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# A Prototype of Google Dialog Flow for School Teachers' Uses in Conducting Classroom Research

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**Abstract:** The main purpose of the study is to develop a prototype of Google Dialog Flow (Dialog flow) for interacting with in-service school teachers on the content relating to the classroom research. The project has been carried out since the early of May 2020 and is still ongoing. This paper presenting the progress report as of October 2020 focuses on the description of how well the first version of the dialogue prototype can be applied to interact with the teachers; and how the prototype can be improved to engage the teachers to use chatbots in self-taught and improve their research skills. The trial prototype was carried out for the first time in a public school in Bangkok, Thailand. Thirty teacher participants had used the chatbots for their interaction via LINE application for a period of two months during June-July 2020. Data collection included pre-test and post-test assessments, chat logs and interviews. The results of the study showed a significant improvement in teacher performance. The prototype received positive feedback. However, key areas of improvement include adding case-based contents, improving humanistic setting and creating a better design for keyword suggestion tools.

**Keywords**: Artificial intelligence, Chatbot, Teacher professional development, Classroom research, Dialog flow.

## Introduction

This study has been conducted as part of a research project named "Artificial Intelligence for Teacher Professional Development on Classroom Research" funded by the National Research Council of Thailand. The development of teachers' research skill in Thailand relies heavily on traditional practices: lectures, workshops, and personal consultations. This project has sought new ways of teacher professional development that allow teachers to continue improving their research skills at their own pace. Particularly when the COVID-19 outbreak has occurred, the new practices of teacher professional development that allows social distancing is vital.

## Background of Development of Teachers' Research Skills in Thailand

Conducting classroom research work is widely acknowledged to become an important aspect in the teacher professional development and it could affect the quality improvement of teaching and learning. As stipulated by the Thai Teachers and Educational Personnel Act B.E. 2546 (2003), the Teachers' Council of Thailand (TCT) has duties to promote education and research relating to the practice of the Profession; and thus, it sets out professional standards for teachers to include the teachers' knowledge in educational research (The Teachers' Council of Thailand, 2005). The Office of the Teacher Civil Service and Education Personnel Commission (OTEPC) also requires classroom research work as one of the criterion for the annual evaluation and promotion of teacher academic ranks (Office of the Teacher Civil Service and Education Personnel Commission, 2010).

Previous studies on the workshop seminars organized for the development of teachers' research skills in Thailand can be divided into three different types including 1) workshops on the development of the



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content knowledge 2) workshops on specific needs and 3) workshops on advice and support giving system.

The first type of workshops on “the development of the content knowledge” is very common in Thailand and appears to focus on teachers’ knowledge on research skills acquired from a research course they took during their pre-service years. The previous studies showed a positive result of this type of training. Most participants in studies reflected that they significantly had a better understanding of the research procedures (Boonthao et al., 2014; Kakkaew et al., 2017; Chaiwong et al., 2018; Linsri & Sanrattana, 2013). Many participants felt more confident to conduct their own research after participating in the training (Kunlasomboon et al., 2015). Nevertheless, the training was found to be a time-consuming process. Some researchers pointed out that the time the teachers have spent on the training did not correlate with the result of the teachers’ research capacity development. Many teachers may spend several hours attending the training workshops; yet they may not apply the knowledge acquired from the training to perform any classroom research work (Chaiwong et al., 2018). Some of the other studies indicated that teachers have had a lot of responsibilities to carry out within the time limit (Weerachan et al., 2015; Sophakayang et al., 2013). Thus, it is questionable if the teachers would have time to conduct research studies or continue their self-studies after the training and how the teachers’ research skills would be sustained after attending those workshops.

The second type of workshops is on “specific needs”; this type of training may be involved with the teacher’s requirement to use their research knowledge to do some specific tasks. The studies indicated that the teachers usually requested to learn specific content in developing research skills including statistical methods (Linsri & Sanrattana, 2013) and creating measurement tools (Detkhan, 2015). For example, the teachers need to indicate the average T-scores of students’ performances both before and after the instructional intervention in the teacher’s evaluation form of Wor17/2552 (in Thai, ว17/2552) issued by the Office of the Teacher Civil Service and Education Personnel Commission or OTEPC (Office of the Teacher Civil Service and Education Personnel Commission, 2013, p.47). This may imply that the criteria of teachers’ evaluation for applying to new positions and academic ranks would require the teachers’ knowledge and skills in conducting statistical analysis in their research work (Office of the Teacher Civil Service and Education Personnel Commission, 2013).

Although the teachers have been familiar with the specific requirement of conducting statistical analysis on the research for decades, they had to face with changes in policy when the OTEPC has amended the criteria for applying to the new positions namely Wor21/2560 (OTEPC, 2018). The amended criteria neither require the teacher’s evaluation form of Wor17/2552 nor the statistical report anymore. However, the amended criteria do not state how the research work would be required for any specific contexts or tasks and this has become challenges for the teachers to develop better research skills for any specific jobs.

The third type of workshops is in a form of “advice and support giving system.” This system varies from receiving classroom observation feedback from a teacher supervisor (in Thai, Suk-sa-ni-taed), receiving a consultation from academic experts and exchanging ideas during a local professional learning community, etc. The system allows the teachers to personally consult with experienced researchers regarding their research topics and issues during the process of conducting research (Chaiwong et al., 2018; Chantapassa et al., 2014; Kongkhao et al., 2016). Nevertheless, this system appears have some disadvantages on the limited number of the available experts giving consultation to teachers. Moreover, due to the teachers’ different background and knowledge in research practices, those who may possess basic knowledge of conducting research may ask the experts tedious questions which can underutilize the consulting time of the experts.

According to the literature, teachers’ research skill development in Thailand relies heavily on traditional practices including lectures, conferences, workshops, seminars and personal consultations. The

practices usually require teachers' attendance during face-to-face training and the training period varies from one to three days. Although they are faced time constraint, still they had to find the time to attend the training. This could be questionable if this type of training is considered to be cost or time effective if the teacher do not have time to actually conduct research studies or continued their self-studies after the training.

In regard to the situation of the COVID-19 pandemic, the new practice of teacher professional development is now crucial keeping in view the guidelines by Government for social distancing. This project has therefore sought new ways of teacher professional development that allow teachers to continue improving their research skills at their own pace, while the teachers are physically distant. The artificial intelligence (AI) system has been created to support the teachers to gain self-learning access on essential knowledge in doing research before seeking to consult with the experts.

### *Chatbots for Educational Purpose*

Natural language processing (NLP) technology is a branch of artificial intelligence (AI) that studies how machines understand human language. The NLP technology uses a chatbot, an AI program that simulates interactives human conversation by using key pre-calculated user phrases and auditory or text-based signals (The Thai Teachers and Educational Personnel Act B.E. 2546, 2003), to assist organizations to decrease unnecessary employment (Boulay, 2016) by handling recurring tasks, repetitive conversations and questions (Young, 2018). In education, a number of universities have used the NLP technology to create virtual teaching assistants to support their students. The students can receive information and inquire about timetables through the virtual interactions (Lipko, 2016). Furthermore, the research studies on technology for teacher development in the field of language teaching were very extensive including the Computer Assisted Language Learning (CALL) program (Torsani, 2016). Many studies revealed that the training on the application of NLP technology for language education focused on assisting the teachers to use technology tools to support language teaching (see Haines, 2015; Kessler & Hubbard, 2017; Link et al., 2014; Shermis & Burstein, 2013). In addition, there have recently been a few attempts to utilize the NLP technology in generating feedbacks on teachers' discourse in real classrooms in order to improve the teachers' oral language usage (Jensen et al., 2020; Meurice & Meunier, 2020). However, these efforts are mainly made in the field of language education.

The prospect system in this project used Google technology i.e. Google Dialog Flow (GDF) to design a dialog prototype to interact with the teachers about basic knowledge of classroom research. The GDF is a cloud-based application using NLP technology to build chatbots for different purposes. Various research studies on use of chatbots for educational purposes have showed positive feedbacks including time saving, handling repetitive tasks, and completing tasks that did not need human to process. Study by Ondáš et al. (2019) used the GDF platform in teaching science-related subjects, to develop three chatbots for supporting education in the Department of Electronics and Multimedia Communications, Technical University of Kosice. One of the chatbots played the role of a virtual teacher in answering the students' questions about the assignments and helped the students to spend time efficiently in their studies. It was easy to interact with as compared to browsing the internet. Shaw (2016) used a chatbot as a virtual teacher assistant to interact with the students in science and mathematics classes. The virtual teacher reminded the students about the assignments, interacted with the students, collected the students' answers in order to prepare the statistical data for the students and send the data back to them to allow them to see their own progress.

Pham et al. (2018) used a chatbot in the mobile application to support English learning. Users could develop vocabulary, learn grammar, take quizzes and practice the English language in chatrooms. The results of the research study suggested that a chatbot with user friendly features would be the most suitable application for content learning in education. Similarly, a domain-specific chatbot was created

and implemented in English as a second language (ESL) classroom (Louis & Cocquio, 2019). The bot was tested on its usability and the result showed that it was able to understand and to respond intelligently to most of the ESL students' inquiries.

Because of its advantages, the research studies on chatbots used for educational purposes around the world are continuing to grow, especially for supporting and facilitating learning in both normal classrooms and non-formal learning (Georgescu, 2018). Nevertheless, the potential of chatbots for supporting informal learning is immense. Chatbots could be a useful tool to promote lifelong learning and to encourage those who may be interested in informal learning. The teachers who have time constraint could use the chatbots to avail an opportunity for participating in their professional development. This research project has therefore proposed to create a system to support the teachers to continue their learning and improving research skills by interacting with a chatbot namely the AI-CAR. The chatbot would also be a helpful tool for those who may not want to ask questions in public; the teachers could use the bot for asking private ask questions. The dialog prototype will allow them to inquire about some information they may not want to directly ask the experts.

### *The Design of AI-CAR Prototype*

In this study, the researchers adapted the dialog flow platform proposed by Reyes et al. (2019) to create a chatbot. The process was divided into two main steps: 1) creating knowledge abstraction and 2) conducting response generation.

*1) Creating the knowledge abstraction*

Many teachers' questions are found to be very contextual due to the nature of the teaching job and may not focus on any course content or syllabus outline. Thus, the topics of content were organized to be less formal and less theoretical. In this regard, we referred to a practical framework called the Research Skill Development Framework (RSD) (Willison & O'Regan, 2007; Willison & O'Regan, 2008) divides the research skills into six facets including 1) Embark and clarify, 2) Find and generate, 3) Evaluate and reflect, 4) Organize and manage, 5) Analyze and synthesize and 6) Communicate and apply

After organizing the topics of content, a list of possible questions was created according to each facet; yet, the questions may not derive from frequently asked questions about some research methods. The users of this system are in-service teachers whose questions regarding conducting the research practices may be relevant to the context. The questions and answers which are both theoretical and practice-based were created to find how the teachers interact with them. Keywords and concepts were determined in order to find connections between questions and their facets. Then, the correlations among the questions and answers were checked.

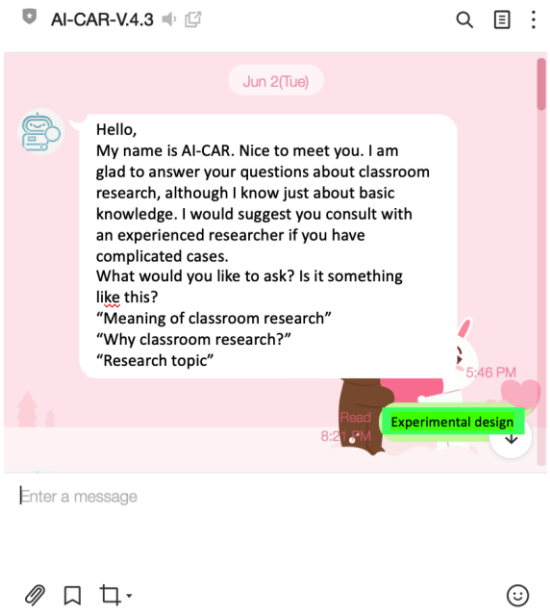
*2) Conducting the response generation*

The "context" and "training examples" were designed (Reyes et al., 2019) to facilitate the teachers' activation of intents as much as possible. Some important contexts relating to classroom research included in the responses are students' ages, students' conditions, grade levels, subject areas, etc. Pictures and tables are added in the responses in order for the responses to be attractive and interesting.

As stated in the previous research, there was a concern on the use of intents in Thai, the chatbots were thus tried out by a group of networked teachers before this research project was officially kicked off. It was found from the result of the trial that the teachers sometimes produced incorrect spelling, especially with using the wrong Thai tone marks or special characters. They sometimes used their own terms rather than the theoretical terms in research methodology. This is because the Thai words can be written in many variations and one word could have different meanings depending on the contexts. Although

those variations are understandable by human, it may not be practical for the AI to detect those words. This has caused mismatching of the intents. For example, there are two technical terms that the Thai teachers may use in the research practices including “Krueng-mue-wi-jai” which literally means “a research tool” in English and “Baeb-tod-sob” which means “a test”. The teachers may use the terms “Krueng-mue-wi-jai” to refer to “a test” instead of using “Baeb-tod-sob.” Although using the word “Krueng-mue-wi-jai” or “a research tool” would be too broad to find out about the pre-test or post-test tools, the Thai teachers preferred not to use the word “Baeb-tod-sob” which actually means “a test.” Thus, the language variation of Thai may not allow for the intents to include all related words; otherwise, there will be too many keywords for each concept. At this moment, the work on finding appropriate keywords to be used for the intents is in progress and the unambiguous words would be avoided, as much as possible.

In regards to the discussion relating to the research methodology, the teachers would prefer using the terms related to the research. In order to avoid typo errors a “Suggested Keywords” was added in every response (see picture 1). These keywords are similar to “suggested questions” in the frequently asked questions. Teachers may copy the suggested keywords for their questions instead of typing the whole sentence. This will save time on finding and typing words, prevent misspelling and indirectly guide the teachers to understand what the next topic could be and what questions they could ask.




**Picture 1.** Keyword suggestion tool

Finally, yet importantly, this chatbot was not created as part of the learning environment as discussed in the previous studies. The ultimate goal is to create the chatbot that can be an “independent system.” In this study, the dialog prototype was launched after a training program was conducted and the teachers were invited to add LINE ID of the AI-CAR to chat with. The plan of the training program, the pre-test/post-test assessments and the dialog prototype were designed to be similar to other normal online training. All relating documents were reviewed by five experts from three different fields including classroom research, information technology, and curriculum and instructions. The researchers then revised the plan of the training program, pre-test/post-test assessment and the dialog prototype based on the feedbacks received from the experts. However, the chatbot was not made to be included as a part of the training program.

***Research questions***

This study aims at exploring teachers' attitudes and behaviors towards using the AI-CAR and assessing teachers' performance. It investigates how teachers are receptive to new ways of learning and how they perform on the pre-test and the post-test assessments. Our research questions are as follows:

1. Is there any significance between the pre-test and the post-test in terms of performance?
2. What are teachers' perceptions towards the dialog prototype?
3. Which topics related to classroom research are inquired by the teachers?

In regard to the research questions no.1, the hypotheses postulated for this study are as follows:

$H_0$: There is no significant difference between pre-test and post-test results in terms of teacher performance.

$H_1$: There is a significant difference between pre-test and post-test results in terms of teacher performance

## Methodology

There were three main stages in conducting this study. The first stage was during March – May 2020. We created the AI-CAR system as explained in the "Design of AI-CAR Prototype" section. The second stage was in the end of May 2020. A two-day online training session of classroom research was conducted in a public school in Bangkok. 92 teachers attended the training session. All teachers had taken pre-test and post-test assessments for their performance measurement. After the training, 30 teachers volunteered to participated in this study. Thus, data from pre-test and post-test assessment used in this study came from only 30 teacher participants. The third stage was during June-August 2020, the teacher participants had used AI-CAR for two months. Then, the interviews were conducted in early August 2020. The quantitative data from the pre-test and post-test assessments was used for the comparison of results and hypothesis testing. The qualitative data from the interviews was used to analyzed teachers' perceptions towards the dialog prototype.

The pre-test and post-test assessment took the form of a 30 multiple choice quiz questions with four possible answers. The assessment mainly evaluates teachers' fundamental knowledge of research methodology including research title, literature review, research framework, research questions, hypothesis, research methods, research tools, data collection, data analysis and research ethics. Table 1 presents the items mapping in regard with the cognitive level of Bloom's Taxonomy (2001). The post-test assessment was conducted two months later in order to avoid recall effect of the pre-test.

**Table 1.** The item mapping between topics, question items, and the cognitive level of Bloom's taxonomy (2001)

| | Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|---|
| **Research title** | | Q28 | Q8 | | | |
| **Literature review** | | | Q22 | | Q29 | |
| **Research framework** | | Q6, Q16 | | | | |
| **Research question** | | | Q7 | | Q30 | |
| **Hypothesis** | | Q9,Q19, Q20 | Q18 | | | |
| **Research methods** | | Q1,Q2,Q3,Q17,Q21 | Q24 | | | |
| **Research tool** | Q5,Q14 | Q15 | Q23 | | | |
| **Data collection** | Q13 | Q1,Q25 | | | | |
| **Data analysis** | Q10,Q11,Q12 | Q4 | | | | |
| **Research ethics** | | Q27 | Q26 | | | |

The AI-CAR was introduced to 30 volunteer teacher participants. They were informed that they would have approximately two months to chat with the AI-CAR via LINE application. In the beginning of August 2020, each teacher participant was interviewed by the first author for 20 minutes. Semi-structured interview technique was used to create questions (see Table 2) for the discussion with the teacher

regarding their perceptions toward the AI-CAR. Chat logs were downloaded for the researcher to read and to be used as a medium for the interview with each participant. Interview data was saturated after 10 interviews and the interview stopped.

**Table 2.** Questions for the interviews

| | |
|---|---|
| 1. | What do you think of the AI-CAR in general? |
| 2. | Could you share good/bad experiences of using the AI-CAR? |
| 3. | Did you receive all information you are looking for? What else should be included? |
| 4. | How well did the AI-CAR explain about classroom research? |

To answer the research questions, the two sets of data including both the quantitative and qualitative data were used. The quantitative data received from the pre-test and the post-test assessments of 30 volunteer teachers were used to compare the differences and to answer the research question number 1. The qualitative data from chat logs and interviews were analyzed to answer the research question number 2 and number 3.

## Research Findings

The findings of the study include three aspects as follows: 1) Teachers' performance after using the AI-CAR, 2) Teachers' attitudes towards the AI-CAR dialog prototype and 3) Topics of the teachers' interests. The details of each aspect are described below:

*1) Teachers' Performance after Using Chatbots*

In this study, teacher participants are relatively young. More than half of the participants were in the middle age, 80% of participants are younger than 36 years old. Data about teachers' ages were consistent with the number of teaching years, 77% of participants have teaching experience in within 0-5 years and 73% of the participants have a Bachelor's degree. This data seems to indicate that most teacher participants still recall the research methodologies learned during their pre-service years.

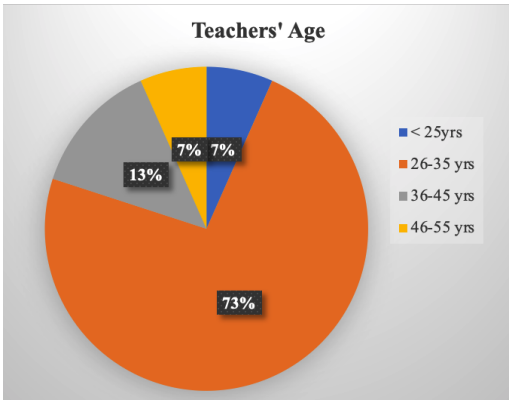



**Figure 1.** Teachers' Age

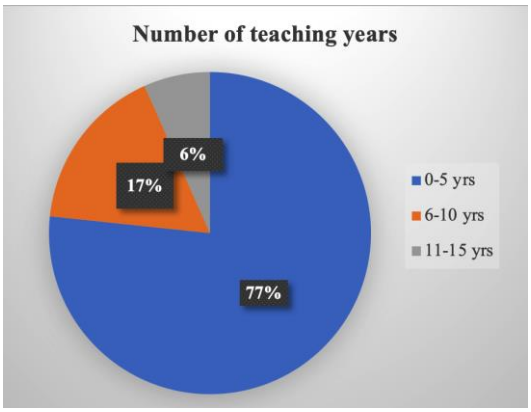



**Figure 2.** Number of teaching years

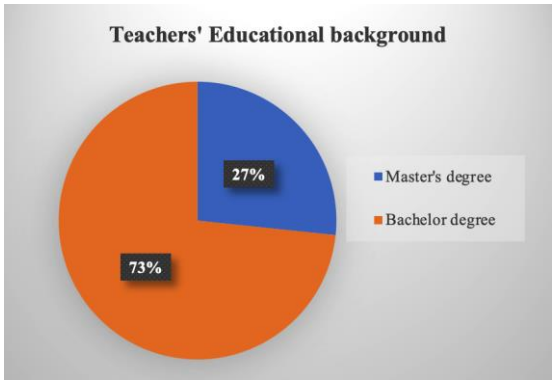



**Figure 3.** Teachers' educational background

When comparing the results of the pre-test and post-test assessments, the findings showed that most teacher participants performed better in the post-test assessment, 20 participants (67%) had higher post-test scores. Interestingly, within the group of 20 participants who have higher post-test scores, 16 participants (80%) were less than 36 years old and 15 participants (75%) have only Bachelor's degree (see Figure 4 and Figure 5)

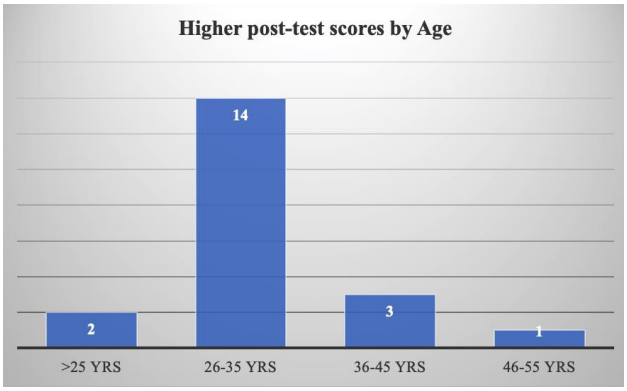



**Figure 4.** Number of teachers who have higher post-test scores categorized by age

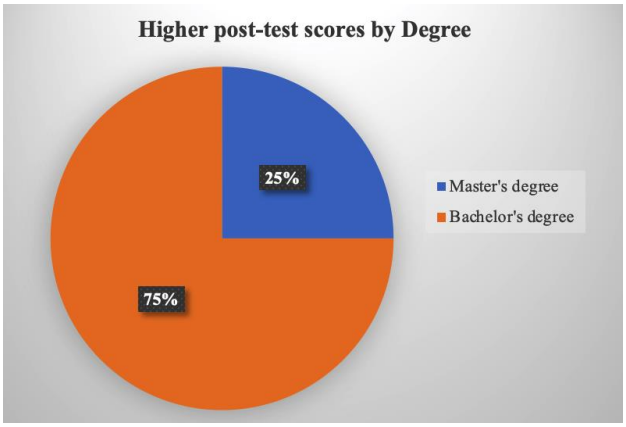



**Figure 5.** Number of teachers who have higher post-test scores categorized by degree

However, it was noted that a teacher participant's post test scores appeared to be almost triple of the pre-test scores. For the rest of the participants, five participants' (17%) post-test scores were exactly equal to the pre-test scores, and the other five participants' (17%) post-test scores were lower than their pre-test scores. Statistical modelling was applied to analyze the two different means of a repeated measuring design in the same subjects in this study (Greene and D'Oliveira, 1999; Field, 2005) and the 'paired-samples t-test' was adopted. The descriptive statistics for the pre-and post-test results are illustrated in the Table 3 and the paired-sample t test results are displayed in the Table 4.

**Table 3.** Descriptive statistics for the pre-and post-test results (N=30)

| | Mean | No. of subjects | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| **Pre-test** | 17.67 | 30 | 4.41 | 0.806 |
| **Post-test** | 20.67 | 30 | 5.38 | 0.982 |

**Table 4.** Paired Sample T-Test Result

| | Paired Differences (95% Confidence Interval) | | | *T* | df | Sig (2-tailed) |
|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | | | |
| **Pre-test/Post-test** | -3.00 | 5.00 | .9135 | -3.284 | 29 | 0.003 |

As the results can be seen in the Table 4, the null hypothesis was rejected ($t(29) = -3.284$, $p= 0.003$, i.e. $p<0.05$). This revealed that there is a significance between pre-test and post-test in terms of teacher performance.

*2) Teachers' Attitudes Towards the AI-CAR*

*2.1 Attitudes toward the content*

The teachers showed positive attitudes towards the content in the AI-CAR in terms of credibility and usefulness. During the interview, the teachers compared the AI-CAR with the internet searches. They pointed out that this AI-CAR system was very helpful and reliable as they thought the information in the AI-CAR did not come from random people. They trusted that this system was rather well-created as part of the research project; and thus, in their opinion, the AI-CAR would be a useful tool that could help them to access the credible information about how to conduct classroom research.

The teachers reflected that the content in the AI-CAR was precise and easy to read. The tables provided in the system offered a good summary of knowledge. Furthermore, they would not mind if the system would offer more readings to them, especially the topics of their interest that they were particularly interested at. Videos or links to the website full of information would also be welcome. Some teachers

admitted that the AI-CAR was a good system for reviewing knowledge. It helped them to recap and revisit what they have learned.

Besides, the teachers found that using the AI-CAR system to access the information online was more convenient than going to the libraries to find reading resources. This finding supports a previous study indicating that the challenge of teachers' conducting research is that the teachers have difficulties to access academic resources such as books, journals, etc. (Boonthao et al., 2014). It could be quite challenging when the teachers look forward to getting full articles to read at the local libraries but they could not find the resources they were looking for at those places.

On the other hand, some other teachers insisted that the information in the AI-CAR was too theoretical and they would prefer reading "the research papers" to reading the research methods. Interestingly, the data from the interviews echoed that the teachers were actually not lacking of knowledge in the research methods, but they would rather seek how to apply the research methods into real classrooms (Hopkins, 2008; Weerachan et al., 2015).

These findings remind us our original idea in discovering the position of the AI-CAR that lies somewhere in between the theory and practice. The AI-CAR can supplement the traditional training by providing a summary of knowledge to the teachers and that they could revisit and review the information available anytime they need. In addition, exercises or short quizzes can also be included at the end of each unit summary so that they can practice answering the quizzes at their own pace. Most importantly, some examples of previous researches or case studies can be added in the system and that the teachers can explore those cases. This could help the teachers to expand their horizons and also to generate new perspectives and ideas needed for solving problems in their classrooms.

*2.2) Attitudes towards the settings*

Some teachers shared ideas that the keyword suggestion tool was a helpful guide for exploring the information required for their questions although it may sometimes appear to be annoying because the keywords showed up in every answer. One of the teachers mentioned that he felt "compelled" to use those suggestions. Even though it gave him good questions to ask, he still preferred to write his own. The chat logs revealed that teachers usually started chatting with their own questions despite of the suggested keywords provided. However, if the system cannot find an answer for that question, the teachers would then use the keyword suggestion tool. Some teachers would keep using the tool until no more suggestions were provided. It was found that some teachers tended to use the keyword suggestion tool by randomizing main topics as this would help them to explore and evaluate overall answers on the AI-CAR. It was also found that while the keywords suggested were usually short phases or simple words, some teachers would still cut or reduce the texts that they need to type. This causes the system unable to perform properly in finding the intents.

Data from the interviews reflected that teachers would like the AI-CAR to be more humanistic. Some teachers insisted that they would like to see some emotional responses from the system (i.e., interjections, emoji, etc.). One teacher gave a comment on the name of the system that although it caught her attention, the name should be more vibrant. The teacher participant explained that the topic of classroom research was usually rigorous by its nature, a more attractive or fun name would tend to give them a more joyful learning experience.

*3) Topics of Teachers' Interests*

Regarding the third research question, the study revealed that the topic most teachers would inquire was statistics, although the statistics may not be relevant to the actual problems occurred in their classrooms. The teachers would like to acquire more information in depth about how to create tests to evaluate students' performance, which statistics will best suit each data set and how to interpret statistic

data. As mentioned earlier, the teachers were required to submit the details of quantitative analysis of their research as it is a part of teachers' evaluation criteria (Office of the Teacher Civil Service and Education Personnel Commission, 2013).

Another topic mostly inquired by the teachers was writing a research report. Many teachers pointed out that conducting research was not as hard as preparing and documenting a report. Many teachers agreed that it was very hard to write up a report that would meet the requirements and would like to know details of each topic they should include in their research report. Again, this comment has shown that the teachers were worried about whether their work would meet the "standards" for teachers' evaluation. These findings reflected the seriousness of teachers' evaluation process in Thailand. It seemed that the procedure used to assess teachers' research has indirect impact on how the teachers conduct the research study. When the research is required for the teachers' evaluation process, the scope of research will be inevitably limit, and this could have a further impact on the quality of research as a whole.

## Discussions and Limitations

This study offers the original design concept which is the development of a chatbot used to interact with teachers regarding questions and answers about the research methods. To our knowledge, it is also the first attempt to use chatbot for teaching the content knowledge outside the classroom environment. Although the study revealed the positive feedback in terms of teacher performance and teachers' attitudes, there are challenges in several areas that need to be addressed and accomplished. One of the most challenging issues is that the teachers expected something more than just a Q&A system. They seemed to look for a tool that could briefly explain fundamental knowledge regarding research methods, suggest good articles for reading and sometimes offer reviews of research papers.

It seems that a new virtual learning environment with a "virtual educator" are being developed to meet the teachers' needs for their professional development and it is worth for future investigation and study. The teachers' comments and suggestions are valuable and will be enhanced in the development of the prototype; however, the main goal of this project will continue to be emphasized and maintained and that is to provide the prototype with multimodality to be used for the improvement of teachers' research skills.

It could be observed that this research was conducted during the major crisis of COVID-19 pandemic, while the teacher participants were facing big challenges in adjusting their normal practices. It was very hard to make things to follow schedules as planned and the data collected may not be as rich as it should. Nevertheless, we as the researchers would like to express our sincere appreciation to the teachers' contributions and supports to make this study happened.

## Conclusion and Future Research

In summary, this study suggested that the teachers who used the AI-CAR had shown a significant performance between before-using and after-using the prototype which can be observed from their pre-test and post-test results. In regard to their attitudes, the teachers have positive attitudes towards the AI-CAR in terms of accessibility, credibility and usefulness. The key improvements needed include adding case-based contents, improving humanistic setting, and creating a better design for keyword suggestion tools. The minor improvement includes the vibrant name of the system.

All in all, the prototype has been in a satisfactory progress and the research has shown a positive result. As indicated in the beginning, this study reports the progress of the research project named "Artificial Intelligence for teacher professional development on classroom research." We are going to launch the second version of the AI-CAR in the mid of November 2020.

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