry, work experience, and academic qualifications. Each supervisor completed a questionnaire. Industry-desired competencies were assessed using a four-point Likert-type rating scale. A mean score of 2.5 or higher indicated "competent," while a mean score below 2.5 indicated "not yet competent." These assessments by industry supervisors formed the basis for evaluating the impact of CBT on students' acquisition of desired competencies. Data was analysed using percentages, means and correlations.

9.0 Results and Discussion

9.1 Demographic Characteristics of Industry Level Supervisors

Overall, the analysis provides insights into the demographic characteristics of the respondents, including their gender, age distribution, industry type, years of experience, and educational qualifications. These characteristics offer a foundation for understanding the composition of the sample and can help inform further analysis and interpretation of the study's findings.

Majority of industry-level supervisors are male (66.7%), while only 33.3% are female. This aligns with the broader trend of a shortage of females in science-related programs nationally (Dauoda, 2006). About 80% of supervisors at the industry level are below 50 years old. Specifically, 44.4% fall within the age bracket of 41-50 years. This indicates that a significant portion of supervisors are in the mid-career stage, which may influence their approach to training.

Since the Competency-Based Training (CBT) is implemented in the agricultural engineering department, it's logical that all students in that department had their practical training in agricultural-related organizations. This ensures that students receive relevant training aligned with their field of study.

Over 90% of supervisors at the industry level have been with their organizations for more than five years. This signifies that they possess extensive experience, which can be a valuable asset for training students. Their wealth of knowledge and expertise can contribute significantly to the development of students' competencies.

More than 60% of supervisors have at least a first-degree qualification, indicating a relatively high level of formal education. However, none of them have education levels limited to basic education. This suggests that supervisors generally possess a solid educational background, which is critical for supervising competency-based training programme. It's important to note that while formal education is valuable, some competencies may require hands-on training. Therefore, a balanced approach that incorporates both theoretical and practical components may yield the best results in competency development (Rothwell, & Graber, 2016).

Table I: Demographic characteristics of industry supervisors

Characteristics	Frequency	Percent
Sex:		
Male	18	66.7
Female	9	33.3
Total	27	100
Age groups:		
20 – 30years	2	7.4
31 – 40years	11	40.7
41- 50years	12	44.4
51 – 60years	1	3.7
>60years	1	3.7
Total	27	100
Type of industry:		
Textiles	-	0
Agricultural	27	100
Mining	-	0
Construction	-	0
Others	-	0
Total	27	100
Experience:		
<3years	3	11.1
3-5years	9	33.3
6-10years	10	37.0
11-14years	2	7.4
>14years	3	11.1
Total	27	100
Qualification:		
Basic certificate	-	0
Senior high certificate	2	7.4
Diploma	7	25.9
Bachelor degree	13	48.1
Master's degree	5	18.5
Total	27	100

Source: Field Survey 2022

9.2 Students Competencies as Assessed by Industry Supervisors

The study assessed the competency levels of students based on 19 industry-desired competencies, as evaluated by industry supervisors during the students' practical training. Overall, the study underscores the effectiveness of the CBT programme in equipping students with industry-relevant competencies (Wang, 2019). It also highlights the valuable role of industry supervisors in providing authentic assessment and hands-on training. Addressing specific areas of weakness identified in the study can further enhance the competency levels of students.

Students were assessed to be competent in 15 out of the 19 industry-desired competencies, as indicated by mean scores of 2.5 and above. This demonstrates that the Competency-Based Training (CBT) programme is generally effective in equipping students with the necessary skills. The competency where students excelled the most was "possessing theoretical agricultural knowledge," with a mean score of 2.64. This suggests that students have a strong foundation in theoretical knowledge related to agriculture. The study's findings are consistent with previous research which highlighted the effectiveness of practical training in competency acquisition (Ansah & Ernest 2013 and Kirkpatrick & Kirkpatrick 2006). The competency with the lowest mean score was "ability to organise ideas clearly in an outline," which scored 2.52. This indicates an area where students may need additional support and training.

On the other hand, the study identified specific areas where students were found to be less competent. These included critical thinking skills, networking abilities, ICT proficiency, and adaptability to changes. Addressing these areas should be a priority to enhance students' overall competency.

Table II: Competencies levels as assessed by Industry supervisors

Desired competencies	N	M	SD	Decision
Problem solving skills in the world of work	27	2.56	.799	Competent
Critical thinking skills	27	2.41	.690	Not competent
Knowledge of socio-economic demands at work place	27	2.53	.689	Competent
Ability to transfer skills learnt to practical situations	27	2.53	.765	Competent
Knowledge of interpersonal skills at work place	27	2.59	.779	Competent
Self-confidence	27	2.56	.833	Competent
Ability to network in a variety of situations	27	2.45	.746	Not competent
Ability to self-reflect actions	27	2.54	.707	Competent
Knowledge of ICT skills needed for work place	27	2.34	.786	Not competent
Awareness of leadership skills needed to lead others	27	2.57	.647	Competent
Group decision making through dialogue and consensus	27	2.58	.705	Competent
Organise ideas clearly in an outline	27	2.52	.709	Competent
Ability to know and handle different sides to an issues	27	2.53	.709	Competent
Ability to work methodically	27	2.55	.688	Competent
Capacity to deal with changes outside comfort zone	27	2.44	.623	Not competent
Possesses theoretical agricultural knowledge	27	2.64	.632	Competent
Possesses practical agricultural knowledge	27	2.54	.552	Competent
Skills to work with people from diverse cultures	27	2.53	.728	Competent
Being able to handle different activities at work place	27	2.59	.690	Competent

Competent = 2.5 and above, not competent = less than 2.5, Source: Field Survey 2022

9.3 Effect of Industry Supervisors Demographic Characteristics on Students Competencies.

Table 4 shows the correlation coefficients between the demographic characteristics of industry supervisors and their assessments of students' competency levels in various areas. The correlations are computed using Pearson Product Moment Correlation (PPMC) and are significant at $p < 0.05$, indicating the strength and direction of the relationship between these variables.

The study found a positive and significant correlation between the age of industry supervisors and students' acquisition of problem-solving skills in the world of work. This suggests that supervisors' age may enhance students' competency in this area. This aligns with Almfleh's (2013) and Tams, & Schäffer, (2021) findings that trainers' years of experience positively influenced training outcomes.

Experience of industry supervisors was positively and significantly related to students' acquisition of self-confidence. This indicates that a supervisor's experience can have a substantial impact on students' development of self-confidence, which is crucial for success in the professional world. This finding is consistent with Yang, & Li, 2018; and Garland et al. (2017) research that highlighted the association between supervisors' years of experience and effective training delivery.

The study also revealed a positive and significant relationship between the age of industry supervisors and their ability to equip students with skills needed to handle various activities in the working environment. This suggests that a supervisor's age may significantly influence students' acquisition of industry-specific skills. This finding aligns with Herschell et al.'s (2010) assertion that age plays a crucial role in identifying trainers best suited for competency-based training.

Experience of industry supervisors was positively and significantly correlated with their capacity to provide students with the necessary skills for handling diverse work-related activities. This implies that experienced supervisors are more adept at imparting industry-relevant skills to students. This finding supports the idea that experience is an investment that enhances one's ability and job performance (Ismail, & Al-Kabi, (2014;Anane, 2013; and Sturman, 2003).

Table III: Industry supervisors' demographic characteristics and students acquisition of industry desired competencies

	Sex	Age	Industry	Education	Experience
Problem solving skills in the world of work	-.210	.466*	.050	.210	.236
Critical thinking skills	.036	.218	-.185	-.004	-.027
Knowledge of socio-cultural demands at work place	.139	.288	.104	-.064	.170
Ability to transfer skills to practical situations	.204	-.116	-.088	-.088	-.101
Knowledge of interpersonal skills at work place	.000	-.081	.080	.171	.131
Self-confidence	-.346	.333	.138	.132	.506**
Ability to network in a variety of situations	-.046	-.174	-.058	.092	-.154
Ability to self-reflect actions	.230	-.017	-.202	-.264	-.213
Knowledge of ICT skills needed for work place	.159	.132	-.134	.151	-.057
Awareness of leadership skills needed to lead others	.042	.063	-.135	-.229	.367
Group decision making through consensus	-.154	-.058	.004	.031	.154
Organise ideas clearly in an outline	.139	.052	-.112	.151	.111
Ability to know and handle different issues	-.071	.255	-.121	.094	.119
Ability to work methodically	.046	.174	-.157	.264	.154
Capacity to deal with changes outside comfort zone	.052	.198	-.178	.138	-.025
Possesses theoretical agricultural knowledge	-.118	.134	-.041	.203	.134
Possesses practical agricultural knowledge	.000	.000	.275	.050	.205
Skills to work with people from diverse cultures	-.038	.007	-.055	.150	.210
Able to handle different activities at work place	-.083	.510**	.117	.174	.457*

Significant @ p<0.05, Source: Field Survey 2022

10.0 Conclusion and Recommendations

10.1 Conclusion

The study provides a comprehensive overview of the demographic characteristics of industry supervisors and their impact on students' acquisition of industry desired competencies. The findings reveal valuable insights into the gender distribution, age range, industry focus, experience levels, and educational qualifications of supervisors. These characteristics play a crucial role in shaping the training and assessment of students during their practical training. The study underscores the effectiveness of the Competency-Based Training (CBT) programme in equipping students with industry-relevant competencies. Students were assessed to be competent in a majority of the industry-desired competencies, demonstrating the programme's overall success. Notably, students exhibited strong theoretical agricultural knowledge, highlighting the effectiveness of the educational approach. However, areas for improvement were identified, particularly in critical thinking skills, networking abilities, ICT proficiency, and adaptability to change. Addressing these areas should be a priority to enhance students' overall competency.

10.2 Recommendations:

- Efforts should be made to encourage and include more females in science-related programmes to help address the gender imbalance and promote diversity in supervisory roles.
- Tailored training programmes should be developed to strengthen competencies in areas where students demonstrated lower proficiency, such as critical thinking, networking, ICT skills, and adaptability.
- While formal education is important, a balanced approach that incorporates hands-on training alongside theoretical knowledge is essential for comprehensive competency development.
- Industry supervisors should be encouraged to engage in continuous professional development to stay updated with the latest industry trends and practices.
- Further research should be conducted to explore the long-term effects of Competency-Based Training on students' performance in the workforce.

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