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Original Article

### Effectiveness of Outreach Programme Strategies in Practical Skills Development among TVET Trainees in Uganda

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*Outreach program  
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Practical Skills  
Development,  
TVET Trainees,  
TVET institutions.*

Background: Most Technical and Vocational Education and Training (TVET) institutions in Uganda lack awareness regarding the necessity of outreach programmes for their long-term sustenance. Consequently, these institutions miss critical opportunities to equip learners with practical skills, connect with local markets, and promote institutional reputation. Aim: This study explored the potential of outreach programme strategies to foster industry-aligned practical skills development in Uganda. Methods: Descriptive statistics, frequency tables and plots, and independent-samples t-tests (preceded by Brown-Forsythe tests of equality of variances) were used to examine practical-skills development (items PS1-PS5) across community, school-based, and ICT-related skills outreach programmes. Results: Descriptive statistics showed that skills gained through outreach programmes most strongly complemented institutional training, while frequency tables indicated high levels of agreement that outreach improved real-world application, hands-on experience, exposure to tools and work conditions, and problem-solving. Frequency density plots revealed that these effects varied by field of study, with agricultural trainees responding more to certain items, building and construction trainees to others, and fashion/design and automotive trainees to still others. The t-test confirmed that average practical skills development increased significantly after outreach strategies were introduced, particularly for school-based programmes supporting farmers. However, ICT-related outreach had insignificant improvement. Conclusions: Outreach programmes, when properly designed, scheduled, and made mandatory, significantly enhance practical skills development in TVET institutions by complementing classroom training and providing real-world exposure. Their effectiveness differs across fields of study, with the strongest overall gains linked to structured community and school-based interventions. However, ICT-focused outreach has so far shown little measurable impact on practical skills.

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## INTRODUCTION

There is a growing body of literature that recognises the role played by outreach programs in accelerating practical skills development among TVET graduates. Scholars believe that TVET institutions take a central role in experiential learning, which shapes graduates' competence and work ethic, and is facilitated by tailoring internship placements to correspond with the curriculum and skills (Yoto et al., 2024). More evidence points to learning beyond the classroom context through outreach programs in streamlining benefits to communities through learning, employment opportunities, and skills (Ridwan et al., 2026). Sudiroh et al. (2026) added that outreach programmes aimed at enforcing alignment between a vocational school and industry enhance the relevance of vocational education by providing authentic workplace experiences and improving students' work readiness and technical competencies.

Ningsih et al. (2025) showed that outreach programmes through industrial work practice aim to equip students with real-world work experience, suggesting an expansion of practical skills. More recent evidence maintains the critical role of outreach programs in aiding curriculum synchronisation to foster graduate employability

through practical skilling. It has been previously observed that outreach programs bridge the rural-urban skill gap that exists between the various levels of learners (Srivastava et al., 2025). Extensive research has shown that industrial equipment improves learning at TVET institutions. A study by Fitriani and Jaelani (2026) confirms that providing access to industrial-standard equipment and technology during practical learning allows students to develop hands-on skills that align with industry expectations, thereby reducing the existing skills gap.

Studies that have employed models show community and industry partnerships as a strategy to address declining student interest in STEM and confront skills shortages, which includes vocational education and training (Watters & Diezmann, 2013). Likewise, Ramli et al. (2024) identify work-based learning (WBL) as an essential part of vocational education and training (VET) programs due to its positive effects on participants' lives and economies. Also, Ahmad and Mastiani (2025) point out that partnerships, specifically through curriculum synchronisation, field work practices (PKL), and competency certification, make a real contribution to improving student work readiness, which suggests expanding practical skills. Additionally, Fadholi et al. (2025) explain that the

Industrial Class Program, a collaborative endeavour between vocational schools and industry, is designed to move beyond theoretical instruction by providing direct exposure to industry practices to develop a competent workforce. Nonetheless, several studies have indicated that the outreach program involves strengthening soft skills and work character alongside hard skills in the curriculum, which is prepared jointly with business and industry to meet workforce demands (Wahjusaputri et al., 2024). Also, Muharam et al. (2025) noted that an effective integration between vocational education and industry, including co-training, is an effective strategy for bridging the gap between graduates and labour market needs.

In Indonesia, Gholibi et al. (2024) found that industry collaboration and internships are crucial for outreach programs to take place. Other forms of outreach programs highlighted by scholars were work-based learning, especially in ICT and other fields. Ogunleeye (2026) showed that work-based learning, a type of outreach, provides direct experience in real work environments, strengthening technical abilities and fostering professional competencies. In Indonesia, outreach activities are included as one of the program assessment indicators for the implementation of the Merdeka curriculum, which is designed to enhance vocational education (Yoto et al., 2024). More evidence indicates that outreach programmes are effectively achieved through partnership implementation, including orchestral and practical learning, industrial practice, and field work practice, directly addressing the question of expanding practical skills. Despite the importance of outreach programmes, most TVET institutions in Uganda do not know that they need outreach programmes for their sustenance.

Outreach programmes help equip learners with practical skills, connect them to locally untapped markets, and promote innovations for institutional reputation. Previous studies, for instance, those conducted by Somantri and Pramudita (2024), have

shown that the most strategic approach to closing the practical skills gap is to allow companies to actively participate in providing internship opportunities that allow students to acquire relevant practical skills. However, the most striking reality is that most TVET institutions have not invested in outreach programs and thus do not know how much it can impact their learning, teaching, job creation, and empowerment.

## METHODS

### Philosophical Paradigm

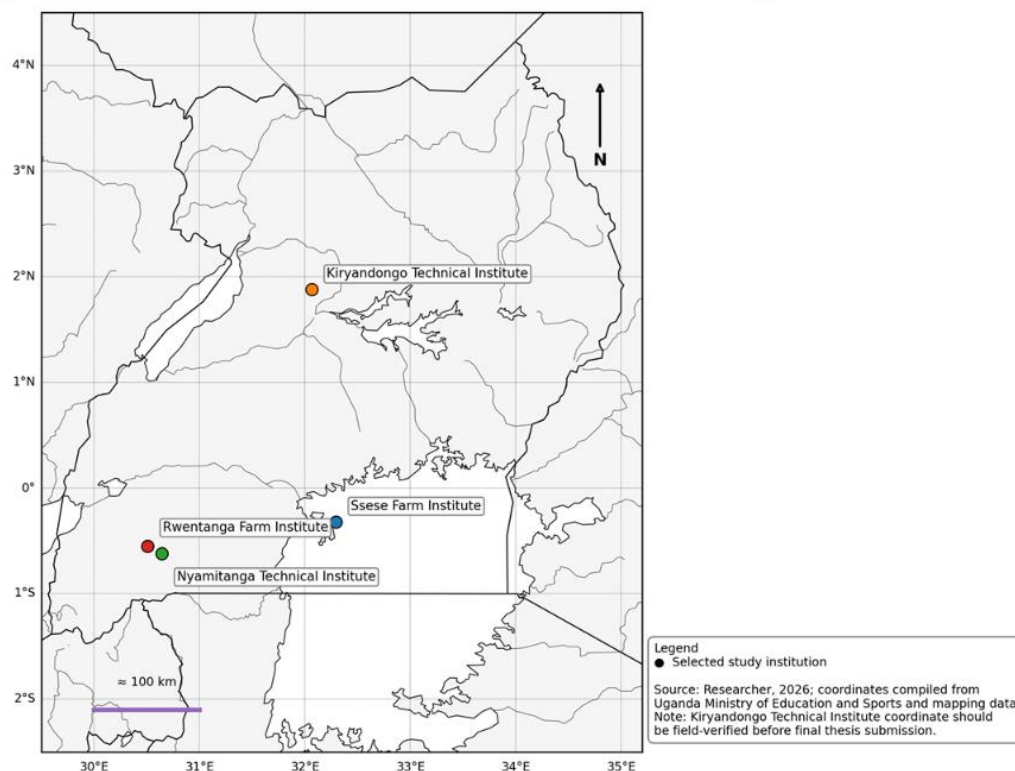
The study was guided by the pragmatic paradigm, which places practical problem-solving above the search for absolute truths (Kaushik & Walsh, 2019). It views reality as complex and multi-layered, with knowledge emerging from interactions among the researcher, participants, and the study-specific context (Rylander, 2012). This orientation made it possible to draw on diverse methods and data sources flexibly while remaining relevant to the research problem.

### Research Design

A mixed-methods approach was adopted, following a convergent parallel design (Demir & Pismek, 2018; Tomasi et al., 2018). Quantitative and qualitative data were gathered and analysed independently but concurrently, after which the findings were compared, integrated, and triangulated. The analysis drew on two related theories, the human capital and social capital theories.

### Study Area

Fieldwork took place in the Central and Western regions of Uganda and focused on four TVET institutions that had already put outreach programme strategies into practice: Nyamitanga Vocational Training Institute, Kiryandongo Vocational Training Institute, Rwetanga Farm Institute, and Ssesse Farm Institute, as seen in the map below.

**Figure 1: Map of the Study Area****Map Showing the Geographical Location of Selected Study Institutions in Uganda**

### Target Population

The study focused on people directly involved in the work of these institutions: managers and administrators, marketing and admissions staff, those handling scholarships and funding, industry partners, current students, and alumni. Institutions were eligible if they were properly registered and accredited by the Ministry of Education and Sports and UVTAB, offered recognised TVET programmes, were in the Central or Western regions, and had been running outreach activities for at least one year with some form of documentation. Learners, employers, and community members were included if they had taken part in or benefited from the outreach work and were prepared to give informed consent. This study explored three forms of outreach programmes. These were community skills outreaches, school-based outreaches, and ICT-related outreach programmes.

### Sampling Procedure and Sample Size

Managers, administrators, registrars or Directors of Studies, deputy principals responsible for academics, and heads of departments or sections were chosen purposively. Instructors were selected at random. Current students were drawn through stratified random sampling, while alumni were selected by simple random sampling. The institutions themselves were chosen through stratified random sampling that took account of location and the strength of their outreach programmes. For the quantitative strand, a sample of 269 participants was calculated using the Taro Yamane formula, based on a population of roughly 26,680 TVET graduates from the November/December 2024 examinations and a margin of error of about 6.1 percent, as seen below.

$$n = \frac{26680}{1 + 26680(0.0607^2)} \approx 269$$

The qualitative strand involved approximately five administrators selected purposively from the same groups of senior staff.

### **Study Variables**

The dependent variables were practical skills development that were employable in the TVET industry. Government policies, organisational capacity, and available resources served as intervening variables. The independent variables were the outreach program strategies categorised into community outreach, school-based outreaches, and ICT-related outreach programmes.

### **Data Collection Methods and Instruments**

Qualitative information was gathered through semi-structured interviews guided by an interview schedule and through document analysis using a simple checklist. Quantitative data were collected using an interviewer-administered questionnaire that was initially prepared in Microsoft Word and then uploaded to the Kobo Collect Toolbox platform for digital data collection. Once collected, the data were exported to Excel and imported into Stata 18.0. The qualitative tools were kept in paper form so that they could be used comfortably alongside audio recording.

### **Reliability and Validity**

A pilot survey was undertaken on a few trainees before the main data collection. Internal consistency was assessed using Cronbach's alpha, with 0.70 as the minimum acceptable level. The construct covering outreach core goals or quality of training showed the strongest reliability ( $\alpha = 0.8931$ ), followed by practical skills ( $\alpha = 0.8279$ ), equity-focused interventions ( $\alpha = 0.7437$ ), soft skills ( $\alpha = 0.6887$ ), and industry partnerships ( $\alpha = 0.6461$ ). Construct validity was examined through both convergent and divergent tests. Most items (26 out of 30, or 86.7 percent) correlated above 0.40 with their own dimensions, supporting convergent validity. Divergent validity was more moderate: 17 of the 30 items (56.7 percent) correlated more

strongly with their intended dimension than with the others. Results for reliability and validity were conducted on piloted data and are attached in the appendix/supplementary materials section.

### **Data Analysis**

The analyses address raw data exploration, descriptive statistics, frequency distributions, visual comparisons across training fields, and hypothesis testing of mean differences across categories of skills outreach programmes using a t-test. All procedures were conducted using appropriate statistical software, with significance evaluated at the conventional  $\alpha = 0.05$  level.

### **Raw Data for the Development of Practical Skills in TVET Training**

The primary data consist of responses to items measuring practical skills development (denoted PS1–PS5) collected from TVET trainees. Items PS1 to PS5 corresponded to: outreach programmes improved the ability to apply technical skills in real-world settings; outreach programmes enhanced hands-on experience relevant to the field of training; skills gained through outreach programmes complemented institutional training; outreach programmes exposed trainees to real tools, equipment, and work conditions; and outreach programmes strengthened practical problem-solving abilities, respectively. These raw scores form the basis for all subsequent analyses and were screened for completeness, coding accuracy, and outliers prior to analysis.

### **Descriptive Statistics for the Dimensions of Practical Skills Development**

Descriptive statistics were computed for each practical-skills dimension to summarise central tendency and dispersion. For a given variable  $X$ , the sample mean and sample standard deviation are given by

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i, s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}.$$

Additional measures (minimum, maximum, skewness, and kurtosis) were also examined to characterise the distributional properties of each dimension.

### Frequency Tables for All Items (PS1–PS5)

Frequency distributions were constructed for each of the five practical-skills items. For an item with  $k$  response categories, the absolute frequency  $f_j$  and relative frequency  $p_j$  of category  $j$  are

$$f_j = \text{number of observations in category } j, p_j = \frac{f_j}{n}, j = 1, \dots, k,$$

Where  $n = \sum_{j=1}^k f_j$ . Cumulative frequencies were also tabulated to facilitate interpretation of response patterns.

### Frequency Plots for All Items against the Fields Undertaken by the Trainees

Bar charts (or equivalent frequency plots) were produced to display the distribution of responses to PS1–PS5 stratified by the training field undertaken by the respondents. These visualisations allow direct comparison of response patterns across fields and highlight any systematic differences in endorsement rates.

### T-test Investigating Mean Differences in Practical Skills from Various Community Skills Outreach Programmes

An independent-samples  $t$ -test was used to examine whether mean practical-skills scores differed across categories of community skills outreach programmes. The test statistic is

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}},$$

With degrees of freedom determined under the equal-variance assumption or via the Welch approximation when variances are unequal. Prior to the  $t$ -test, homogeneity of variances was assessed with the Brown–Forsythe test:

$$F_{BF} = \frac{(N - k) \sum_{j=1}^k n_j (\bar{z}_{j.} - \bar{z}_{..})^2}{(k - 1) \sum_{j=1}^k \sum_{i=1}^{n_j} (z_{ij} - \bar{z}_{j.})^2},$$

Where  $z_{ij} = |x_{ij} - \tilde{x}_j|$  and  $\tilde{x}_j$  is the median of group  $j$ . A non-significant Brown–Forsythe result supports the use of the pooled-variance  $t$ -test; otherwise, the Welch (unequal-variance) version is reported.

### Ethical Considerations

Approval was secured from the Uganda Christian University Research Ethics Committee, the Uganda National Council for Science and Technology, the Permanent Secretary of the Ministry of Education and Sports, and the principals of the participating institutions. Every participant gave informed consent. Confidentiality and anonymity were protected by the use of pseudonyms, and the final report was shared with the institutions and stakeholders who had taken part in the study.

### RESULTS

In a bid to assess the effectiveness of the outreach programme strategy in the development of practical skills in TVET training in Uganda, this study presented the items that were used to construct the dimensions of practical skills development in Table 1. Further breakdown of the statistics for this dimension is also shown in the following Table 2, followed by the distribution of each item, tabulated by the field of the trainee study, and later on the  $t$ -test to measure if differences in the practical skills development originated from the contributions from the various outreach programs in place as follows.

**Table 1: Row Data for the Development of Practical Skills in TVET Training**

| Dimension                                                      | Factors considered                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Outreach Programme Strategies and Practical Skills Development | <p>Outreach programmes improved the ability to apply technical skills in real-world settings.</p> <p>Outreach programmes enhanced hands-on experience relevant to the field of training.</p> <p>Skills gained through outreach programmes complemented institutional training.</p> <p>Outreach programmes exposed trainees to real tools, equipment, and work conditions.</p> <p>Outreach programmes strengthened practical problem-solving abilities.</p> |

The Outreach Programme Strategies and Practical Skills Development dimension was made up of the following factors/items: outreach programmes improved the ability to apply technical skills in real-world settings; outreach programmes enhanced hands-on experience relevant to the field of training;

skills gained through outreach programmes complemented institutional training; outreach programmes exposed trainees to real tools, equipment, and work conditions; and outreach programmes strengthened practical problem-solving abilities.

**Table 2: Descriptive Statistics for the Dimensions of Practical Skills Development Dimensions**

|     | Median | Mean (arithmetic) | Std. Deviation | Skewness | Kurtosis | Minimum | Maximum |
|-----|--------|-------------------|----------------|----------|----------|---------|---------|
| ps1 | 4.000  | 4.464             | 0.5072         | 0.05677  | -1.786   | 3.000   | 5.000   |
| ps2 | 4.000  | 4.405             | 0.5838         | -0.6078  | 0.7400   | 2.000   | 5.000   |
| ps3 | 5.000  | 4.542             | 0.5568         | -0.9645  | 1.453    | 2.000   | 5.000   |
| ps4 | 4.000  | 4.430             | 0.6483         | -1.377   | 3.916    | 1.000   | 5.000   |
| ps5 | 4.000  | 4.414             | 0.6110         | -1.034   | 2.459    | 2.000   | 5.000   |

The descriptive statistics for the five items (ps1–ps5) measuring outreach programme strategies and practical skills development reveal consistently high levels of agreement, with arithmetic means ranging from 4.405 to 4.542 and medians of 4 or 5 on a 5-point scale. Standard deviations were relatively low (0.507–0.648), while skewness values were predominantly negative (except for a near-zero positive value for ps1), and response ranges were restricted mostly between 2–5 or 3–5. These patterns indicate that trainees largely agreed or strongly

agreed that outreach programmes improved their ability to apply technical skills in real-world settings, enhanced relevant hands-on experience, complemented institutional training, exposed them to real tools, equipment, and work conditions, and strengthened practical problem-solving abilities, with responses tightly clustered toward the upper end of the scale.

#### Frequencies for ps1

**Table 3: Frequencies for ps1**

| ps1     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| 3       | 1         | 0.4     | 0.4           | 0.4                |
| 4       | 140       | 52.0    | 52.8          | 53.2               |
| 5       | 124       | 46.1    | 46.8          | 100.0              |
| Missing | 4         | 1.5     |               |                    |
| Total   | 269       | 100.0   |               |                    |

For PS1, the most common score was 4, selected by 140 respondents (52.8% of valid responses), followed closely by score 5 (124 respondents, 46.8%), while score 3 was chosen by only one respondent, and scores 1 and 2 were not recorded.

**Frequencies for ps2****Table 4: Frequencies for ps2**

| ps2     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| 2       | 2         | 0.7     | 0.8           | 0.8                |
| 3       | 7         | 2.6     | 2.7           | 3.4                |
| 4       | 137       | 50.9    | 51.9          | 55.3               |
| 5       | 118       | 43.9    | 44.7          | 100.0              |
| Missing | 5         | 1.9     |               |                    |
| Total   | 269       | 100.0   |               |                    |

For ps2, the most common score was 4, selected by 137 respondents (51.9% of valid responses), followed by score 5 (118 respondents, 44.7%), while scores 2 and 3 were chosen by only a small minority (2 and 7 respondents, respectively), and score 1 was not recorded.

**Frequencies for ps3****Table 5: Frequencies for ps3**

| ps3     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| 2       | 2         | 0.7     | 0.8           | 0.8                |
| 3       | 2         | 0.7     | 0.8           | 1.5                |
| 4       | 111       | 41.3    | 42.0          | 43.6               |
| 5       | 149       | 55.4    | 56.4          | 100.0              |
| Missing | 5         | 1.9     |               |                    |
| Total   | 269       | 100.0   |               |                    |

For PS3, the most common score was 5, selected by 149 respondents (56.4% of valid responses), followed by score 4 (111 respondents, 42.0%), while scores 2 and 3 were each chosen by only two respondents, and score 1 was not recorded.

**Frequencies for ps4**

**Table 6: Frequencies for ps4**

| ps4     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| 1       | 1         | 0.4     | 0.4           | 0.4                |
| 2       | 4         | 1.5     | 1.5           | 1.9                |
| 3       | 5         | 1.9     | 1.9           | 3.8                |
| 4       | 125       | 46.5    | 47.2          | 50.9               |
| 5       | 130       | 48.3    | 49.1          | 100.0              |
| Missing | 4         | 1.5     |               |                    |
| Total   | 269       | 100.0   |               |                    |

For ps4, the most common score was 5, selected by 130 respondents (49.1% of valid responses), followed closely by score 4 (125 respondents, 47.2%), while scores 1, 2, and 3 were chosen by

only a small minority (1, 4, and 5 respondents, respectively).

#### **Frequencies for ps5**

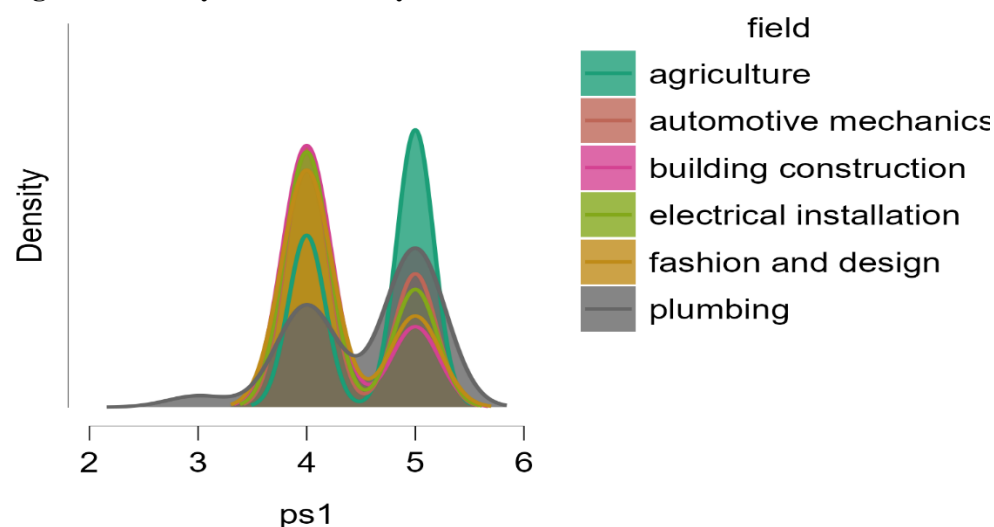
**Table 7: Frequencies for ps5**

| ps5     | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------|-----------|---------|---------------|--------------------|
| 2       | 5         | 1.9     | 1.9           | 1.9                |
| 3       | 2         | 0.7     | 0.8           | 2.7                |
| 4       | 135       | 50.2    | 51.3          | 54.0               |
| 5       | 121       | 45.0    | 46.0          | 100.0              |
| Missing | 6         | 2.2     |               |                    |
| Total   | 269       | 100.0   |               |                    |

Across the five items measuring practical skills development, the most common scores were as follows: for ps1 the modal score was 4 (52.8% of valid responses), for ps2 the modal score was also 4 (51.9%), for ps3 the modal score was 5 (56.4%), for ps4 the modal score was 5 (49.1%), and for ps5 the

modal score was 4 (51.3%), indicating that respondents predominantly selected the higher agreement options of 4 or 5 on the scale.

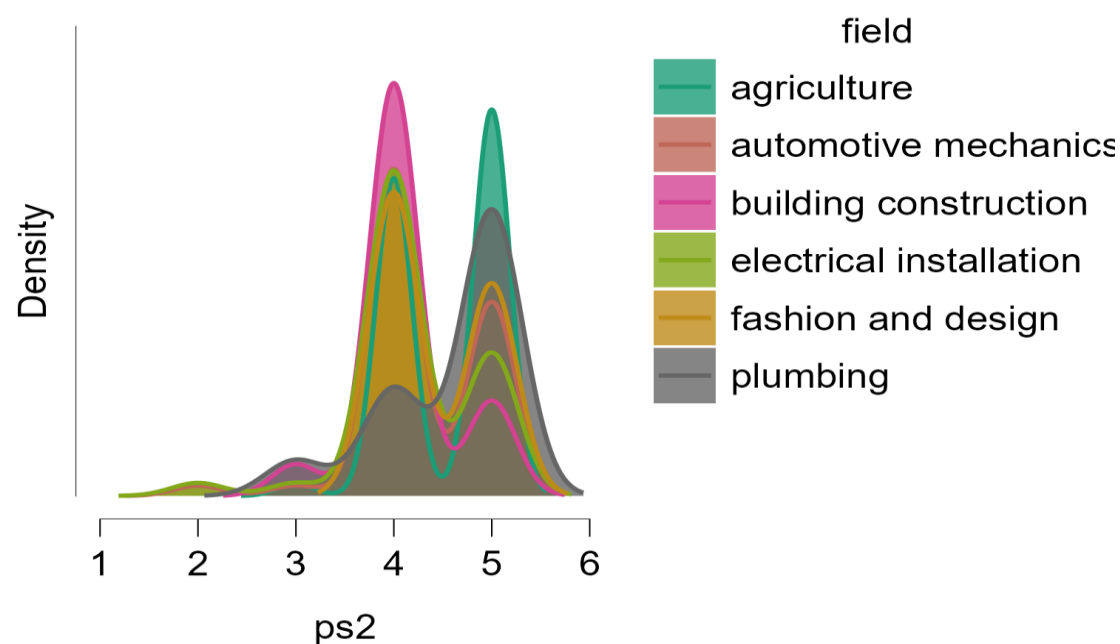
#### **Frequency Plot Showing the distribution of PS1 by Field of Study**

**Figure 2: PS1 by Fields of Study**

Based on the density plot for ps1, high scores, particularly the strong peak at 5, were most common among trainees in the agriculture field, which shows the tallest and sharpest density concentration at the highest rating, while other programmes such as fashion and design, building construction, electrical installation and plumbing displayed their main

peaks more around score 4, with relatively lower or more spread-out densities at 5. This implied that agricultural, fashion and design skills taught simulated technical skills in a real-world setting.

#### **Frequency Plot Showing the Distribution of PS2 by Field of Study**

**Figure 3: PS2 by Fields of Study**

Based on the density plot for PS2, high scores were most common among trainees in building

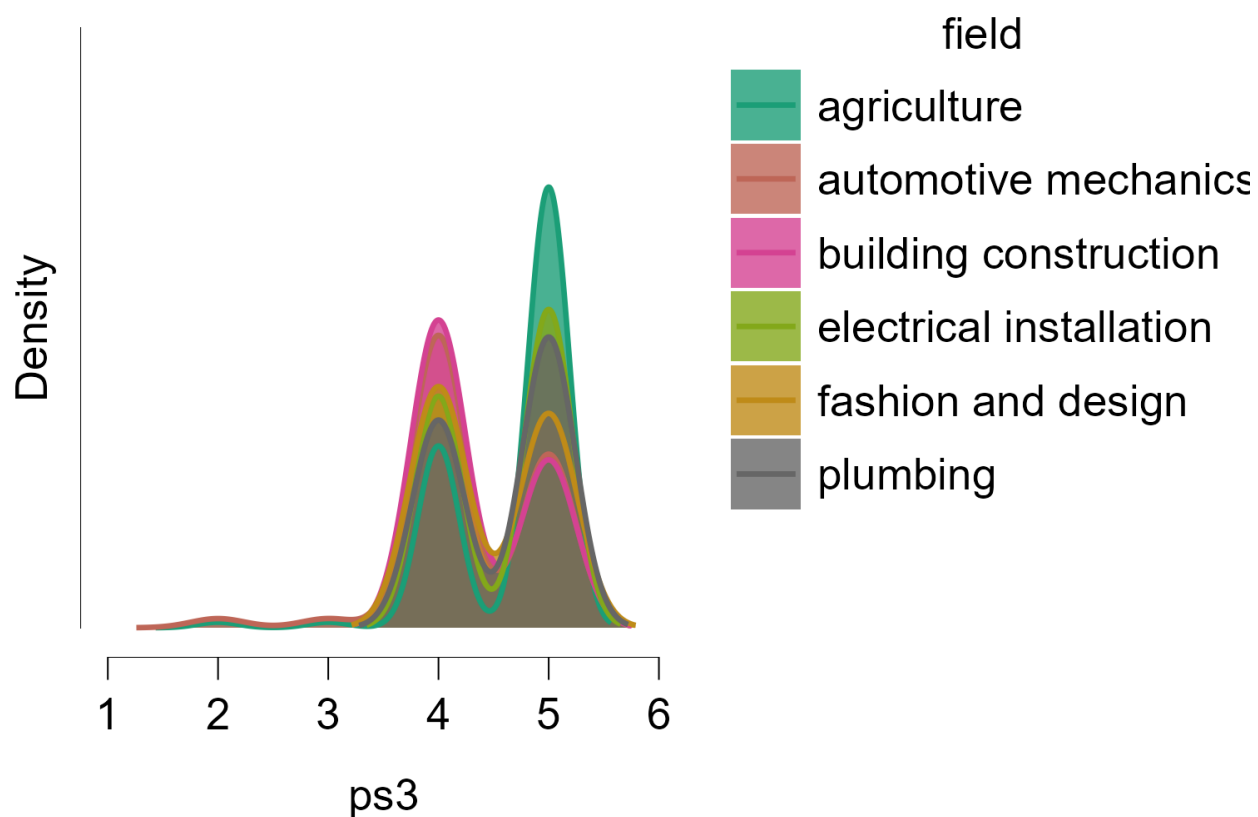
construction, which shows the tallest and sharpest peak at score 4, while agriculture displays a strong

peak at score 5, and other fields such as fashion and design, electrical installation, and plumbing show moderate concentrations mainly around scores 4 and 5. Outreach programmes enhanced hands-on

experience relevant to the field of training, especially in the building and construction fields.

#### Frequency Plot Showing the Distribution of PS3 by Field of Study

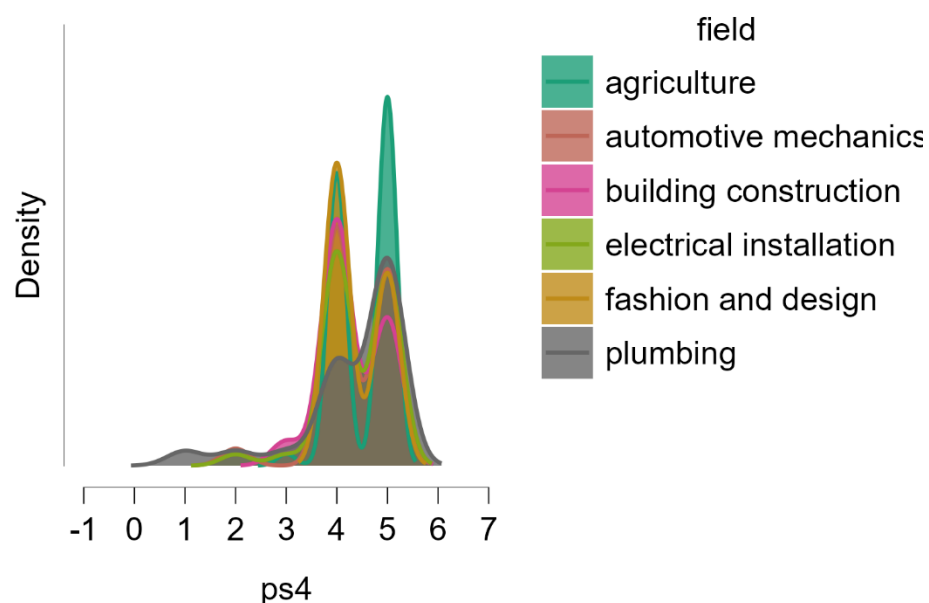
**Figure 1: PS3 by Field of Study**



In the density plot for PS3, trainees in agriculture stand out with the highest concentration of responses at score 5, reflected in the tallest peak on the right side of the distribution. Other fields such as electrical installation, plumbing, and fashion and design also show notable density at 5, while building construction has a clearer peak at score 4, indicating that the strongest endorsement of this

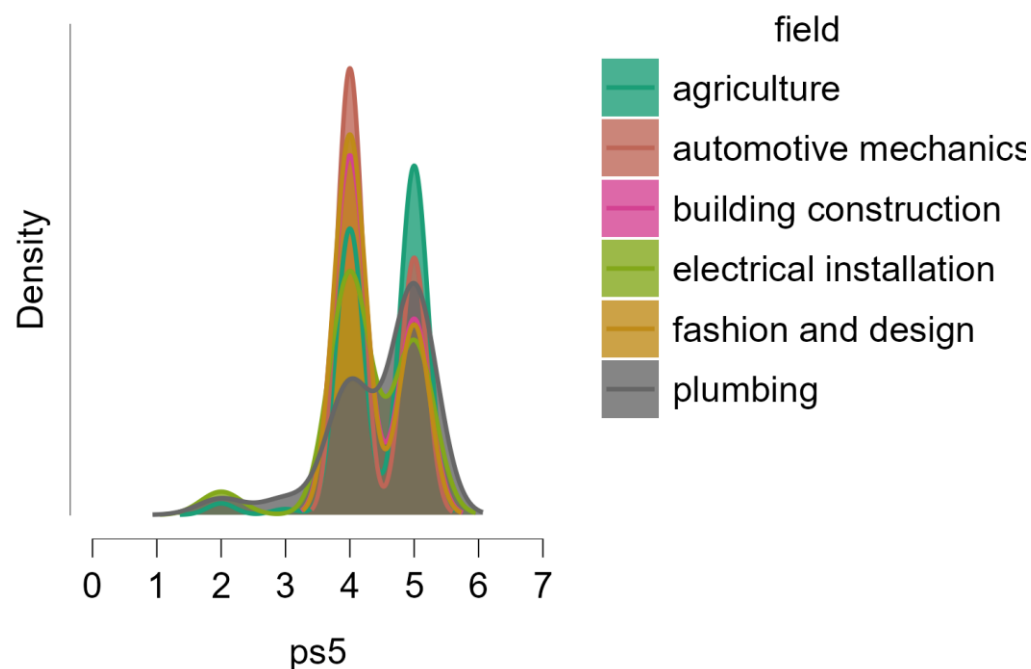
item was concentrated in the agriculture programme. Skills gained through outreach programmes complemented institutional training in agricultural field activities.

#### Frequency Plot Showing the Distribution of PS4 by Field of Study

**Figure 5: PS4 by Field of Study**

Looking at the density plot for PS4, the agriculture field displays the highest peak at score 5, showing the highest density of strong agreement. Fashion and design, by contrast, concentrates more heavily around score 4, while building construction, electrical installation, and plumbing show moderate

densities at both 4 and 5, with responses remaining overall clustered toward the upper end of the scale. Outreach programmes exposed trainees to real tools, equipment, and work conditions more in the agricultural field than in any other field.

**Figure 6: PS5 by Field of Study**

The density plot for PS5 shows that responses were most heavily concentrated at score 4 among trainees in automotive mechanics, which has the tallest peak in that region. Agriculture, by comparison, registers a clearer peak at score 5, while the remaining fields of building construction, electrical installation, fashion and design, and plumbing display moderate densities mainly around score 4, with smaller

secondary peaks at 5. Most of the trainees in automotive mechanics and fashion and design hailed outreach programmes in strengthening practical problem-solving abilities.

### Investigating Whether There are Mean Differences in Practical Skills from Various Community Skills Outreach Programs

**Table 8: T-test for Mean Practical Skills by Community Skills Outreach Programs**

|            | t      | df  | p                   | Cohen's d | SE Cohen's d |
|------------|--------|-----|---------------------|-----------|--------------|
| <b>ps1</b> | -7.378 | 262 | < .001              | -0.9089   | 0.1357       |
| <b>ps2</b> | -3.859 | 261 | < .001              | -0.4763   | 0.1270       |
| <b>ps3</b> | -6.160 | 261 | < .001 <sup>a</sup> | -0.7604   | 0.1324       |
| <b>ps4</b> | -5.515 | 262 | < .001              | -0.6793   | 0.1303       |
| <b>ps5</b> | -5.538 | 260 | < .001 <sup>a</sup> | -0.6848   | 0.1310       |

*Note.* Student's t-test.

<sup>a</sup> Brown-Forsythe test is significant ( $p < .05$ ), suggesting a violation of the equal variance assumption

The independent samples t-test results show statistically significant mean differences on all five practical skills items (ps1–ps5) at  $p < .001$ . The negative t-values and negative Cohen's d effect sizes indicate that one group scored consistently higher than the other across the items. Effect sizes range from medium (ps2,  $d = -0.476$ ) to large (ps1,  $d = -0.909$ ), with the remaining items (ps3–ps5) also showing medium-to-large effects. For ps3 and ps5, the Brown-Forsythe test indicated a violation of the equal-variance assumption, yet the differences remained highly significant. Therefore, the results confirm that mean levels of perceived practical skills development through outreach programmes differ meaningfully across community skills outreach programmes.

The administrators explained that outreach activities were deliberately incorporated into the

training programme to expose trainees to real working environments. Rather than limiting practical learning to institutional workshops or demonstration facilities, trainees were routinely taken into communities to work directly with farmers and other professionals. One administrator described the arrangement as follows:

*"We take students outside the institution to work directly with farmers. It is actually timetabled; every Tuesday and Thursday, students spend half a day working on farms where they apply what they have learnt. For diploma students, we also take them to abattoirs and to work with veterinary officers and district extension workers. They participate in activities such as vaccinations, meat inspection, and coffee farm management." (Farm Institute Trainer1)*

**Table 9: Test of Equality of Variances (Brown-Forsythe)**

| <b>Test of Equality of Variances (Brown-Forsythe)</b> |        |                 |                 |      |
|-------------------------------------------------------|--------|-----------------|-----------------|------|
|                                                       | F      | df <sub>1</sub> | df <sub>2</sub> | p    |
| <b>ps1</b>                                            | 1.810  | 1               | 262             | .180 |
| <b>ps2</b>                                            | 2.009  | 1               | 261             | .158 |
| <b>ps3</b>                                            | 5.484  | 1               | 261             | .020 |
| <b>ps4</b>                                            | 0.4144 | 1               | 262             | .520 |
| <b>ps5</b>                                            | 4.124  | 1               | 260             | .043 |

The Brown-Forsythe test of equality of variances shows that the assumption of equal variances was met for ps1 ( $F = 1.810$ ,  $p = .180$ ), ps2 ( $F = 2.009$ ,  $p = .158$ ), and ps4 ( $F = 0.414$ ,  $p = .520$ ). However, the test was significant for ps3 ( $F = 5.484$ ,  $p = .020$ ) and ps5 ( $F = 4.124$ ,  $p = .043$ ), indicating a violation of the equal-variance assumption for these two items. These results confirm the footnotes in the

independent samples t-test and support the use of adjusted procedures where necessary for ps3 and ps5.

#### **Investigating Whether There are Mean Differences in Practical Skills from Various School-Based Skills Outreach Programs**

**Table 10: Independent Samples T-Test**

| <b>Independent Samples T-Test</b> |        |     |                     |           |              |
|-----------------------------------|--------|-----|---------------------|-----------|--------------|
|                                   | t      | df  | p                   | Cohen's d | SE Cohen's d |
| <b>ps1</b>                        | -7.208 | 262 | < .001              | -0.8904   | 0.1343       |
| <b>ps2</b>                        | -3.064 | 261 | .002                | -0.3791   | 0.1257       |
| <b>ps3</b>                        | -5.030 | 261 | < .001 <sup>a</sup> | -0.6223   | 0.1291       |
| <b>ps4</b>                        | -4.215 | 262 | < .001              | -0.5207   | 0.1273       |
| <b>ps5</b>                        | -4.081 | 260 | < .001 <sup>a</sup> | -0.5060   | 0.1276       |

**Note.** Student's t-test.

<sup>a</sup> Brown-Forsythe test is significant ( $p < .05$ ), suggesting a violation of the equal variance assumption

The independent samples t-test results show statistically significant mean differences on all five practical skills items (ps1–ps5), with p-values ranging from < .001 to .002. The negative t-values and negative Cohen's d effect sizes indicate that one group scored consistently higher than the other across the items. Effect sizes range from medium (ps2,  $d = -0.379$ ) to large (ps1,  $d = -0.890$ ), with the remaining items (ps3–ps5) also showing medium-to-large effects. For ps3 and ps5, the Brown-Forsythe test indicated a violation of the equal-variance assumption, yet the differences remained highly significant. Therefore, the results confirm that mean levels of perceived practical skills

development through outreach programmes differ across school-based outreach programmes.

Administrators further indicated that participation was not voluntary because outreach constituted part of the formal academic programme. Its inclusion in assessment encouraged trainees to participate consistently despite some initial resistance to field-based activities. One administrator explained:

*“Participation is mandatory for all trainees because it is part of their academic requirements. It is treated as a full paper, so if a student does not participate, they have to retake it. Some students initially think the activities are demanding, but later they*

*appreciate them because they realise that they are gaining practical skills and getting exposure to how real farms operate.”*

**Table 11: Test of Equality of Variances (Brown-Forsythe)**

| Test of Equality of Variances (Brown-Forsythe) |        |                 |                 |      |
|------------------------------------------------|--------|-----------------|-----------------|------|
|                                                | F      | df <sub>1</sub> | df <sub>2</sub> | p    |
| ps1                                            | 0.5196 | 1               | 262             | .472 |
| ps2                                            | 1.853  | 1               | 261             | .175 |
| ps3                                            | 6.685  | 1               | 261             | .010 |
| ps4                                            | 0.1121 | 1               | 262             | .738 |
| ps5                                            | 4.173  | 1               | 260             | .042 |

Results from the Brown-Forsythe procedure indicate that equal variances can be assumed for ps1 ( $F = 0.520$ ,  $p = .472$ ), ps2 ( $F = 1.853$ ,  $p = .175$ ), and ps4 ( $F = 0.112$ ,  $p = .738$ ). In contrast, significant results for ps3 ( $F = 6.685$ ,  $p = .010$ ) and ps5 ( $F = 4.173$ ,  $p = .042$ ) show that the homogeneity of variance assumption was not met for these two

items, consistent with the notes attached to the corresponding t-tests.

#### **Investigating Whether There are Mean Differences in Practical Skills from Various ICT-Related Skills Outreach Programs**

**Table 12: Independent Samples T-Test**

| Independent Samples T-Test |         |     |      |           |              |
|----------------------------|---------|-----|------|-----------|--------------|
|                            | t       | df  | p    | Cohen's d | SE Cohen's d |
| ps1                        | -0.8762 | 262 | .382 | -0.2825   | 0.3226       |
| ps2                        | -1.646  | 261 | .101 | -0.5305   | 0.3233       |
| ps3                        | -0.3471 | 261 | .729 | -0.1119   | 0.3225       |
| ps4                        | -1.327  | 262 | .186 | -0.4277   | 0.3230       |
| ps5                        | 0.5913  | 260 | .555 | 0.1907    | 0.3226       |

**Note. Student's t-test.**

The independent samples t-test conducted for the ICT-related skills outreach programmes revealed no significant mean differences on any of the five practical skills items. All p-values exceeded the conventional .05 threshold (ranging from .101 to .729), indicating that the observed differences could reasonably be attributed to chance. Although

Cohen's d values varied in both size and direction, none of the contrasts reached significance. These findings suggest that trainees' perceptions of practical skills development did not differ meaningfully across the ICT-related outreach programmes under comparison.

**Table 13: Test of Equality of Variances (Brown-Forsythe)**

| <b>Test of Equality of Variances (Brown-Forsythe)</b> |        |                 |                 |      |
|-------------------------------------------------------|--------|-----------------|-----------------|------|
|                                                       | F      | df <sub>1</sub> | df <sub>2</sub> | p    |
| <b>ps1</b>                                            | 0.1602 | 1               | 262             | .689 |
| <b>ps2</b>                                            | 1.152  | 1               | 261             | .284 |
| <b>ps3</b>                                            | 0.1205 | 1               | 261             | .729 |
| <b>ps4</b>                                            | 1.886  | 1               | 262             | .171 |
| <b>ps5</b>                                            | 1.395  | 1               | 260             | .239 |

The Brown-Forsythe tests for the ICT-related comparison show that the assumption of equal variances is held for every item. None of the p-values reached significance (all > .17), ranging from .171 for ps4 to .729 for ps3. Consequently, the standard Student's t-test results reported earlier can be interpreted without concern about unequal group variances.

## CONCLUSIONS

To assess whether outreach programmes were tailored to practical skills development, the following items were utilised: outreach programmes improved the ability to apply technical skills in real-world settings; outreach programmes enhanced hands-on experience relevant to the field of training; skills gained through outreach programmes complemented institutional training; outreach programmes exposed trainees to real tools, equipment, and work conditions; and outreach programmes strengthened practical problem-solving abilities. Among these, descriptive statistics revealed that item "skills gained through outreach programmes complemented institutional training" was the most reported and offered a more influential contribution to skills development. Also, the frequency distribution tables showed that most respondents highly agreed and strongly agreed with factors designed to represent items for how outreach programmes impact skills development. Frequency density plots showed that practical skills development varied by field of study. Practical skills development 1 and 3 were more responsive among agricultural trainees; PS2 was more common among trainees in building and construction.

Practical skills development 4 and 5 were more sensitive to responses from trainees in fashion and design and automotive mechanics. This is evidence that learners in different fields had varying degrees of understanding of the impact of TVET outreach programmes on practical skills development.

Results from the T-test confirmed that the average levels of perceived practical skills development through outreach programmes differed significantly across community skills outreach programmes. In other words, after the introduction of outreach programme strategies, their effect on skills development significantly increased. This was affirmed by evidence from one of the administrators of the farm institutes, who indicated that outreach programmes in their institution are timetabled in their daily activities. The learners were aware of the work schedules for outreach programmes of visiting farmer farms and gardens every Tuesday and Thursday of every week. Also, results from the t-test outputs revealed that school-based outreaches, which are formally designed to equip visiting farmers with knowledge on how to keep their animals healthy and farms profitable in a bid to promote farmer productivity, were statistically significant. In other words, the findings indicated that all forms of practical skills development were enhanced by outreach programme interventions at the various institutes. This was backed by the qualitative verbatim that seemed to show that outreach programmes were made mandatory and each student was to be obliged to learn and stay updated about the issues pressing the farmers and the communities. Regarding ICT-related outreach programmes, the t-test showed that the mean

practical skills remained unfazed despite various attempts to empower online teaching.

## DISCUSSION OF FINDINGS

All construct items perfectly measured practical skills outreach programmes, with a consensus centring around a 4- and 5-point scale. The third construct, reading skills gained through outreach programmes complemented by institutional training, was rated highest at 56.4%. Secondly, outreach programmes that strengthened practical problem-solving abilities were rated second at 56.2%. Thirdly, the most profound contribution of the outreach programme was improving the ability to apply technical skills in real-world settings (52.8%). This was followed by the statement that the outreach programme impact was enhancing hands-on experience relevant to the field of training (51.9% of the participants). Lastly, outreach programmes exposing trainees to real tools, equipment, and work conditions had 49.1%.

This implied that agricultural, fashion, and design skills taught simulated the technical skills in a real-world setting. These outreach programmes enhanced hands-on experience relevant to the field of training, especially in the building and construction fields. Moreover, the skills gained through outreach programmes complemented institutional training in agricultural field activities. Likewise, outreach programmes exposed trainees to real tools, equipment, and work conditions more in the agricultural field than in any other field. Lastly, most of the trainees in automotive mechanics and fashion and design hailed outreach programmes for strengthening practical problem-solving abilities.

Regarding the outreach programme strategies, three of them were evaluated. These are community skills outreach, school-based, and ICT-related outreach programmes. Without a doubt, the community-based outreach was seen to enhance practical skills development. This is in line with findings from other studies. For example, Frimpong et al. (2025) revealed that students who participated in a

community-based experiential learning program acquired problem-solving, critical thinking, and interdisciplinary knowledge skills. A similar study by Phinla (2024) demonstrated the effectiveness of community-driven methods in enhancing student engagement and skill development. Also, Alarabi et al. (2025) confirmed the significant role of community engagement in sharpening problem-solving and teamwork skills for both pre-service and in-service teachers. Previous studies have shown that school-based outreach is vital in creating student self-awareness, social awareness, self-management, responsible decision-making, and relationship skills (Clerke, 2013). This is supported by Lonsdale and Anderson (2012), who suggested that school-community outreach collaborations show intellectual benefits related to the development of improved or new knowledge and skills.

## POLICY IMPLICATIONS

Mandate and formalise outreach as a core, compulsory component of TVET curricula. The government should, through the TVET Council, revise the TVET policy to make it mandatory for most or all public (and preferably private) TVET institutions to schedule outreach programmes as regular, assessed activities rather than optional extras. Embed them in institutional calendars and student assessment so that participation becomes obligatory, as already practised successfully in some farm institutes.

Provide dedicated, sustained funding and logistical support. Allocate budget lines for transport, tools/equipment for field use, facilitator allowances, community liaison, and materials. Without this, compulsory programmes risk becoming tokenistic. Support should prioritise high-impact, non-ICT models that the data show move practical skills (farm/garden visits, school-based farmer training, construction-site or workshop attachments, etc.).

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