

# Peer-Assisted Learning as a Strategy to Improve Motor Controls Laboratory Competence in Technical-Vocational Education: An Action Research Study

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**ABSTRACT:** This action research aimed at improving the third year Electrical technology students in motor control activities through incorporation of peer assisted learning system that is the buddy-buddy learning system. Technical education involves some laboratory work, which is a mandatory aspect, and most of the students are unable to show the confidence and self-reliance in the laboratory workplace. In response to this, the students who had excelled in their performance were paired with other students so as to serve as peer tutors when practical lessons about start-stop, forward-reverse, and wye-delta motor control circuits were taking place. It was based on the action research plan, act, observe, and reflect to conduct the research on 62 students. The data was collected using performance rubrics, attendance records, surveys, and reflection forms. Results showed that laboratory performance had improved greatly and increased to 90 percent with increase in confidence, attendance, and engagement. Peer tutors also got prepared better on concepts and became leaders. In conclusion, the buddy-buddy system was observed to be effective in enhancing the learning, motivation, and cooperation in the laboratory.

**KEYWORDS:** peer-assisted learning, technical-vocational education and training, motor controls laboratory, learning-by-teaching, EDCOM II

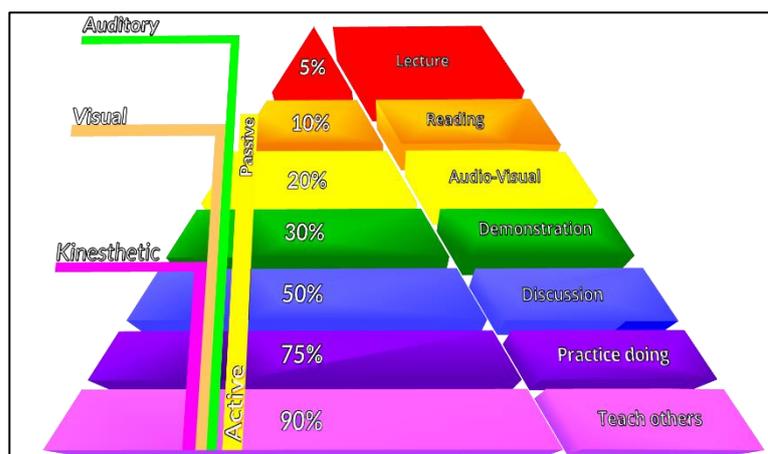
## I. INTRODUCTION

Laboratory learning is not a complete part of technical education as it enables a student to apply theoretical knowledge practically. The skill in the installation and troubleshooting of motors are also desirable skills among electrical technology students of a State University in the Philippines that reflect the skills and knowledge they ought to possess in the industry workplaces. Indeed, the learnings will enable them to qualify through the National Certification III in Electrical Installation and Maintenance (NC III-EIM). However, in most cases, teachers tend to observe a difference in the level of confidence, interest, and performance of the students, particularly in case of working independently at the laboratories. To address these gaps, structured peer-assisted learning (PAL) strategy was employed in this research, and it is generally known locally as the buddy-buddy system to improve student confidence, cooperation, and their performance. The aim of the research was to evaluate the capability of matching students, who are more capable and appoint such students as peer tutors to enhance laboratory performance and motivation. Established learning theories such as the theory of learning through

experience [1], Experiential Learning Cycle [2], the Zone of Proximal Development [3], and the protégé effect, according to which learners who teach others learn better and remember more (Fig.1), are also the basis of the intervention [4], [5], [6].

The recent studies in the field of engineering and medical education confirm that the structured peer-assisted learning (PAL) is effective in improving the practical performance, confidence, and engagement [7], [8], [9]. These constitute theoretical and practical arguments to explain why peer-assisted approach should be implemented in the actual technical setting.

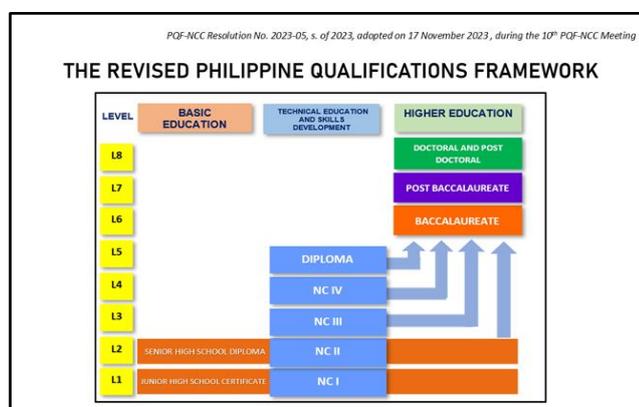
Figure 1. The Learning Pyramid Model of Instructional Effectiveness



Source: Adapted from the National Training Laboratories Institute of Applied Behavioral Science Learning Pyramid

The importance of enhancing the performance during laboratories is even more strong in the context of the nationwide Technical-Vocational Education and Training (TVET). The Second Congressional Commission on Education (EDCOM II) Final Report (2026) [10], has found that most TVET programs in the Philippines are still confined in lower qualification levels especially the National Certificate (NC) I and NC II, and higher level programs like NC III, NC IV and Philippine Qualifications Framework (PQF) Level 5 are a rare case (Fig. 2).

Figure 2. The Philippine Qualification Framework



Source: <https://pqf.gov.ph/>

Notably, the economic returns to TVET are much greater on high qualification levels (NC III-IV) and training that is associated with employment. Graduates who have high-level qualifications have a significantly higher salary as compared to graduates who lack TVET certifications. In view of this, enhancing the laboratory competence, confidence, and preparedness of students to become NC III certified is not only an instructional issue of concern, but also a strategic response to the national workforce requirements. This research would help equip students to achieve higher qualifications with better employment prospects and higher economic rewards by making them more capable via organized peer-assisted learning.

## **II. METHODOLOGY**

The model on which the action research was founded was the cyclical model of Kemmis and McTaggart [11], that consisted of planning, acting, observing, and reflecting. It was conducted in a state university of 62 third year students of Electrical Technology divided into two groups (Set A = 38; Set B = 24). The study was carried out in the Motor Control Laboratory which had starter panels, push-button stations, relays, contactors and the standard safety tools and equipment.

### **2.1. Intervention Design**

A buddy-buddy was a peer-assisted learning system was implemented. The level of skills was determined by first conducting a diagnostic test on the students. The high performing students were given the role of peer tutor and they were oriented briefly on the safety, scaffolding and communication. Each tutor had one or two tutees to work together in learning start-stop control, forward-reverse wiring and wye-delta circuits. Tutors informed the tutees on the interpretation of schematics, wiring order and troubleshooting. Reflection sheets were also used to promote self-reflection and metacognition, by completing at the conclusion of every lab session.

### **2.2 Data Collection**

Quantitative and qualitative techniques were used. The accuracy of wiring, safety and tool handling were measured with the use of the performance rubrics. The attendance records were followed before and after the intervention. The student confidence and self-perceived improvement were measured using surveys and reflection forms. The field notes and short interviews assisted in recording behavioral changes and engagement.

### **2.3 Data Analysis**

Quantitative information was summarized in terms of descriptive statistics. Changes in attendance and laboratory scores were compared to each other on a section-to-section basis. Qualitative data in the form of reflections, observations, and thematic analysis of the data were conducted and the analysis was anchored on confidence, collaboration, and independence. Triangulation of different data sources was used to support validity.

### **2.4 Ethical Considerations**

Participation in tutoring was voluntary and the confidentiality was considered. All the participants had equal access to instructional materials. The laboratory activities was highly compliant with the use of PPE and safety compliance were strictly observed.

## **III. RESULTS AND DISCUSSIONS**

### **3.1 Performance and Mastery**

According to the findings of the performance rubric, the motor control competencies of students improved significantly in both parts of the research (Table 1). In set A, the mean score rose by 13 percentage points in the post-test after 78 percent in the pre-test, a difference of 13. Equally, Set B went up by 16 points, by increasing to 88. In general, the aggregate mean increased by 15 points, as compared to 75 percent to 90 percent. The above findings indicate that the teaching intervention was effective in improving the accuracy of the procedures as well as conceptual knowledge, and practical skills. Students that had initially shown slightly correct

wiring were in a position to advance towards more autonomous and precise task completion whereas tutors portrayed near-perfect performance with more detailed conceptual presentation.

Table 1. Pre-Post Performance Outcomes in Motor Control Study

Group	Pre (%)	Post (%)	Gain (%)
Set A	78	91	+13
Set B	72	88	+16
Combined	75	90	+15

The improvement noticed is consistent with mastery learning theories that were put forth by Bloom who maintained that given enough time, structured feedback and corrective instruction most students are capable of attaining high levels of mastery [12]. The increase in moderate pre-test scores to near-mastery post-test scores indicates the effect of guided practice and performance-based testing. The framework of Bloom underlines that the lack of learning can be minimized in case the students are given a chance to correct their mistakes and improve their abilities before making a new step, which seems to be in line with the increase observed in this research.

The results are also corroborated by the three-stage model of learning, a skill that was created by Fitts and Posner through a motor learning perspective [13]. In their model, learners pass through cognitive phase, which is a learning phase where understanding is hard and where error is common, through associative phase, which is a phase where performance is more correct and finally through autonomous phase, where performance is accurate and autonomous. The fact that the post-tests improved indicates that students moved past the original conceptual knowledge to more fluent and self-directed performance on motor control tasks.

Moreover, the tutor role and systematic instructions can be viewed in the light of the scaffolding theory based on the works of Vygotsky [3]. The Zone of Proximal Development as an idea introduced by Vygotsky accentuates the ability of learners to demonstrate a better performance when assisted by more knowledgeable people. The fact that the students have shifted their partially correct wiring to independent correct implementation shows that both procedural and conceptual knowledge was internalized with the help of scaffolded instruction and feedback.

These interpretations are empirically validated. Experiments on intentional practice by Ericsson, show that systematic practice coupled with instant feedback are highly effective at improving technical and motor performance [14]. Also, studies summarized by Hattie have found feedback to be among the strongest factors that can be used to enhance student achievement [16]. These findings are consistent with the greatly realized gains in both parts of this study, which makes it reasonable to infer that the combination of guided practice, corrective feedback, and performance assessment was effective in enhancing the motor control competencies of the students.

In general, the data suggest that the structured lab teaching, mastery-based evaluation, and the support provided through scaffolding had a substantial impact on the improvement of the accuracy of the performance and the level of conceptual knowledge. The moderate pre-test scores as compared to near mastery scores after the test show successful acquisition of the skills and this proves the theories in mastery learning, motor skills development and instructional scaffolding.

### 3.2 Self-esteem and Involvement

The post-intervention survey revealed that the level of self-confidence increases, and the desire to undertake complex tasks. A lot of students stated that they felt less shy and more comfortable to act when they cooperated with another student.

### 3.3 Attendance and Engagement

The attendance and engagement scores indicate that both of the sections have significantly improved with the introduction of the buddy-buddy system and increased tutor support (Table 2). In Set A, attendance rose by 9 percentage points since the intervention, with the percentage of attendance being 86 percent before and 95

percent after the intervention. Set B had more significant improvement with an increase of 30 points with a rise from 60 percent to 90 percent. On the whole, the rates of combined attendance were improved by 20 points and were 93 and 73, respectively. These results indicate that a highly positive effect on the participation and commitment of students to motor control sessions was produced by well-organized peer support and greater instructional guidance. It is worth noting that Set B that showed poorer attendance initially showed the most improvement, which suggests that the intervention was especially efficient with students who were less engaged in the past.

Table 2. Pre-Post Attendance Rates Following Buddy System Implementation

Group	Before (%)	After (%)
Set A	86	95
Set B	60	90
Combined	73	93

The given rise of the attendance can be understood in terms of the social learning theory [15], which is based on the significance of the peer interaction, modeling, and shared accountability in the behavior formation. The buddy system must have created a sense of responsibility and support to each other, encouraging students to be present at the sessions. Engagement is more likely to be increased when learners feel that their involvement does not only influence their own development but also the development of their peers.

The results also coincide with the theory of social development of Vygotsky, especially, the idea of collaborative learning in the Zone of Proximal Development (ZPD). Buddy systems and other peer-assisted mechanisms provide students with the space to exchange their knowledge and academic performance thus enhancing social and academic activities. The enormous increase in attendance indicates that students were able to enjoy the collective learning responsibility and tutor facilitation.

The study also confirms the connection between the engagement strategies and the better attendance. Hattie found cooperative learning and teacher-student relationships as high-impact factors that have influence on student achievement and engagement [16]. Favorable interaction with peers and instructional climate are factors that not only promote academic achievement, but also regular attendance. On the same note, it points out that motivation goes up with the sense of social belonging and support provided to learners within organized learning communities [17].

Similar results are reported in empirical studies of peer mentoring and cooperative learning. Indicatively, it established that structured peer-assisted learning programs had a significant positive effect in enhancing attendance, engagement, and academic performance in low-performing or low-motivation students [18]. These findings are reflected in the significant growth of Set B, which implies that students who had a lower attendance level at the beginning might react better to collaborative accountability systems.

In general, the data show that the implementation of the buddy system and increased tutor support played an important role in the improvement of attendance and participation in the motor control sessions. The steadiness of the results of the two sections and the dramatic rise in the results of Set B in particular is a testament to the efficiency of peer-assisted learning strategy in promoting responsibility, motivation, and long-term participation.

### 3.4 Tutor Development

The tutors stated that they needed to prepare to teach in order to be able to explain what they knew and predict the most common errors, which, in fact, is a real application of the protege effect. They also reported of leadership and communication improvement.

### 3.5 Discussion

It was found that peer-assisted learning enhances academic and affective aspects of technical learning. The outcome of the laboratory performance and attendance enhancement is in line with the outcomes of Bugaj et al. [7], who also discovered the same outcomes in skills-based PAL settings. The buddy-buddy approach is aligned with the key theories of learning. It engaged students in the experience and reflection [2], provided scaffolding in Vygotsky, ZPD [3], and facilitated deeper processes of learning the protege effect [4], [6]. Procedural retention, which was also supported by the motor learning literatures, was as such reinforced by repeated practice and teaching [19], [20]. The matched stimulated ordered matching practice that eradicated the decay of the skills [21]. Moreover, peer learning enhanced motivation and persistence, which are essential to the further participation in technical training [9]. In summary, the buddy-buddy system made the laboratory a reflective and participatory activity. It brought about an academic and social enhancement of the lives of both tutors and tutees, meaning that PAL is replicable to other technical-vocational courses.

## IV. CONCLUSION

A learning system known as the buddy-buddy peer-assisted learning was implemented in motor controls laboratory sessions and the outcome proved that the students got much more confident, learned more and participated more. The approach could incorporate the learning-by-teaching theories, social constructivism, and experiential learning. The results show that structured teamwork among peers supports the process of active learning, retention, and skill transfer. It is recommended that the curricula of technical education should define peer-assisted learning structures on a formal basis. It will be necessary to test the model in other settings in the future, extend the intervention, and randomize tutor assignment to enhance the generalizability.

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