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**INSTRUCTIONAL INNOVATIONS: TEACHERS' INVALUABLE TOOLS
FOR STUDENTS' ACADEMIC SUCCESS**

Abstract:

This study aims to explore and compare pre-service teachers' use of instructional innovations. A sample of 250 pre-service teachers from different major fields was selected using stratified random sampling. Primary data were collected through a questionnaire consisting of two sections: 1) background information; and 2) the use of instructional innovations. The data were analyzed using the one-way ANOVA test and the post-hoc Scheffé's test. The findings reveal that instructional innovations were mostly used in the 'implementation' stage ($M = 4.04$, $SD = 0.42$). In addition, user-friendliness towards technology was the most influential factor when determining the use of instructional innovations, followed by convenience of the innovations' application, conformity to learning management, the expense, and training, respectively. The use of instructional innovations between pre-service teachers from different major fields was significantly different, with a significance level of 0.05.

Keywords:

Instructional innovations, pre-service teachers, teaching approaches, teaching practicum

JEL Classification: I29

Introduction

Education is the process which helps develop people's thinking processes and skills; it is therefore considered to be a very important process in human development. Supported by the internet and social networks, modern education—which is understood to be an open learning platform—has become faster and more accessible. That is, students are exposed to all kinds of information from around the world without facing the limitations of time, distance, or location. However, at all levels in Thailand, education has been urged to undergo reform in order to keep pace with the rapidly changing world and new educational standards. It is suggested that in the era of Thailand 4.0, education should strive to produce teachers who encourage students' thinking process rather than memorizing content. Subsequently, high marks in exams should not be a top priority, and lectures should be minimized. Instead, problem-based and active learning should be implemented since they boost student-centeredness. In this regard, students are allowed to make full use of their knowledge to solve problems in a sequential manner, helping them keep up with the world and apply their knowledge in their lives (Walton & Matthews, 1989). With regards to curriculum development, teachers should pay attention to their students' needs and interests, and provide them with opportunities to apply their knowledge and skills in a wide variety of major fields. With an emphasis on teaching and learning management based on the competency-based approach, students can apply learning methods and innovations by integrating technology into teaching and learning in a way which emphasizes critical thinking and other advanced thinking skills.

Innovation refers to a concept, practice, or new invention that has never been used before, or which has been adapted from an existing one in a way which makes it more effective. Applying innovation helps to increase efficiency and effectiveness, while it can also save time and labor (Tweesak, 2016). Modern teaching and learning management is involved with a variety of innovative methods so that it can respond to the needs of students of Generation X and Y. Previous literature asserts that these learners are far more interested in media containing images and animations compared to traditional media format and content. For this reason, educational institutions and teachers should take a creative direction rather than following old-fashioned methods. Developing learners' technological literacy and creativity to develop new innovations is no less important than other academic skills, since they allow students to challenge themselves by thinking about how their learning can be made more productive and result in better achievements and high national education quality (Pasana, 2018).

The main goal of the teaching and learning at the Department of Curriculum and Instruction, Faculty of Education, Ramkhamhaeng University, is to produce graduates with the knowledge, abilities, and skills in the teaching profession. The pre-service teachers are expected to become effective, professional teachers and educators who

are able to transfer their knowledge and experiences to their own students. As a partial fulfilment of the graduation requirement, students must undergo teaching practicum, involving teaching in real school settings. During this time, the pre-service teachers practice the actual teaching and learning instructional innovations. These experiences are one of the most important factors that help them to more easily understand the lesson content and activate the students' interests and achieve desirable outcomes.

Given the importance of instructional innovations, the researchers are interested in exploring the guidelines for pre-service teachers to use instructional innovations while undergoing teaching practicum. The primary objectives of this study were:

- 1) to investigate the use of instructional innovations among pre-service teachers in the teaching practicum program;
- 2) to identify influential factors affecting the use of instructional innovations, and;
- 3) to compare the use of instructional innovations among pre-service teachers from different major fields.

It was hypothesized that the pre-service teachers from different major fields would use different instructional innovations. The findings of the study will be used to further enhance pre-service teachers' experience in using instructional innovations.

3. Methods

The study population included 716 pre-service teachers who were enrolled in the teaching practicum program in the Department of Curriculum and Instruction, Faculty of Education, Ramkhamhaeng University during the first semester of the 2018 academic year. The sample size was determined using the finished table of Krejcie and Morgan at a confidence level of 95%. After applying the stratified random sampling technique, the final sample group comprised 250 pre-service teachers. The variables are classified into two types: ten major fields as an independent variable, and factors in accepting instructional innovations as a dependent variable, based on Roger's concept for learning materials and management (Roger, 2003).

With regards to data collection, a questionnaire with a five-point scale was carried out to investigate the pre-service teachers' use of instructional innovations. The questionnaire included two sections with sub-sections as follows:

Section 1: Background information.

Section 2: Use of instructional innovations

Part 1 contained 21 items about the use of instructional innovations in accordance with Rogers' (2003) five decision-making stages in the decision innovation process: knowledge, persuasion, decision, implementation, and confirmation.

Part 2 posed questions regarding the factors affecting the use of instructional innovations, in terms of the instruction innovation characteristics, using 21-item checklist which was tested for reliability and achieved a reliability score of 0.93.

After the distribution of a set of questionnaire to the participants, all the participants completed and returned the questionnaires, with a return rate of 100%. The researchers analyzed the data by employing: 1) the frequency and percentage of each item in the background information section; 2) the means (\bar{x}) and standard deviation (SD) of each category on the use of instructional innovations; and 3) the one-way ANOVA test to compare differences of responses among different major fields, as well as the means of any significant differences with the post-hoc Scheffé's test.

Findings

This section presents the findings in accordance with the aforementioned sections of the questionnaire.

Section 1: Basic Information

The respondents included 229 females, representing 91.60% of the total sample, and 21 males representing 8.4% of the total sample. One-hundred and eighty-seven of the respondents (74.8%) were enrolled in the *Teaching Practicum 1* course, while the rest (25.20%) were in the *Teaching Practicum 2* course. The participants were also divided into different major fields: Early Childhood Education (23.2%), Thai (20%), Social Studies (17.6%), Elementary Education (12%), Mathematics (11.2%), Science (6.8%), Arts (3.2%), English (2.8%), Computer Education (2.0%), and Chinese-major students (0.8%).

Section 2: Use of Instructional Innovations

Table 1 demonstrates the use of instructional innovations by pre-service teachers.

Table 1: Means (\bar{x}) and standard deviations (SD) of the use of instructional innovations by pre-service teachers

Instructional innovations	\bar{x}	SD	Stage	Ranking
1. Flipped classroom	3.84	1.26	Implementation	14
2. Line	4.26	0.90	Implementation	5
3. Messenger	4.07	1.35	Implementation	10
4. Blog/weblog	3.80	1.27	Implementation	15
5. Web board	3.79	1.36	Implementation	16
6. Interactive board	3.71	1.39	Implementation	18
7. Electronic book	4.07	1.45	Implementation	9

Instructional innovations	\bar{X}	SD	Stage	Ranking
8. Mobile learning	4.17	0.90	Implementation	8
9. Infographics	4.25	1.14	Implementation	6
10. Second life	3.71	1.38	Implementation	19
11. E-learning	3.75	1.38	Implementation	17
12. Augmented reality	3.69	1.41	Implementation	20
13. Game for education	4.37	1.22	Implementation	3
14. Graphic presentation program	4.57	0.71	Decision and Implementation	2
15. VDO/Clip VDO	4.30	0.93	Implementation	4
16. Computer Assisted Instruction	3.98	1.38	Implementation	12
17. Educational television channels	3.85	1.28	Implementation	13
18. Website for education	4.00	1.37	Implementation	11
19. Google Classroom	4.71	0.69	Decision and Implementation	1
20. Facebook	4.24	1.32	Implementation	7
21. Powtoon, Prezi, and Plickers	3.68	1.39	Implementation	21
Total	4.04	0.42	Implementation	

Table 1 indicates that the pre-service teachers' use of instructional innovations was mostly during the 'implementation' stage ($\bar{x} = 4.04$, $SD = 0.42$). Considering individual instruction innovations reveals three most frequently used instructional innovations: Google Classroom ($\bar{x} = 4.71$, $SD = 0.69$), Graphic Presentation Program ($\bar{x} = 4.57$, $SD = 0.71$), and Game for Education ($\bar{x} = 4.37$, $SD = 1.22$), respectively.

Table 2: Factors influencing pre-service teachers' use of instructional innovations

No.	Factors	N	%	Ranking
1.	Expense	260	8.34	4
2.	User-friendliness of technology	1,596	51.20	1
3.	Convenience of innovations' application	868	27.90	2
4.	Training	76	2.44	5
5.	Conformity to learning management	316	10.10	3
	Total	3,116	100	

The findings in Table 2 suggest that the most influential factor was user-friendliness of the technology (51.20%) followed by convenience of the innovations' application (27.90%), conformity to learning management (10.10%), expense (8.34%), and training (2.44%), respectively.

Table 3: Analysis of variance for comparing the use of instructional innovations between majors

Instructional innovations	Sum of Squares	Df	Mean Squares	F	Sig.	Post Hoc
1. Flipped Classroom Between Groups Within Groups Total	77.85 315.75 393.60	9 240 249	8.65 1.32	6.58*	0.00	- Elementary Education, Thai, Mathematics, Science > Social Studies
2. Line Between Groups Within Groups Total	14.24 183.37 197.62	9 240 249	1.58 0.76	2.07*	0.03	- Mathematics, Art Education > Chinese
3. Messenger Between Groups Within Groups Total	74.08 380.62 454.70	9 240 249	8.23 1.59	5.19*	0.00	- Thai, Social Studies > Early Childhood
4. Blog / weblog Between Groups Within Groups Total	73.06 330.34 403.40	9 240 249	8.12 1.38	5.90*	0.00	- Mathematics, Science > Social Studies
5. Web board Between Groups Within Groups Total	65.39 396.37 461.76	9 240 249	7.27 1.65	4.40*	0.00	- Mathematics > Social Studies
6. Interactive Board Between Groups Within Groups Total	105.19 378.49 483.68	9 240 249	11.69 1.58	7.41*	0.00	- Mathematics, Science>Early Childhood - Elementary Education, Thai, English Mathematics, Science, Social Studies > Art Education
7. Electronic book Between Groups Within Groups Total	42.01 478.69 520.70	9 240 249	4.67 1.99	2.34*	0.02	- Art Education > Early Childhood, Thai, Mathematics
8. Mobile Learning Between Groups Within Groups Total	26.96 175.98 202.94	9 240 249	3.00 0.73	4.09*	0.00	- Chinese > Early Childhood, Elementary Education, Thai - Elementary Education, Chinese > Science - Social Studies >English, Science - Chinese > Social Studies - Art Education > Early Childhood, Elementary Education, Thai, Science, Social Studies - Computer Education > Early Childhood, Elementary Education, Thai, Science
9. Infographics Between Groups Within Groups Total	22.70 299.93 322.62	9 240 249	2.52 1.25	2.02*	0.04	- Chinese > Early Childhood, Elementary Education, Thai - Chinese > Science, Social Studies
10. Second Life Between Groups Within Groups Total	58.57 413.12 471.68	9 240 249	6.51 1.72	3.78*	0.00	- Mathematics > Social Studies
11. e-learning						- Early Childhood, Thai, Mathematics >

Instructional innovations	Sum of Squares	Df	Mean Squares	F	Sig.	Post Hoc
Between Groups	90.12	9	10.01	6.28*	0.00	Social Studies
Within Groups	382.50	240	1.59			
Total	472.62	249				
12. Augmented Reality						- Early Childhood, Social Studies > Thai
Between Groups	61.88	9	6.88	3.83*	0.00	
Within Groups	431.40	240	1.80			
Total	493.28	249				
13. Game for Education						- Early Childhood, Elementary Education Thai, Mathematics > Social Studies
Between Groups	78.23	9	8.69	7.09*	0.00	
Within Groups	294.17	240	1.23			
Total	372.40	249				
14. Graphic Presentation Program						- English>Early Childhood, Elementary Education, Thai - Chinese > Early Childhood, Elementary Education, Thai - Mathematics > Early Childhood, Elementary Education, Thai
Between Groups	10.14	9	1.13	2.35*	0.01	
Within Groups	115.06	240	0.48			
Total	125.20	249				
15. VDO /Clip VDO						- Chinese > Early Childhood, Elementary Education, Thai, English - Art Education > Early Childhood, Thai, English - Computer Education > Early Childhood, Elementary Education, Thai, English, Science
Between Groups	15.74	9	1.75	2.09*	0.03	
Within Groups	200.76	240	0.84			
Total	216.50	249				
16. Computer Assisted Instruction						- Thai, Social Studies>Early Childhood
Between Groups	61.68	9	6.85	3.99*	0.00	
Within Groups	412.26	240	1.72			
Total	473.94	249				
17. Educational Television Channels						- Mathematics > Social Studies - Thai, Social Studies > Art Education
Between Groups	75.66	9	8.41	6.08*	0.00	
Within Groups	331.87	240	1.38			
Total	407.52	249				
18. Website for Education						- Mathematics > Social Studies
Between Groups	48.56	9	5.40	3.12*	0.00	
Within Groups	415.44	240	1.73			
Total	464.00	249				
19. Google Classroom						- Chinese > Early Childhood, Elementary Education - Social Studies > English - Computer Education > Early Childhood, Elementary Education, Thai, English, Mathematics, Science, Social Studies, Art Education
Between Groups	9.73	9	1.08	2.40*	0.01	
Within Groups	107.96	240	0.45			
Total	117.68	249				
20. Facebook						- Early Childhood > Thai
	80.19	9	8.91	6.08*	0.00	

Instructional innovations	Sum of Squares	Df	Mean Squares	F	Sig.	Post Hoc
Between Groups	351.92	240	1.47			- Social Studies > Thai
Within Groups	432.12	249				
Total						
21. Powtoon, Prezi, Plickers	65.83	9	7.31	4.26*	0.00	- Mathematics > Social Studies
Between Groups	412.21	240	1.72			
Within Groups	478.04	249				
Total						
22. Total						- Social Studies > Early Childhood, Thai, English
Between Groups	9.96	9	1.11	7.72*	0.00	
Within Groups	34.41	240	0.14			
Total	44.37	249				

*p<0.05

The statistical analysis confirms that there was a variance in the use of instructional innovations between the majors, with a significance level of 0.05.

Discussion and Conclusions

Based on the findings of the current study, this section provides an in-depth discussion of the findings to shed light on recommendations for future research.

1. In response to the first objective, the researchers found that the pre-service teachers used instructional innovations the most during the 'implementation' stage, which is at level four in Rogers' (2003) five stages of the innovation-decision process. This means that the pre-service teachers accepted the three preceding steps of acknowledging the value of the developed innovation, perceived it as interesting and worthwhile, and made a decision to adopt it. Furthermore, it suggests that the pre-service teachers had realized, were interested in, and had implemented the innovations in their classrooms.

2. For the second objective, it was found that the user-friendliness of technology was the most crucial factor affecting the use of instructional innovations (51.20%), followed by convenience of the innovations' application (27.90%), conformity to learning management (10.10%), expense (8.34%), and training (2.44%), respectively. These findings concur with Baek, Jung, and Kim's (2008) study which revealed that the factors affecting teachers' use of technology included adaptability to external technology, expectations of teacher roles, the convenience of technological applications, and the ability to manage classrooms and handle advanced technology. They also added that most teachers intend to use technology to support teaching and learning, and many experienced teachers often decide to use instructional innovations as they are on-trend. However, less experienced teachers are likely to use instructional innovations in response to their own needs. Further, training on a particular instructional innovation may result in increased acceptance of that innovation (Mooij & Smeets, 2001; Tondeur et al., 2008).

3. To address the third objective, the researchers compared the use of instructional innovations among the pre-service teachers from different major fields. The analysis yields a statistically significant difference between the different major fields in terms of the pre-service teachers' use of instructional innovations. The difference in major fields implies differences in content knowledge, aptitude, interest, and ability to recognize and use instructional innovations. Sang et al. (2010) reported that the ability to use computers and computer attitude affects the use of ICT among pre-service teachers from different major fields.

With regards to the use of each instructional innovation, the instructional innovations used by the pre-service social studies teachers were the most diverse, to a total of seven different innovations, including flipped classroom, blog or weblog, web board, mobile learning, augmented reality, Google Classroom, and Facebook. This may stem from those students' exposure to a wide variety of instructional innovations during their early years' courses, such as *Innovations in Social Studies* and *Analysis of Social Studies Instructional Media*, both of which touch on teaching, creating, and using innovations for teaching and learning. They were also allowed to experiment with innovative designs to develop teaching materials. Subsequently, the pre-service Social Studies teachers were equipped with basic knowledge, familiarity, and experience with a wide range of instructional innovations.

Implications and Recommendations for Future Research

Training on the use of instructional innovations should be provided to pre-service teachers to prepare them for modern innovations and to guide them on the correct use of innovations. Future research should investigate the use of instructional innovations of teachers at other levels, such as early childhood education, basic education, vocational education, and tertiary education, since the findings can be used to improve the long-term use of instructional innovations.

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