



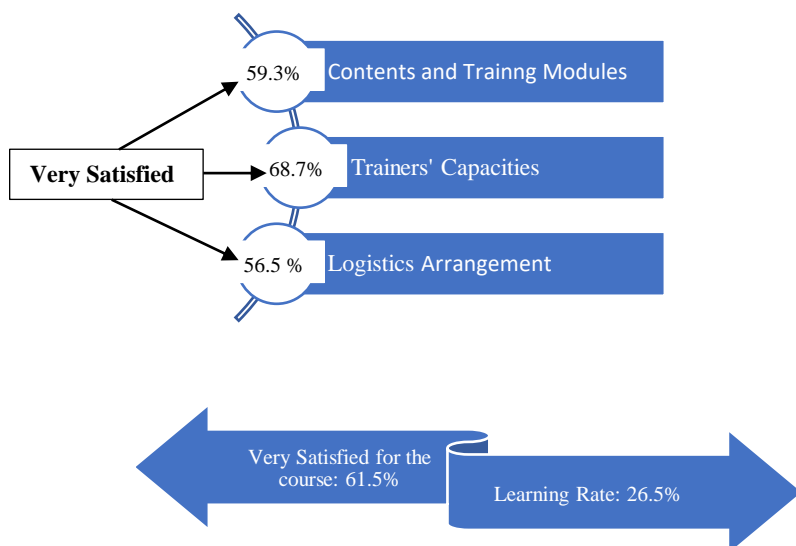
Southeast Asian Ministers of Education Organization Regional Center for Technical Education Development
(SEAMEO TED)

Training Evaluation Report

Training Course on Programmable Logic Controller (PLC)¹ for Electricity Teachers
8-9 August 2023, Kampong Chhnang Province, Cambodia

On August 8-9, 2023 at General and Technical High School of Samdech Preah Bat Borom Neat Norodom Sihamoni located in Kampong Chhnang Province there was a training course on Programmable Logic Controller (PLC) for 28 electricity teachers from different general and technical high schools countrywide in a purpose of enhancing their capacities of PLC application to meet the need of IR 4.0 skills. Specifically, training objectives are as follows: (1) to increase awareness of operating Mitsubishi PLC by linking the school facilities with the current industrial skills; (2) to enhance the program application of Mitsubishi PLC; (3) to expose technical teachers to practical application of Mitsubishi PLC. The evaluation objectives should fit the training objectives following the scope of organization (Phillips & Stone, 2000)¹.

Executive Summary



¹ Phillips, J. J., & Stone, R. D. (2000). *How to measure training results: A practical guide to tracking the six key indicators* (No. 19397). McGraw-Hill.

1. Introduction

Teacher training as part of continuous professional development program help teachers to identify their skill deficiencies understanding their student' needs and to position themselves to the new skill development (Meroni & Velasco, 2023)². Each supervising organization provides training programs for teachers to meet technological innovation to assist them to function instructionally and technically to ensure that no one left behind. Therefore, capacity building programs play an integral part in cultivating teachers' talents and building human capitals.

Technology might be ahead of us if we are not on track with it. However, some teachers are not aware of new technologies with new skills to teach their students hindering their teaching goals (Meroni & Velasco, 2023)³. Training and development can be done everywhere for target participants, but the transfer of learning by participants from the training course to the work setting is still a problem for consideration (Phillips & Stone, 2000)⁴. Teachers can be technological mindfulness aligning with growing instructional methods.

The evaluation is conducted to measure the training effectiveness. Specifically, the evaluation provides information for improvement of future training courses and decides whether the training course continues or discontinues (Kirkpatrick & Kirkpatrick, 2006)⁵. The evaluation report has three main objectives: 1) to identify challenges in organizing the training course; 2) to determine the learning rate of trainees right after the training course; and 3) to identify the suggestion from trainees for improvement.

² Meroni, C., & Velasco, V. (2023). School-Based Interventions for Migrant Students in the Framework of the Health Promoting Whole-School Approach: An Umbrella Review. *Sustainability*, 15(3), 1894.

³ Meroni, C., & Velasco, V. (2023). School-Based Interventions for Migrant Students in the Framework of the Health Promoting Whole-School Approach: An Umbrella Review. *Sustainability*, 15(3), 1894.

⁴ Phillips, J. J., & Stone, R. D. (2000). *How to measure training results: A practical guide to tracking the six key indicators* (No. 19397). McGraw-Hill.

⁵ Kirkpatrick, D., & Kirkpatrick, J. (2006). *Evaluating training programs: The four levels*. Berrett-Koehler Publishers.

2. Demographic Information of Trainees

28 trainees as electricity teachers have different demographic information. **Figure 1** shown the trainees' genders (male and female).

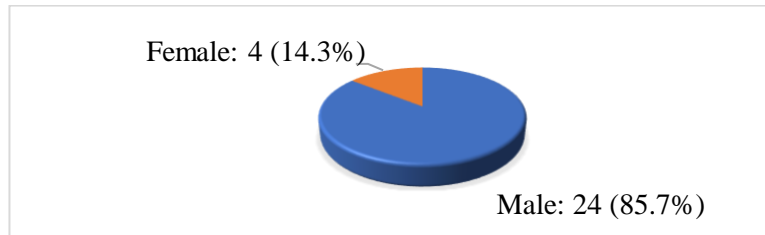


Figure 1: Trainees' Gender

Trainees have different age ranges with frequencies and percentage from 24 to 42 years old as shown in **Table 1**.

Table 1: Trainees' Age Range

Age Range	Frequency	Percent
24-29	8	28.6%
30-35	14	50.0%
36-41	3	10.7%
42-47	2	7.1%
Missing	1	3.6%
Total	28	100%

Figure 2 highlighted trainees' academic degrees ranging from Associate Degree to Master's.

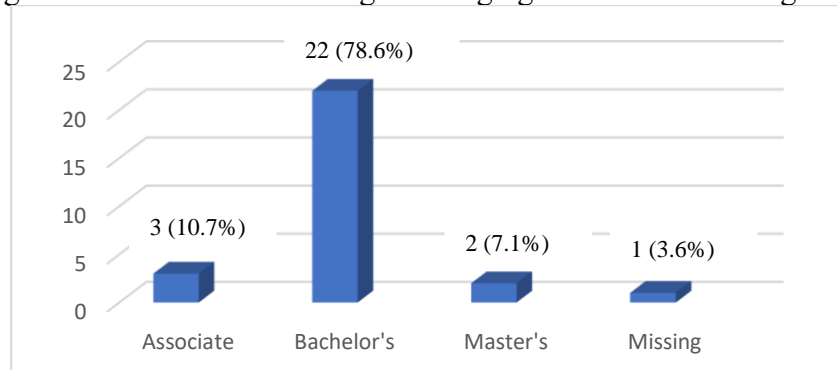


Figure 2: Trainees' Academic Degree

There were 28 trainees from 12 general and technical high schools (GTHSs) from different provinces participating the training course as shown in **Table 2**.

Table 2: School Names of Trainees

No.	School Name	School Province	Frequency	Percent
1	GTHS Puok	Siem Reap	1	3.6%
2	GTHS Preah Bat Borom Neat Norodom Sihamoni	Kampong Chhnang	8	28.6%
3	GTHS Tbeing Mean Chey	Preah Vihear	2	7.1%
4	GTHS Bavet	Svay Rieng	4	14.3%
5	GTHS Peam Chikang	Kampong Cham	3	10.7%
6	GTHS DonBosco	Banteay Meanchey	1	3.6%
7	GTHS ROTA	Kandal	2	7.1%
8	GTHS Techo Sen Koh Kong	Koh Kong	1	3.6%
9	GTHS Kampong Chheuteal	Kampong Thom	2	7.1%
10	GTHS Chumpou Vaon	Phnom Penh	2	7.1%
11	GTHS Preah Reach Samphear	Kampot	1	3.6%
	Missing		1	3.6%
	Total		28	100%

The 28 trainees have taught eight subjects for electricity trade with different percentage as shown in **Figure 3**.

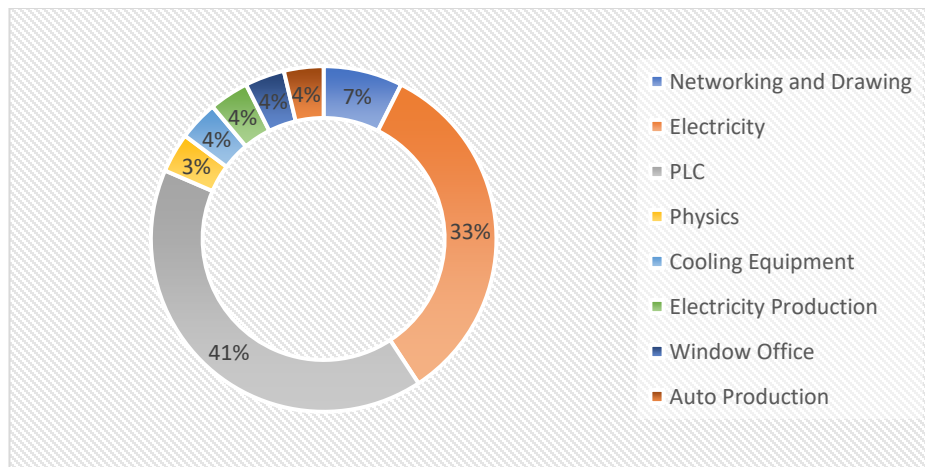


Figure 3: Subjects Taught by Trainees

Most of the trainees have taught Electricity trade at school from 1 to 6 years (64.3%) as shown in **Table 3**.

Table 3: Teaching Period (Years) of Trainees

Teaching Period (Years)	Frequency	Percent
1-6	18	64.3
7-12	8	28.6
13-18	1	3.6
Missing	1	3.6
Total	28	100.0

3. Data Analysis and Results

The training course lasted two days. At the last day before finishing the course, a satisfaction survey questionnaire encompassing three categories consisting of contents and training modules, trainers' capacities, and logistics arrangement and preparation for the course has been distributed to each of the trainee with a detailed instruction on how to fill out the questionnaire correctly. The contents and training modules cover five items. The trainers' capacities cover four items. And logistics arrangement and preparation for the course cover six items. A total of 15 items has a Likert-type five-point scale for trainees' rating such as 1 for not satisfied, 2 for slightly satisfied, 3 for satisfied, 4 for very satisfied, and 5 for extremely satisfied. At the end of the survey questionnaire, a space for comments and suggestion from trainees was provided. Level 1 (Satisfaction) of training evaluation is called the satisfaction sheet was applied (Kirkpatrick & Kirkpatrick, 2010)⁶. To measure learning, level 2 of training evaluation is called Learning was employed with pre-tests and post-tests (Kirkpatrick & Kirkpatrick, 2010)⁷. Level-2 measurement ensures the success of training programs whether participants acquire desired knowledge (Phillips & Stone, 2000)⁸. To ensure the test content validity, a test was developed by trainers extracting each training module. The test has 23 items with 23 points. Finally, to solicit the suggestion from trainees for improvement, thematic analysis was employed to identify codes and categories grounded from the trainees' voices.

To analyze data, descriptive statistics (mean and standard deviation) were employed. To ensure data consistency and reliability of the data, Cronbach's Alpha was used. The reliability statistics

⁶ Kirkpatrick, J., & Kirkpatrick, W. K. (2010). Training on trial. *The Journal for Quality and Participation*, 33(3), 26.

⁷ Kirkpatrick, J., & Kirkpatrick, W. K. (2010). Training on trial. *The Journal for Quality and Participation*, 33(3), 26.

⁸ Phillips, J. J., & Stone, R. D. (2000). *How to measure training results: A practical guide to tracking the six key indicators* (No. 19397). McGraw-Hill.

($\alpha=.856$, $N=28$). Descriptive statistics were resultant as means (M) and standard deviations (SD) as shown in **Table 4**, **Table 5**, and **Table 6** subsequently for each category.

Table 4: Contents and Training Modules

No.	Item	Mean	SD	Very Satisfied (%)
1	The contents are beneficial for my trade	4.39	.567	53.6
2	Each of the content items and modules are relevant to the ones that I have taught my students	3.79	.876	42.9
3	Each module provides extensive knowledge appropriately to achieve preliminary learning objectives	4.14	.591	64.3
4	After the course, I will be able to apply what I have learned to my work	3.71	.600	57.1
5	Learning objectives and modules are clear, orderly prepared and easily to catch up	4.00	.471	78.6
Mean		4.00	.621	59.3

Table 5: Trainers' Capacities

No.	Item	Mean	SD	Very Satisfied (%)
1	Trainers are knowledgeable for each training module	4.29	.460	71.4
2	Trainers prepared modules and training activities appropriately	4.25	.518	67.9
3	The training methods were appropriate to engage trainees interactively	4.14	.591	64.3
4	Trainers explained the modules clearly	4.29	.460	71.4
Mean		4.24	.507	68.7

Table 6: Logistic Arrangement and Preparation for the Course

No.	Item	Mean	SD	Very Satisfied (%)
1	Coordinating activities were acceptable before the training course	4.32	.548	60.7
2	Time allotted for the training was sufficient	3.71	.600	57.1
3	Documents and materials distributed were helpful	3.89	.685	53.6
4	The training rooms and facilities were adequate and comfortable	3.79	.686	50.0
5	Refreshment was delicious and acceptable	3.93	.716	50.0
6	The activities during the training were acceptable	4.04	.576	67.9
Mean		3.94	.635	56.5

For objective 1: to identify challenges in organizing the training course, means (M) and standard deviations (SD) were used. Following the results highlighted in Table 4, 5, and 6, all items range from 3 to 4. For example, contents and training modules have Mean (M=4.00), trainers' capacities have Mean (M=4.24), and logistics arrangement and preparation for the course have Mean (M=3.94).

In response to objective 2: to determine the learning rate of trainees right after the training course, pre-tests and post-tests were applied. The pre-tests and post-tests were conducted to measure prior-learning and after-training knowledge. Learning can be determined as the extent to changes of attitudes, improvement of knowledge and increasing skills (Kirkpatrick & Kirkpatrick, 2006)⁹. However, learning can be measured right after the training course as the trainees' knowledge improves. The learning rate was 26.55%. The learning score and learning rate were measured as shown in **Table 7**.

Table 7: Participants' Learning Score and Learning Rate

No	Pre-test score	Post-test score	Learning score	Pre-test rate (Percentage)	Post-test rate (Percentage)	Learning Rate
1	8	20	12	34.78%	86.96%	
2	12	17	5	52.17%	73.91%	
3	14	16	2	60.87%	69.57%	
4	12	15	3	52.17%	65.22%	
5	14	18	4	60.87%	78.26%	
6	15	19	4	65.22%	82.61%	
7	13	19	6	56.52%	82.61%	
8	13	20	7	56.52%	86.96%	
9	15	18	3	65.22%	78.26%	
10	10	20	10	43.48%	86.96%	
11	15	17	2	65.22%	73.91%	
12	15	20	5	65.22%	86.96%	
13	14	18	4	60.87%	78.26%	
14	8	20	12	34.78%	86.96%	
15	4	15	11	17.39%	65.22%	
16	15	17	2	65.22%	73.91%	
17	15	19	4	65.22%	82.61%	

⁹ Kirkpatrick, D., & Kirkpatrick, J. (2006). *Evaluating training programs: The four levels*. Berrett-Koehler Publishers.

18	14	18	4	60.87%	78.26%	
19	15	20	5	65.22%	86.96%	
20	7	15	8	30.43%	65.22%	
21	11	21	10	47.83%	91.30%	
22	7	18	11	30.43%	78.26%	
23	12	17	5	52.17%	73.91%	
24	12	19	7	52.17%	82.61%	
25	13	16	3	56.52%	69.57%	
26	7	17	10	30.43%	73.91%	
27	12	18	6	52.17%	78.26%	
28	12	18	6	52.17%	78.26%	
Mean	11.9	18	6.1	51.86%	78.42%	26.55%

Note: Score range: 0-23 points

Regarding the objective 3: to solicit the suggestion from trainees for improvement, the thematic analysis was used. Each trainee provided suggestion and comments consisting of a total 44 codes with 10 themes. In response to the objective 3, **Table 8** highlighted the results. Each trainee was labelled as pseudonyms differently to protect their privacies and data bias during the data collection process.

Table 8: Suggestion for Training Improvement

No.	Number of Code	Suggestion/Comments
1	5	Extending period of training course longer
2	1	More focused on practical activities
3	1	Next training module should focus on Motor Ordering System
4	1	Next training module should focus on how to bind a Motor
5	1	Training space should be larger

Five themes were grounded from the trainees' voices as the following descriptions:

Extending Training period longer

The training period last two days. Five trainees mentioned repeatedly this them. For example, **Sok** commented that "The training course duration should be longer than this". **Chantha** stressed that "We should extend the training time longer". **Dara** who is a technical teacher from Puok general and technical high school recommended to prolong the training time in order for participants to capture more succinct of practical perspectives. Another trainee named **Vutha** from Kampong Chheuteal general and technical high school noted that "The training period should be extended

longer and longer for teachers to learn more”. Finally, **Sothy** from Peam Chikang general and technical high school added that “The training time is too short for teachers to learn”.

Focused on Practical Activities

One trainee named **Sara** noted that “The training modules should focus more on practical activities and application”.

Motor Ordering System

One trainee named **Vichet** stated that “If there will be another training course, should focus on Motor Ordering System for our teachers”.

Process How to Bind a Motor

One trainee called **Nida** reported that “The training course should focus on the process how to bind a motor”.

Larger Training Space

One trainee called **Piseth** noted that “The training space should be larger than this one as trainees need space for practicing equipment”.

4. Conclusion

The results encapsulated three key themes consisting of challenges in organizing the training course, learning rates of trainees, and suggestion from trainees for improvement. The ultimate challenges were contents and training modules, trainers’ capacities, and logistic arrangement and preparation for the course. The rating scale from 3 to 4 underscores high appreciation in the training giving positive reaction (Kirkpatrick & Kirkpatrick, 2006)¹⁰. The learning rate of trainees right after the training course was 26.55%. More than 70% of trainees didn’t get new knowledge (Kirkpatrick & Kirkpatrick, 2006)¹¹. This might be due to time constraint during filling out post tests and carelessness of filling out the test without clear instruction from training facilitators. The score results of level 1 and level 2 were correlative and consistent with each other meaning that a low level-1 score reflects a low level-2 score (Phillips & Stone, 2000)¹².

¹⁰ Kirkpatrick, D., & Kirkpatrick, J. (2006). *Evaluating training programs: The four levels*. Berrett-Koehler Publishers.

¹¹ Kirkpatrick, D., & Kirkpatrick, J. (2006). *Evaluating training programs: The four levels*. Berrett-Koehler Publishers.

¹² Phillips, J. J., & Stone, R. D. (2000). *How to measure training results: A practical guide to tracking the six key indicators* (No. 19397). McGraw-Hill.

The suggestion solicited from trainees were (1) should extend the training period longer; (2) more focused on practical activities; (3) more focused on Motor Ordering System for the next training module; (4) more focused on how to bind a Motor; and (5) enlarging the training space. The results were applicable for the reality of training characteristics and school context. One of the main objectives of policy on technical education is to develop the capacities of technical education teachers for their respective majors through training programs (MoEYS, 2013)¹³.

¹³ MoEYS. (2013). *Policy on technical education [Policy]*. Phnom Penh, Cambodia. Ministry of Education, Youth and Sport.

Annex

Training Modules and Contents

Training Module	Contents
Introduction to Mitsubishi PLC	<ol style="list-style-type: none">1. PLC (Programmable logic controller)2. Benefits of PLC Application3. Mitsubishi PLC4. Methods of Mitsubishi PLC Application5. Lining for Input Section
Program Application for Mitsubishi PLC	<ol style="list-style-type: none">1. Installation Method for GX WORKER 22. Method for Add Port Com3. Application Method for GX WORKER 25. Method to connect PLC with Program Software
Application of Basic Instruction	<ol style="list-style-type: none">1. Structure of Program Instruction2. Application of Coil Device3. Instruction Application4. Sample Project Application
Numbering Systems and Coding	<ol style="list-style-type: none">1. Numbering Systems2. Number Conversion3. One's and Two's Complement4. Binary Codes
Logic Concepts and Basic Sequence Control Circuits	<ol style="list-style-type: none">1. Logic Concepts2. Basic Sequence Control Circuits
Ladder diagram (LD)	<ol style="list-style-type: none">1. Overview2. Bus line3. Connection line4. Contacts5. Coils6. Example