APPLYING PDCA CYCLE FOR DETECTING PRESCHOOLS' TEACHING QUALITY

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ABSTRACT. *The Taiwanese Ministry of Education launched the Early Childhood Education and Care Curriculum Framework (ECECCF) in education as the teaching guideline for preschools in 2017. Preschool teachers were asked to fulfil the requirement of ECEC-CF to lift students' performance. While there are no specific quality evaluation indicators available in the guideline, building a better assurance framework to enhance teaching quality has become a new challenge in preschools. Previous studies indicated the PDCA cycle (the Plan-Do-Check-Act cycle) is a useful tool in education field, while there are still limited conducting examples in early childhood education. This study aims to propose a teaching quality management strategy by using the PDCA cycle for early childhood education. Taking new Taipei city as an example, this study conducted the questionnaire survey based on the target preschool teachers to verify the proposed framework. The findings suggest a useful teaching framework of the PDCA cycle and its application for determining the obstacles which might exist in the preschools.*
Keywords: PDCA cycle, Teaching quality, Management system, Preschool

1. **Introduction.** In 2017, the Taiwan Ministry of Education initiated the Early Childhood Education and Care Curriculum Framework (ECECCF) to make sure that the preschool students can obtain the ECECCF key competence. The ECECCF includes six major domains: physical activity and health, cognition, language arts, social studies, emotions, and aesthetics; and there are total 57 objectives and 290 learning indicators integrated in the six major domains. Moreover, the Taiwan Ministry of Education announced the ECECCF as the teaching guideline for the preschool teachers. Thus, the preschool teachers' priority assessment has changed to organize curriculum well to assure students' ability can obtain the ECECCF objectives and the indicators [1].

Besides the new challenge of organizing curriculum, the preschool teachers also face the new defined preschool service model. According to the Taiwan Ministry of Education, the preschools' future service model is provided as a diversified, innovative and refined model. The Taiwan Ministry of Education announced that a refined service model is a model which can enhance the total quality of education [2,3]. The total quality is attaching importance to education field since 1990s [4]. The researches proved that using Total Quality Management (TQM) can efficiently provide educational quality assurance [5,6].

In Taiwan, the concept of TQM has been applied on National Quality Award (NQA) and higher education evaluation. Further, there were 5 universities applying TQM very well and rewarding NQA [7,8]. Though TQM has gotten attention in Taiwan higher education, we found limited researches in Taiwan early childhood education. With this concern,

applying TQM on Taiwan early childhood education to assisting preschool teachers to organize curriculum and enhance the total quality of education will be worthy to advance.

The notion of TQM is pursuing continuous quality improvement and the PDCA cycle (the Plan-Do-Check-Act cycle) has proven a useful strategy in TQM. The PDCA cycle was first introduced to Japan by W. Edward Deming in 1950 and was called the PDSA cycle (the Plan-Do-Study-Act cycle) [9,10]. Japan recast the PDSA cycle as the PDCA cycle and it was applied to Western industry in 1980s [9,10]. According to Deming [11], the PDSA cycle is a constantly rotating cycle and its four stages are as follows:

1) Plan: plan a change or test aimed at improvement.
2) Do: carry out the change or test (preferably on a small scale).
3) Study: examine the results. What did we learn? What went wrong?
4) Act: adopt the change, abandon it or run through the cycle again.

Nowadays, the PDCA cycle has become a systematic quality improvement strategy and been used in education field. ISO (International Organization for Standardizations) is adopting the PDCA cycle as a standard quality assurance procedure of education organization [12]. In Japan, the PDCA cycle is a legal standard procedure of preschool evaluation and curriculum management [13,14]. As a result that the PDCA cycle is a quality improvement strategy for Japan preschools, we assume the Japanese experience may apply in other preschool settings. Therefore, this study supposed that adopting the PDCA cycle in teaching quality management can support Taiwan preschool teachers to execute ECECCF effectively and enhance their educational quality.

This study will provide an example to adopt the PDCA cycle in pursuing continuous teaching quality improvement for preschools. First, this study reviewed related literature about the PDCA cycle and then based on the concept of ECECCF reshaped the PDCA cycle of teaching quality management for Taiwan preschools. Second, this study developed a questionnaire to survey teaching problems that the Taiwan preschool teachers confronted. Third, we will determine the verification of this questionnaire and display the results of survey. Finally, the conclusion will be drawn.

2. Methods.

2.1. **Research framework.** Figure 1 shows the framework of this research. After reviewing related literature, we adopted the PDCA cycle in preschool teaching quality management. To realize the existing teaching obstacles the preschool teachers might have, we develop a questionnaire based on the PDCA cycle to survey the preschool teachers.
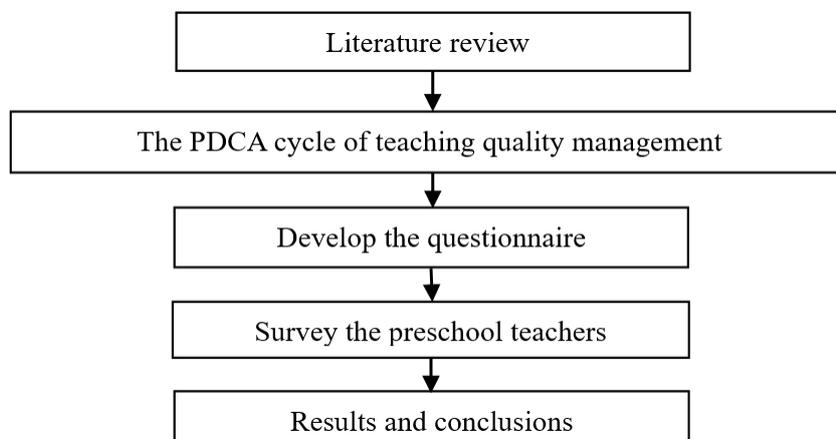

FIGURE 1. Research framework

Reviewing related literature, the PDCA cycle for quality improvement follows by Plan: identify the present situation and then set goals for improvement; Do: implement the actions of the plan; Check: evaluate and study the results after implementation; Act: use the results to ensure standardization or to transfer the results to knowledge [15]. The PDCA cycle for teaching monitoring follows by Plan: set teaching goals and system standards; Do: execute teaching activities; Check: evaluate and analyze the results of teaching activities; Act: diagnose problems and improve teaching quality [16]. Based on above, this study defined the Plan-Do-Check-Act stages of the PDCA cycle for teaching quality management (see Figure 2) as follows.

   1) Plan: Teaching design.
   2) Do: Teaching implementation.
   3) Check: Teaching evaluation.
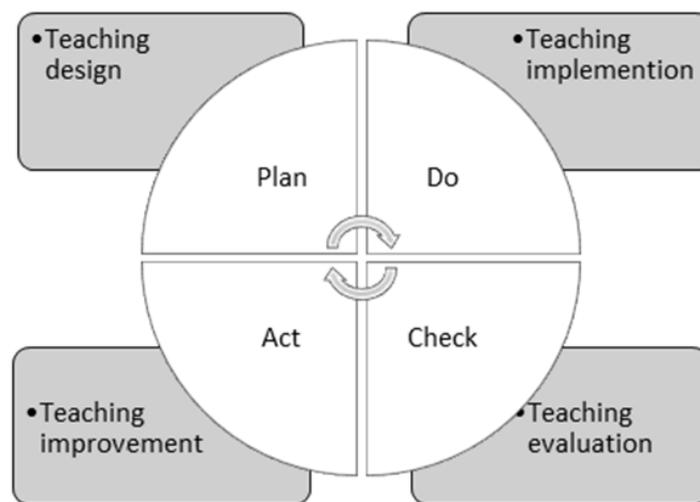   4) Act: Teaching improvement.

FIGURE 2. The PDCA cycle of teaching quality management

2.2. **Research questionnaire.** To develop the research questionnaire, we followed the process as follows. First, we reviewed the supportive literature about the ECECCF [1,17] and the PDCA cycle in education field [18-23] and in preschool curriculum [14,24]. Second, we integrated the ECECCF into the PDCA cycle of teaching quality management for Taiwan preschools. This PDCA cycle of teaching quality management includes the Plan-Do-Check-Act stages as this study defined. Third, the content of this PDCA cycle was verified by four experts through Delphi technique to fit the requirements of teaching quality. Finally, we designed the related 20 indicators in the Plan-Do-Check-Act stages of this cycle (see Table 1) and developed the questionnaire after all.

2.3. **Data collection.** The target samples are the public preschool teachers in New Taipei City. We focus on the public preschools because these teachers are the priority target to implement the Taiwan government's education policy. According to the suggestion of Dillman's estimation [25,26], the theoretical samples of this study are 300 participants in total of 1,362 public preschool teachers in New Taipei City. The mathematical equation is as follows.

$$n = \frac{N}{N\left[\frac{2d}{Z_{\alpha/2}}\right]^2 + 1} = \frac{1362}{1362 \times \left[\frac{2 \times 0.05}{1.96}\right]^2 + 1} \approx 299.64$$

where N is 1362 preschool teachers in New Taipei City public schools, n is sample number, and d is allowable error.

TABLE 1. The PDCA cycle of teaching quality management for Taiwan preschools

Plan	Teaching design
P1	I will design a teaching plan based on ECECCF.
P2	The teaching plan covers the curriculum objectives in ECECCF six major domains.
P3	I will select learning indicators of the ECECCF curriculum objectives for teaching activities.
P4	I will set the student assessment standards of obtaining the selected learning indicators.
P5	I will set the student assessment standards of obtaining the ECECCF key competence.
Do	**Teaching implementation**
D1	I will implement teaching activities in accordance with the teaching plan.
D2	The teaching activities can enable students to acquire the selected learning indicator ability.
D3	I will collect students' learning performance according to student assessment standards.
D4	I will record students' learning performance as a basis for student assessment.
D5	I will record the teaching problems found in the teaching activities.
Check	**Teaching evaluation**
C1	I will evaluate the teaching process.
C2	I will explore the causes of teaching problems.
C3	I will conduct a student formative assessment in accordance with the assessment standards and learning performance to examine the learning indicator ability that students gain.
C4	I will conduct a student summative assessment in accordance with the assessment standards and learning performance to examine the key competence that students gain.
C5	I will investigate the feedback of students and parents on teaching activities.
Act	**Teaching improvement**
A1	I will summarize effective teaching activities for student to acquire the learning indicator ability.
A2	I will develop effective teaching activities into standardized teaching activities.
A3	I will propose teaching improvement strategies based on the causes of teaching problems.
A4	I will collect the noncorresponding or uncompleted learning indicators and incorporate into the next teaching plan.
A5	I will consider feedback from students and parents to revise and improve the teaching plan.

Based on the estimated sample size, this study invited the voluntary participants to fill the self-questionnaire.

2.4. **Statistical analysis.** This questionnaire was designed by a five-point Likert scale format and was analyzed by using descriptive statistics, independent t-test, one-way ANOVA, and Pearson correlation coefficient. The related testing was based on the significant level $\alpha = .05$.

3. Results.

3.1. **The verification of questionnaire.** Based on the related literature, we proposed a draft questionnaire about the PDCA cycle of teaching quality management for Taiwan preschools. The proposed questionnaire was verified by four experts through Delphi techniques. The fitted reliability of the questionnaire in terms of Cronbach's α has been shown in Table 2. This PDCA cycle and the specific dimensions are all with fitted Cronbach's α.

TABLE 2. The reliability of the self-design questionnaire

Teaching quality management	Cronbach's α
The PDCA cycle	.921
Plan	.842
Do	.754
Check	.800
Act	.765

This study conducted the Pearson correlation test to determine whether there is cross relationship between each stage. In Table 3, we found that the correlation coefficient of each stage is from .59 to .70 ($p < .01$). The result reveals that the Plan-Do-Check-Act stages are with internal connections and the PDCA cycle of teaching quality management is a useful improving cycle.

TABLE 3. The correlations of the Plan-Do-Check-Act stages

Cycle	Plan	Do	Check	Act
Plan	1			
Do	.63**	1		
Check	.61**	.65**	1	
Act	.59**	.67**	.70**	1

**$p < .01$

3.2. **The character of samples.** To detect the implementation of preschool curriculum, we conducted the teaching quality management indicators of the PDCA cycle as a review tool for Taiwan preschool teachers. The self-evaluation questionnaires were completed by 151 public preschool teachers in New Taipei City. The response rate was 50.3%. There are 97.4% female and 2.6% male. Most of the participants are in aged 41-50 group (32.4%), then followed by aged 31-40 (27.2%), 21-30 (23.8%) and 51-60 (16.6%). Their working experiences are 1-10 years (45.0%), 21-30 years (28.5%), 11-20 years (21.9%) and above 31 years (4.6%). There are 61.6% of the teachers with bachelor degree, 37.7% of teachers with master degree and 0.7% of teachers with associate degree. Most of the participants worked in 4-6 classes preschools (42.4%), while 35.1% worked in 7 classes and above and only 22.5% worked in 1-3 classes preschools. The details of participants' background are displayed in Table 4.

3.3. **Data analysis.** The result reveals the preschool teachers' background such as age, experiences of service, and educational degree did not make significant differences in performances of implementing the Plan, Do, Check and Act stages. However, various sizes of preschools can make differences in the Plan stage. We found that teachers worked in the size of 4-6 classes preschools have shown a better performance than whom worked in 1-3 classes preschools. See Table 5 and Table 6.

TABLE 4. Analysis of participators' background

Background	Group	Percent
Gender	Male	2.6%
	Female	97.4%
Age	21-30 years old	23.8%
	31-40 years old	27.2%
	41-50 years old	32.4%
	51-60 years old	16.6%
Experiences of service	1-10 years	45.0%
	11-20 years	21.9%
	21-30 years	28.5%
	31 years and above	4.6%
Educational degree	Associate degree	0.7%
	Bachelor	61.6%
	Master and above	37.7%
Size of preschool	1-3 classes	22.5%
	4-6 classes	42.4%
	7 classes and above	35.1%

TABLE 5. Teachers' performance in different scales of preschools

Cycle	1-3 classes ($n = 34$)		4-6 classes ($n = 64$)		7 classes and above ($n = 53$)	
	M	SD	M	SD	M	SD
Plan	3.72	.09	4.02	.63	3.97	.07
Do	3.90	.07	3.96	.05	4.08	.06
Check	3.79	.09	3.78	.06	3.89	.07
Act	3.77	.08	3.80	.06	3.86	.07

TABLE 6. ANOVA for the Plan-Do-Check-Act stages with various sizes of preschools

Cycle	Source of variances	SS	df	MS	F	p
Plan	Between	2.10	2	1.05	4.13	.018*
	Within	37.64	148	.25		
	Total	39.74	150			
Do	Between	.76	2	.38	2.20	.114
	Within	25.42	148	.17		
	Total	26.18	150			
Check	Between	.34	2	.17	.70	.50
	Within	36.10	148	.24		
	Total	36.44	150			
Act	Between	1.9	2	.10	.42	.656
	Within	33.34	148	.18		
	Total	33.53	150			

*$p < .05$

This study found that the teaching quality management performance of Taiwan preschool teachers was at a medium-to-high level as our survey scale. Considering the PDCA cycle as a continuous quality improvement cycle, the low-scoring in specific indicators

TABLE 7. The ranking with the indicators

Cycle	Indicators	M	SD	Ranking in each stage	Ranking in all
Plan	P1	4.01	.71	2	3
	P2	3.99	.62	3	4
	P3	4.10	.60	1	1
	P4	3.91	.65	4	7
	P5	3.67	.71	5	16
Do	D1	4.10	.56	1	1
	D2	3.97	.56	4	6
	D3	3.90	.61	5	8
	D4	3.98	.61	3	5
	D5	3.99	.61	2	4
Check	C1	3.81	.70	2	10
	C2	4.08	.55	1	2
	C3	3.78	.58	3	12
	C4	3.77	.68	4	13
	C5	3.68	.78	5	15
Act	A1	3.75	.71	4	14
	A2	3.62	.72	5	17
	A3	4.01	.52	1	3
	A4	3.79	.69	3	11
	A5	3.89	.63	2	9

TABLE 8. Lists of the low-scoring indicators

Stage		Low-scoring indicators	Ranking
Act	A2	I will develop effective teaching activities into standardized teaching activities.	1
Plan	P5	I will set the student assessment standards of obtaining the ECECCF key competence.	2
Check	C5	I will investigate the feedback of students and parents on teaching activities.	3
Act	A1	I will summarize effective teaching activities for student to acquire the learning indicator ability.	4
Check	C4	I will conduct a student summative assessment in accordance with the assessment standards and learning performance to examine the key competence that students gain.	5

reflects the issue which need improve. Specifically, Table 7 displays the ranking from high-to-low scoring in each stage with the 20 indicators.

Table 8 displays the result of low-scoring indicators in the target preschools, which are A2, P5, C5, A1 and C4. It implies the weakness in the following indicators: student's assessment of the ECECCF (P5&C4), investigating feedback from students and parents (C5), and standardized effective teaching activities (A1&A2). In this case, we found that the low-scoring indicators reflect on major issue in the Check stage and in the Act stage.

4. **Conclusions.** This study provides an example by adopting the PDCA cycle in teaching quality management for Taiwan preschool teachers. This study develops a self-designed questionnaire to detect the obstacles in teaching that Taiwan preschool teachers confronted. We found that the preschool teachers' background did not make differences in implementing the PDCA cycle of teaching quality management in this study. In this survey,

the self-designed questionnaire and the selected 20 indicators all work well. Furthermore, the 20 indicators proposed in the Plan-Do-Check-Act stages can play effective roles to determine the issues in a specific preschool in Taiwan. For further studies, we encourage the early childhood education organizations to extend the PDCA cycle to similar settings for pursuing continuous quality improvement and enhancing the total quality of education.

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