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Improving Youth Competence Through Lightweight Steel Roof Truss Training

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Abstract

The Youth Working Group of Simpang Anduring, Padang, had experience in general building work but lacked structured instruction, specialised tools, and confidence in lightweight steel roof truss installation. This community engagement program aimed to strengthen participants' basic knowledge, supervised tool-use ability, installation skills, and work readiness. Twenty youth construction workers participated in a three-day practice-based program on 10–12 October 2025. The stages comprised partner needs assessment, technical briefing, material and tool introduction, supervised installation, and competency evaluation using a knowledge test and field-performance checklist. The verified field evaluation showed 100% participation, 85% achievement in component identification, 80% in supervised tool operation, 70% in truss and batten installation, and 90% in teamwork and basic safety. These results indicate that direct practice and immediate corrective mentoring improved technical awareness and confidence, although installation practice remained the weakest indicator because it required integrated measurement, alignment, fastening, and bracing skills. The program also expanded the group's readiness to undertake small-scale roof work. Future implementation should use a validated pre-test and post-test, longer practice time, competency-based rubrics, and follow-up monitoring of employment outcomes.

Keywords: community engagement, construction training, lightweight steel, roof truss, youth competence

1. Introduction

The Youth Working Group of Simpang Anduring is a community-based group of young workers who support small residential and neighbourhood construction activities in Kuranji District, Padang City. Initial observation and discussion with the group indicated that most participants were familiar with general building tasks, but none had received structured training specifically on lightweight steel roof truss installation. Their limited access to cutting, drilling, and fastening equipment also restricted opportunities for repeated practice and reduced their confidence to accept roof-truss work independently.

The partner assessment identified four immediate needs: understanding the function and sequence of lightweight steel components, safe operation of specialised tools, supervised practice in measurement and assembly, and a simple competency evaluation. These needs were more urgent than advanced structural design instruction because the participants' principal gap concerned field execution and work readiness. Lightweight steel installation requires consistent measurement, cutting, fastening, alignment, bracing, and anchorage; deficiencies in these tasks can reduce installation quality and safety [1]–[5].

Previous community programs have shown that construction-skills training is most useful when technical explanation is integrated with direct practice, mentoring, and access to tools [6], [7]. Community-based vocational learning also becomes more relevant when training tasks reflect real work situations and local employment opportunities [8]. Accordingly, this program aimed to improve the partner group's basic knowledge, supervised tool-use ability, installation skills, teamwork, safety awareness, and readiness for small-scale lightweight steel roof work. The article contributes a concise practice-based training model and an indicator-level interpretation of participant achievement.

2. Methods

The program was implemented at the partner's construction site from 10 to 12 October 2025 and involved 20 youth construction workers. The intervention used a participatory, practice-based approach. The needs assessment drew on site observation, a group interview with partner representatives, and an initial diagnostic discussion covering participants' work experience, prior

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exposure to lightweight steel, access to equipment, and perceived training needs. The source files did not contain a complete demographic dataset; therefore, age, education, and length-of-service distributions must be added from the original attendance or interview records before final submission.

The needs assessment identified four priority areas. Participants had general building-work exposure, but detailed age, education, and experience data require verification from original records. They had no structured lightweight-steel training, limited access to specialised equipment, low confidence in accepting roof-truss work independently, and uneven awareness of alignment, fastening, bracing, and safe tool use. The program therefore combined component and sequence briefing, tool facilitation, guided field practice, and immediate correction using a performance checklist.

2.1 Program stages

The program consisted of five stages. First, the team mapped partner problems and training needs through observation and discussion. Second, the team prepared the schedule, materials, equipment, and safety arrangements. Third, participants received a technical briefing on components, work sequence, quality points, and safe tool use. Fourth, participants practised measuring, marking, cutting, drilling, fastening, assembling truss members, and installing battens under direct supervision. Fifth, the team evaluated knowledge and field performance, discussed errors with participants, and agreed on a sustainability plan based on tool maintenance, peer learning, and continued practice.

2.2 Training materials, equipment, and evaluation

Training materials included C75.75 lip-channel profiles, top-hat battens, valley gutters, screws, and dynabolts. Practice used steel-cutting machines, steel shears, hand drills, grinders, measuring tapes, squares, water levels, drill bits, and marking tools. Evaluation combined a ten-item knowledge test and an observation checklist covering component identification, tool operation, cutting and fastening, installation, teamwork, and basic safety. Each field indicator was rated as achieved when a participant or working subgroup completed the task under supervision with acceptable accuracy and safe work behaviour. The manuscript source contains only the final observation percentages; verified individual pre-test and post-test scores were not provided. Accordingly, the quantitative gain table below is retained as an author-completion field rather than populated with invented data.

3. Results and Discussions

3.1 Technical socialization and participant involvement

The first day combined technical socialisation with diagnostic questioning. Participants were most engaged when examples were linked to recurring field problems, particularly profile selection, screw fastening, cutting accuracy, and tool safety. The discussion confirmed that the group required practical explanations rather than extensive structural-design theory. Figure 1 documents the on-site socialisation and partner involvement.

Figure 1. Installation socialization activity

3.2 Material and equipment introduction

The second day focused on recognising materials and operating tools. Participants learned the functions of lip-channel profiles, top-hat battens, screws, and anchors, followed by supervised cutting and drilling. The 85% component-identification and 80% tool-operation achievements indicate that demonstration followed by immediate practice was effective for discrete tasks. Similar community construction programs report that tool familiarisation and repeated guided practice are central to reducing uncertainty among novice workers [6], [7]. Figure 2 shows the material and tool-use activities.

Figure 2. Tools and cutting practice.

3.3 Field implementation and evaluation results

The third day integrated measurement, placement, assembly, screw fastening, alignment, bracing, and batten installation. Errors were corrected immediately to prevent unsafe habits from becoming established. Installation practice produced the lowest achievement rate (70%) because it required participants to coordinate several skills rather than perform a single isolated task. This finding supports a staged training design in which component knowledge and tool handling precede full assembly. Figure 3 shows the supervised field installation.

Figure 3. Field roof truss installation.

Participant performance improved across all observed indicators, but the level of achievement differed by task complexity. The results in Table 2 show that participation and basic safety-related teamwork were stronger than integrated installation practice. This pattern suggests that short-duration training can rapidly improve awareness and supervised tool familiarity, whereas competent installation requires more repetition and coordination of several technical actions.

Table 2. Field-performance evaluation results

Evaluation aspect	Indicator	Participants achieving target	Achievement
Attendance and participation	Completion of three-day activity	20 of 20	100%
Component knowledge	Identification of profiles, battens, screws, and anchors	17 of 20	85%
Tool operation	Safe use of cutting and fastening tools under supervision	16 of 20	80%
Installation practice	Participation in truss assembly and batten installation	14 of 20	70%
Teamwork and safety	Cooperation and use of basic safety procedures	18 of 20	90%

Pre-test and post-test completion field: the authors should report the verified mean scores for component knowledge, tool and safety knowledge, installation sequence, quality-control awareness, and the overall score, followed by the absolute and percentage gain. The uploaded source did not contain these individual scores, so values were not invented.

3.4 Program impact, limitations, and sustainability

The clearest immediate impact was increased readiness to participate in lightweight steel work under supervision. Participants could identify major components, handle specialised tools more confidently, and recognise the importance of alignment, bracing, fastening quality, and basic safety. The difference between the 90% teamwork-and-safety result and the 70% installation result shows that behavioural routines can be adopted relatively quickly, while integrated technical competence needs longer practice and individual assessment.

The employment effect should be interpreted cautiously. The program did not directly measure income or job placement; therefore, its verified contribution is improved work readiness and a stronger basis for accepting small-scale assignments. Comparable lightweight steel training has been linked to new work opportunities when training is connected to public works, applicators, or continuing project pipelines [7]. Community-based vocational models likewise emphasise alignment between training tasks and real employment demand [8], [9]. For Simpang Anduring, sustainability depends on maintaining the tools, organising peer practice, documenting completed work, and building links with contractors or neighbourhood housing projects.

The principal limitation is incomplete baseline measurement. The available manuscript records final observation percentages but not individual pre-test and post-test scores or complete participant demographics. Consequently, causal claims about competency gain cannot yet be made quantitatively. Before resubmission, the authors should enter verified scores from original sheets, calculate mean gain and percentage improvement, and report participant age, education, construction experience, and prior lightweight steel exposure. Future programs should also use longer practice sessions, individual competency rubrics, installation-accuracy measurements, and three- to six-month monitoring of employment outcomes.

4. Conclusions

This community engagement program strengthened the practical readiness of 20 members of the Youth Working Group of Simpang Anduring for lightweight steel roof truss work. The strongest results were activity completion (100%), teamwork and basic safety (90%), component identification (85%), and supervised tool use (80%), while integrated truss and batten installation achieved 70% and therefore requires additional practice. The program's main contribution was a field-based training sequence that linked partner needs assessment, technical briefing, tool facilitation, supervised installation, immediate correction, and simple competency evaluation. The verified impact is improved technical awareness, confidence, and readiness for supervised small-scale work; claims regarding income or employment should await follow-up evidence. Future training should include validated pre-test and post-test instruments, complete participant profiles, longer individual practice, competency-based quality checklists, and post-training monitoring of job participation.

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Author Contributions Statement

Kharisma Permata Sari contributed to conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, and writing-review and editing. Mediana Desfita contributed to conceptualization, methodology, validation, investigation, data curation, and writing-review and editing. Akbar Alfa contributed to methodology, validation, investigation, resources, and writing-review and editing. The detailed CRediT matrix is presented in Table 3.

Table 3. Author contributions

Name of Author	C	M	So	Va	Fo	I	R	D	W
Kharisma Permata Sari	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mediana Desfita	✓	✓		✓		✓		✓	✓
Akbar Alfa		✓		✓		✓	✓		✓

Conflict of Interest Statement

Authors state no conflict of interest.

Informed Consent

Informed consent was obtained from individuals involved in the documentation of this community engagement activity.

Ethical Approval

This community engagement activity complied with institutional policies for community service implementation and did not involve medical intervention or animal subjects.

Data Availability

The field observation checklist, attendance record, training documentation, and evaluation data supporting this community engagement article are available from the corresponding author upon reasonable request. Participant-identifying information is not publicly available to protect privacy.

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