

Professional Development in Information Technology Competency for Teachers in Basic Education Schools

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Abstract - The purposes of this study were to identify the present teachers' ICT competencies in Pathum Thani basic education schools required by school administrators, determine the utility, feasibility, propriety, and accuracy of ICT competencies, and develop those ICT competencies for teachers into a training program. A mixed methodology using quantitative, qualitative, and four-phased Ethnographic Delphi Futures Research technique was used. Three sample groups included 181 school administrators of basic educational schools, an experts group of twenty, and a participants group of thirty teachers. Research instruments comprised the survey, the semi-structured interviews, the pre and post-tests, and a self-performance evaluation. The results reveal that ICT areas of school administrators required were related to what the experts group agreed. Based on the findings, an ICT training program was created for thirty teachers.

Keywords - Basic Education Schools, ICT Competency, School Administrators, Teachers' Professional Development

I. INTRODUCTION

As ICT has been continuously used to promote basic education in most schools around the world for decades, teachers have become also an important contributor to improving the quality of effective learning [1]. Now teachers at all grade levels in basic education should have ICT literacy and

computer skills to be able to participate in enhancing students' effectiveness in learning.

II. LITERATURE REVIEWS

Lack of basic literacy in ICT and computer skills can limit a teacher's ability to enhance the quality of classroom learning. It is important for teachers to understand how ICT can improve the standards of basic education in Thailand and to see how ICT can be used as a tool for more effective instruction. The education sectors have strongly emphasized that basic ICT literacy is important to teacher development [2], [3] and high quality teachers are the most important asset of schools, but there are no appropriate policies in place to ensure that schools have good quality teachers on hand [4]. By developing a technical assistance program in ICT applications for e-education including training for teaching staff, in particular the Strategic Objective (implement human resource development program) will facilitate the implementation of regional ICT initiatives.

Many research projects have shown that teaching quality is the strongest school-related factor that can improve student learning and achievement [5-7]. Additionally, teaching quality is in part a function of teacher quality according to the National Assessment of Educational Progress survey data, an unfortunate reality is that teachers were typically not using ICT in the most effective ways, and could not keep pace with the rapid changes in technology. This study was intended to rationally focus on ICT

competency areas for teachers, teachers' professional development, and in response to learner-centered instruction. In this study, the criteria are adopted from the program evaluation standards.

III. OBJECTIVES

The objectives of this study are: 1) to identify the present teachers' ICT competencies in basic educational schools, 2) to determine the propriety, utility, feasibility and accuracy of their ICT competencies, and 3) to develop those ICT competencies into a training program. In order to confirm the accuracy of the results in this study, Ethnographic Delphi Futures Research (EDFR) technique is conducted within the group of experts. This research examined specifically within basic primary and secondary education schools in Pathum Thani, a province where no previous research has been conducted on an innovation approach promoting the teacher's competency development in ICT areas.

IV. MATERIALS AND METHODS

A mixed methodology using quantitative and qualitative techniques, and four-phased (EDFR) technique was used. Three sample groups included 181 school administrators in Pathum Thani, an expert group of 20 experts (in ICT or general education) and a training participant group of 30 teachers. Research instruments included survey questionnaires, structured interviews, pre and post-tests, and a self-performance evaluation.

The four-phases of research including EDFR comprised (i) the first phase; data collection from survey analyzed and summarized in reports for the expert group's opinions, (ii) the second phase; data collection from experts' interviews and statistical analysis, (iii) the third phase; each expert's determination on Mdn and IR values from the group and consensus conclusion, and (iv) the final phase; training program for teachers created from the research findings and teachers' performance evaluation.

A. Training Program for Teachers

Based on the findings, an ICT training program was created for thirty teachers who were selected by using stratified random sampling method from each basic educational area in Pathum Thani province. In the first semester of the 2014 academic year, an eight-hour training course was conducted in a well-equipped computer room at Rangsit University. The trainees took the pre-tests and post-tests of basic ICT knowledge and competency, and a paired-samples t-test was conducted to compare the test scores in training and no training conditions. The teachers also completed the self-evaluation questionnaires asking for comments relating to the overall program.

V. RESULTS

The data analysis from the survey of the first group of 181 school administrators revealed that ICT competencies for teachers were identified in nine areas, and all Mean averages ranged from high to highest level. The nine ICT competency areas included: (1) General ICT Knowledge, (2) Information Access, (3) Internet Usage, (4) ICT for Communication, (5) Teaching Media Production, (6) ICT for Teaching and Administration, (7) ICT Knowledge Related to Laws, Social, and Ethics, (8) Basic Hardware and Software Usage, and (9) Teachers' Professional Development. The overall survey analysis results showed Mean = 4.25, Mdn = 4.00, SD = 0.58, Coefficient of Variation (CV) = 13.63%, and data interpretation (DI) = high.

The findings indicate that the *highest* ICT competencies requirements were in two areas and four sub components; (1) *Internet Usage* area, two sub components: (3.1) Teachers use Internet as widespread knowledge resource and search for new knowledge and technology, (M = 4.60), followed by (3.2) Ability to teach students in using the Internet for information search, (M = 4.55), and (2) *General ICT Knowledge* area, two sub components: (1.3) Awareness of the ICT necessity towards teaching and learning process (M = 4.56),

followed by (1.2) Knowing the benefits of ICT to education ($M = 4.54$).

The results from the survey of the first group of 181 respondents and from the first round interview of the expert group of twenty showed that the nine ICT competency areas of school administrators were related to what the experts group agreed to be at the same high to highest level. Since the data collection from

the expert group was conducted in an interview, the sub components were to define the ICT areas not for selection; therefore, the Mean ranking method was used in order-ranking of the group. By using average Mean scores and Mean ranking for order-ranking, the data of both groups were tabulated comparing statistical values of mean (M), standard deviation (SD), and ranking in Table I as follows.

TABLE I
RANKING OF THE NINE ICT COMPETENCY AREAS REQUIRED BY THE SCHOOL ADMINISTRATORS ANALYZED BY AVERAGE MEAN (HIGH TO LOW) AND STANDARD DEVIATION (SD) COMPARING TO THE AREAS REQUIRED BY THE EXPERT GROUP ANALYZED BY MEAN RANKING METHOD (LOW TO HIGH).

ICT Competency Areas	School Administrator Group N=181			Expert Group (N= 20)	
	Average Mean	SD	Ranking	Mean Rank	Ranking
General ICT Knowledge	4.44	0.11	1	4.20	2
Internet Usage	4.38	0.18	2	3.75	1
Teachers' Professional Development	4.31	0.02	3	7.05	9
ICT for Communication	4.25	0.10	4	4.85	6
Information Access	4.23	0.08	5	4.55	5
ICT for Teaching and Administration	4.20	0.09	6	4.35	4
ICT Knowledge Related to Laws, Social, and Ethics	4.17	0.13	7	6.80	8
Basic Hardware & Software Usage	4.10	0.12	8	5.20	7
Teaching Media Production	4.05	0.06	9	4.25	3

From Table I, the results reveal that the average Mean scores of nine ICT competency areas of school administrators ranked from the first (highest) which was General ICT Knowledge (Average Mean = 4.44, $SD = 0.11$) followed by Internet Usage (Average Mean = 4.38, $SD = 0.18$), and Teachers' Professional Development (Average Mean = 4.31, $SD = 0.02$) at the second and third places, respectively. By using Mean ranking method, the expert group ranked Internet Usage (Mean rank = 3.75) at the first (lowest) followed by General ICT Knowledge (Mean rank = 4.20), and Teaching Media Production (Mean rank = 4.25) at the second and third places, respectively. Remarkably, comparing to what the school administrators required and the

experts group agreed upon in the ICT competences areas, the ranking of the areas differed insignificantly, such as the first and second places lay between General ICT Knowledge and Internet Usage areas, but the third place (Teachers' Professional Development) alternated with the ninth (Teaching Media Production) contrarily.

The data analysis of the expert group first round interview in nine ICT competency areas were compatible with Standards for Evaluation of propriety, utility, feasibility, and accuracy under the setting of consensus criteria at $Mdn > 3.50$ and $IR < 1.50$ required values showing in Table II as follows:

TABLE II
THE EXPERT GROUP'S OPINIONS ON THE NINE ICT COMPETENCY AREAS RELATED TO THE STANDARDS FOR EVALUATION.

ICT Competency Areas (by experts' ranking)	Expert Group's Opinions on Standards for Evaluation							
	Propriety		Utility		Feasibility		Accuracy	
	Mdn	IR	Mdn	IR	Mdn	IR	Mdn	IR
1. Internet Usage	4.00	1.00	4.00	1.00	4.00	1.00	4.00	1.25
2. General ICT Knowledge	4.00	1.00	4.00	1.00	4.00	1.00	4.00	1.00
3. Teaching Media Production	4.00	1.25	4.00	1.25	4.00	1.25	4.00	2.00
4. ICT for Teaching & Administration	4.00	0.25	4.00	1.00	4.00	0.00	4.00	1.00
5. Information Access	4.00	2.00	4.00	1.00	4.00	1.00	4.00	1.25
6. ICT for Communication	4.00	1.00	5.00	0.25	4.00	1.00	4.00	1.00
7. Basic Hardware & Software Usage	4.00	1.00	4.00	1.00	4.00	0.25	4.00	1.00
8. ICT Knowledge Related to Laws, Social, and Ethics	4.00	2.00	4.00	1.00	4.00	1.00	4.00	2.00
9. Teachers' Professional Development	4.50	1.00	5.00	1.00	4.50	1.00	4.00	1.00

In Table II, the results showed ICT competency areas at the highest Mdn at 5.00 followed by 4.50 and 4.00 respectively, and all scores were higher than 3.50 as set for consensus criteria at $Mdn > 3.50$. Among the nine ICT competency areas, both of Teachers' Professional Development and ICT for Communication areas represented the highest $Mdn = 5.00$ in *Utility*. Teachers' Professional Development indicated $Mdn = 4.50$ in both *Propriety* and *Feasibility* evaluation. In addition, the results showed the lowest IR at 0.25, followed by 1.00, 1.25, and 2.0, respectively. Three ICT competency areas that showed $IR = 2.0$ higher than the setting at 1.50 were Information Access in *Propriety*, ICT Knowledge Related to Laws, Social, and Ethics in *Propriety* and *Accuracy*, and Teaching Media Production in *Accuracy*, however, all three areas gained $Mdn = 4.00$ above the setting at 3.50. According to the second round of questionnaires, asking the experts to reconsider the first round results of the group, two experts made a few minor adjustments and the second round results of Mdn and IR values remained

unchanged. Since the final experts' judgment as determined by the equal weighting of the estimates of the experts on this second round, the procedure of conducting a further round was discontinued as the responses showed stability. Based on the results, an ICT training program was created for thirty teachers who were selected by stratified random sampling method in school service areas in Pathum Thani province. The course included five components: (i) *General ICT Knowledge*, (ii) *Internet Usage*, (iii) *ICT for Communication*, (iv) *Teaching Media Production*, *Information Access*, *ICT for Teaching and Administration*, *Basic Hardware & Software Usage*, and *Teachers' Professional Development*, and (v) *ICT Knowledge Related to Laws, Social, and Ethics*. The trainees took the pre-tests and post-tests, and a paired-sample t-tests were conducted to compare the test scores in before training and after training conditions, the paired samples statistics and paired samples test including two-tailed significance level are shown in Table III and Table IV as follows.

TABLE III
THE PAIRED-SAMPLES T-TEST OF THIRTY TEACHERS IN PRE-TESTS AND POST-TESTS SHOWING MEAN, SD AND STANDARD (STD.) ERROR MEAN.

Paired Samples Statistics				
	Mean	N	SD	Std. Error Mean
Pre-tests	1.32	30	1.30	0.24
Post-tests	8.72	30	1.69	0.31

* paired samples correlations = 0.582, Sig. = 0.001

TABLE IV
THE PAIRED-SAMPLES T-TEST OF THIRTY TEACHERS IN PRE-TESTS AND POST-TESTS
SHOWING PAIRED DIFFERENCES OF MEAN, SD, STD. ERROR MEAN, AND 99% CONFIDENCE
INTERVAL OF THE DIFFERENCE, T AND DF VALUES, AND TWO-TAILED SIGNIFICANCE LEVEL

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	SD	Std. Error Mean	99% Confidence Interval of the Difference				
				Lower	Upper			
Pre -Post	-7.40	1.41	0.26	-7.93	-6.87	-28.77	29	.000

*p < 0.01, df = 29, and $\alpha = 0.01$

The paired-samples t-test was analyzed and the results show a significant difference of before and after training. Remarkably, the results illustrate that after the teachers were trained, the results of test the scores increased significantly. The thirty teachers also completed the self-evaluation questionnaires of 24 items asking for comments relating to the training program. The over-all training program evaluation resulted M = 4.62, SD = 0.35, CV = 7.62%, and α level = 0.01 which represented the *highest* level of trainee satisfaction.

VI. DISCUSSION

The research findings in this study importantly indicate that the school administrators' requirements on nine ICT competency areas for their teachers are in agreement with the expert group opinions at high to highest level. This finding also indicates that both groups agree that Internet usage can bring teachers and schools great benefits such as online pedagogy provides teachers with minimum cost materials, motivates the students to have confidence to express themselves, brings schools and communities closer together, allows expanded opportunities for mentoring, and allows for keeping in contact with societies with no limits of time and place. This confirms that, in this digital era of the Internet, the teachers should be encouraged to use technology and media communication in teaching [6].

VII. CONCLUSION

Based on the findings, the results of this study endorse what the expert group

determined as nine ICT competency areas the same as the school administrators at the highest level. Though ranking positions among nine areas found were in different places, Internet Usage and General ICT knowledge ranked first and second highest in both results. More importantly, the results from the experts on *Teachers' Professional Development* area represented the highest level in *Utility*, *Propriety*, and *Feasibility* evaluations, which shows that ICT competency is found to be significant and one of the more important factors related to teachers' professional development.

ACKNOWLEDGEMENT

This research was funded by Rangsit Research Institution, Rangsit University Thailand under the grant number of 77/2555.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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