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Developing Scientific Oral Presentation Competence focusing on Question-and-Answer Sessions of High-Ability Science Students in Thailand

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Abstract

This study is aimed at developing students' scientific oral presentation competence and competence in question-and-answer sessions, through the scientific presentation instruction: focus on question-and-answer sessions (SPIQA). The SPIQA contained coping strategies for question-and-answer sessions, communication strategies, impromptu speech strategies, and Socratic questioning techniques. Also, this study explored the students' opinions toward the SPIQA. The participants were 35 high-ability science high school students. The impacts of the SPIQA on scientific oral presentation competence and competence in question-and-answer sessions were assessed through pre- and post-scientific oral presentation tests. The participants' opinions were obtained from students' learning journals, questionnaires, and interviews. Further information was extracted from the questionnaires through examination of teacher notes and journals. The findings show significant

	improvement in students' scientific oral presentation test scores, implying that a teaching pedagogy made up of a combination of different sets of strategies is effective. Qualitative results indicate that students had positive opinions of the strategies instruction, and that they realized the importance of oral presentation competence and competence in question-and-answer sessions in relation to their future education needs and career goals. In further studies, it is therefore recommended to raise students' awareness of strategy use for solving communication problems.

Introduction

The question-and-answer session is considered an essential feature of a presentation and a critical event of the academic conference (Guest, 2018). A presentation is generally an academic monologue under the direct control of the presenters, as the body of the presentation is usually scripted (Thompson, 1997). On the other hand, the question-and-answer session, which regularly follows the presentation, requires presenters to constantly shift positions between the audience and themselves and requires immediate and appropriate responses from the presenters (Peng, 2018). As a result, presenters' professional credibility is often damaged when they fail to perform in the question-and-answer session (Partington, 2006). According to Guest (2018), presenters are often deemed as academic or linguistic 'frauds' when they are unable to cope or handle questions during the question-and-answer session, despite giving a prepared and polished presentation using a high standard of English. To win the verbal tug-of-war during the question-and-answer session, experienced presenters are not only expected to conduct themselves appropriately and professionally, but also possess the ability to think on the spur of the moment, respond in real-time, and to correctly interpret the meaning of questions (Guest, 2016).

Since the question-and-answer session is viewed as an evaluation, it requires a very different set of skills from those required in the main body of the presentation, most specifically interpersonal management skills, politeness strategies, and face-saving (Heino et al., 2002). Hence, the question-and-answer session can be stressful for any presenter, especially when the presenter is required to engage the audience in a

non-native language (Guest, 2016). In the context of Thailand, as English is considered a second language for the majority, presenters are often faced with difficulties when they are required to give presentations and engage the audience using it. This is a pervasive problem, particularly among high-ability science high school students who are required to present at international scientific conferences and in global competitions.

The present study took place in a high school in Thailand which utilizes a specialized science-based curriculum and caters to high-ability students. Although the students possessed excellent subject knowledge and academic ability, they encountered problems in giving scientific oral presentations, especially in a second language, due to their lack of oral presentation skills. As a result, most faced difficulties in presenting the outcomes of their scientific research projects, particularly in relation to the question-and-answer session. As mentioned earlier, the question-and-answer session requires a very different set of skills from those required in the main body of the presentation, and handling the question-and-answer effectively is crucial to the credibility of the presenter.

Despite a growing interest in research on spoken English for Academic Purposes (EAP) genre of conference presentations, the question-and-answer session is under-researched (Guest, 2018). Notably lacking is research on how English as a Foreign Language (EFL) learners handle the shifting relationship between speaker and discussant during a question-and-answer session, with such skills being rarely taught to non-native English speakers (Guest, 2018). In addition, Guest (2018) stated that very few researchers focus on pragmatic strategies employed by speakers in response to questions and comments in the question-and-answer session, even though strategic competence has been considered a pillar of overall communicative competence for over thirty years.

Thus, to compensate for gaps in previous literature reports, the purpose of this study is to develop student competence in giving scientific oral presentations and in question-and-answer sessions, through initiating the scientific presentation instruction: focus on question-and-answer sessions (SPIQA). Specifically, this research investigates the following questions:

1. To what extent does the scientific presentation instruction: focus on question-and-answer sessions (SPIQA) effectively enhance science high school students' scientific oral presentation competence?

2. What are the opinions of science high school students toward the scientific presentation instruction: focus on question-and-answer sessions (SPIQA) regarding improving their scientific oral presentation competence?

Literature Review

In this section, the meanings of a question-and-answer session (Q&A), the problems and difficulties the presenter encounters in the question-and-answer session, the solutions to such problems and challenges as well as previous research on the question-and-answer session in formal conference situations, are presented.

Question-and-Answer Sessions (Q&A)

The question-and-answer session (Q&A), or discussion session, is one of the key parts of any conference presentation (Guest, 2018). The status of question-and-answer sessions following a paper presentation in conferences has received different considerations from researchers. Webber (2002), Wulff et al. (2009), and Querol-Julián (2011) refer to the question-and-answer session as a distinct sub-genre of the conference presentation, partly governed by unwritten rules and maintained as an accepted code by members of the discourse community. According to Guest (2018), the question-and-answer session requires a different set of skills from those required in the main body of the presentation due to the open-ended and unpredictable nature of the session as well as the increased likelihood of criticism during this period.

Some researchers have taken a multimodal approach in analyzing question-and-answer session interactions, focusing heavily upon both the speaker's and the commenter's paralanguage and noting that such skills are rarely taught to non-native English speakers (Heino et al., 2002). On the other hand, Cheng (2004) performed analyses of question-and-answer sessions through intonation and related prosodic patterns, while Anthony et al. (2006) and Orr et al. (2009) analyzed advice given in textbooks relating to question-and-answer sessions at international conferences. These studies concluded that the subject of question-and-answer sessions has been poorly addressed and that more extensive research on the subject is needed. These research results are aligned

with Guest's (2018) findings, which indicated that very few researchers appear to have focused upon pragmatic strategies employed by presenters in response to questions and comments in the question-and-answer session even though strategic competence has been considered a pillar of overall communicative competence for over thirty years.

In this study, a question-and-answer session is defined as a time period when the audience can have their questions answered, and reflects a situation in which students are expected to respond to questions, despite being under immense pressure, with appropriate use of language and by employing relevant strategies.

Scientific Oral Presentation Competence

Savignon (1972) and other theoreticians (e.g. Canale & Swain, 1980; Bachman & Palmer, 1996, etc.) define communicative competence as the ability to function in a truly communicative setting, one which is dynamic and spontaneous and which is more interpersonal than intrapersonal. In the scope of the present study, scientific oral presentation competence refers to the ability to effectively give scientific presentations and the ability to handle the question-and-answer session, particularly in relation to the use of appropriate grammar, vocabulary, pronunciation, strategies, and interactive communication. For a meaningful conversation to occur, Canale and Swain (1980) and Canale (1983) state that four components must be present. First, grammatical or linguistic competence, which is defined as the knowledge of grammar, vocabulary, and mechanics (Scarcella & Oxford, 1992), which enables learners to understand and structure the use of English language in the correct manner, resulting in language fluency (Shumin, 2002). Second, sociolinguistic competence refers to the ability to clearly and accurately convey a message and the ability to communicate appropriately in a manner adhering to sociocultural norms and contexts (Goh & Burns, 2012). Third, discourse competence pertains to cohesion and coherence, which allow speakers to communicate meaningfully (Dörnyei & Thurrell, 1991), and the fourth component is strategic competence, being the ability to use language appropriately and to handle any problem relating to communication and comprehension (Shumin, 2002). Strategic competence can be in the form of either verbal or non-verbal

communication strategies, which are employed in dealing with communication breakdowns (Canale & Swain, 1980).

Strategies Used in Question-and-Answer Sessions

Strategies refer to the linguistic choices one makes regarding spoken discourse, particularly when under pressure (Guest, 2018). This skill is also known as strategic competence, which is defined as the ability to discern the appropriate use of language in a given situation. This includes understanding when and how to start, maintain, and end a conversation, and how to handle issues relating to communication and comprehension (Richards, 1985; Shumin, 2002). In this study, Socratic questioning is used to construct questions in preparing for question-and-answer sessions, while coping strategies for question-and-answer sessions, communication strategies, and impromptu speech strategies, are used to handle question-and-answer sessions. Each strategy is reviewed in greater detail hereafter.

Socratic Questioning Techniques

For a question-and-answer session to be productive, the questions raised by the audience must play an equal role to the responses from the speaker. As noted by Magee (2001), thought-provoking questions could intellectually stimulate both speakers and other audience members to share their thoughts and opinions towards the topic being debated or discussed. For this reason, Paul and Elder (2019) recommended that teachers integrate the concept of Socratic questioning into training courses for preparing inexperienced conference attendees to be active participants in events.

Socratic questioning is the systematic formation of meaningful questions in academic environments, such as question-and-answer sessions in formal classrooms or at conferences (Lavine, 1984). In this context, meaningful questions are those asked in an open-ended fashion instead of a close-ended manner, as the latter do not provide avenues for the speaker to share invaluable information with the audience. Magee (2001) pointed out that, with an open yet cognitively stimulating style of questioning, speakers are allowed to spontaneously and independently express their understanding, experiences, beliefs, attitudes, or

perspectives toward a subject of discussion. Ultimately, answers elicited by well-thought-out questions could lead to greater insights into a particular subject matter or spark inspiration to open up new areas of research in the future.

In this study, the Socratic questioning techniques derived by Paul and Elder (2019) were adapted and used as a framework, as the main purpose of this study was to help students to be able to professionally handle question-and-answer sessions. To be proficient presenters, students needed to be able to effectively construct, emulate, and employ questions using Socratic questioning.

Communication Strategies (CSs)

The major purpose of communication in all situations is to pass on clear messages and ideas (Dörnyei, 1995; Færch & Kasper, 1983). In the context of a conference presentation, the presentation itself is viewed as one-way communication, while the question-and-answer session is a two-way communication that has the speaker and the audience interacting as equal stakeholders (Guest, 2016, 2018). Within such two-way communications, as Dörnyei (1995) noted, communication breakdown can occur at any time. To minimize instances of this occurring, communication strategies have frequently been operationalized by conference speakers as strategies to compensate for communication limitations and linguistic deficiencies, with the aim to convey the intended messages to the interlocutors. In general, such communication strategies encompass the systematic use of both linguistic and non-linguistic strategies, which can be utilized alongside each other to achieve communicative goals.

Communication strategies are categorized as either reduction or avoidance strategies, or achievement or compensatory strategies (Dörnyei, 1995; Færch & Kasper, 1983). Reduction strategies adopt topic avoidance, message abandonment, and meaning replacement to minimize instances of encountering and solving communication problems. On the other hand, achievement strategies adopt code-switching, intralingual and interlingual transfer, cooperative strategies, and non-linguistic strategies to directly address any communication problems (Dörnyei, 1995; Færch & Kasper, 1983). Achievement strategies can be further sub-categorized as either non-cooperative or cooperative.

Assistance from interlocutors is not required in non-cooperative strategies, but is necessary in cooperative strategies.

Taking into consideration the insights on the fit between strategies and presentation of scientific research project lessons, based on the experience of the researcher and the information gathered from inquiries of highly experienced science teachers, this study included the teaching of both reduction and achievement strategies in the Effective Presentation course. The SPIQA included ten strategies that allow learners to adhere to their original communicative goals through devising alternative plans to utilize available resources (Færch & Kasper, 1983). These strategies facilitate the development of oral communication competence, which is the competence to effectively deliver scientific oral presentations and professionally handle question-and-answer sessions, in alignment with the goal of the SPIQA outlined in this study.

Coping Strategies for Question-and-Answer Sessions

On many occasions, public speakers must deal with unanticipated questions, and these can substantially impact the continuity and smoothness of the overall presentation. Such impromptu questions require the speaker to show their comprehension or thoughts towards the presented topics in an abrupt manner. As this can lead to speaker anxiety, Anthony et al. (2006) suggested that non-native speakers should be provided with classroom instructions relating to the language of questions, and the strategies for reading signs signaling the termination of interactions. This is in accordance with Guest (2018), who stated that strategic competence and developing skills in question-and-answer sessions can go a long way towards removing question-and-answer session anxiety, as strategies involve real-time cognitive and interactive shifts.

In this study, coping strategies for a question-and-answer session (Guest, 2018) were applied in the framework to aid students in dealing with communication problems that might occur while engaging in oral communication, be it question-and-answer sessions, monologue or a conversation.

Impromptu Speech Strategies

Impromptu speech strategies are highly effective in teaching oral communication skills. These strategies allow students to develop their ability to think quickly, organize ideas promptly, and articulate informatively and confidently about various topics (Barruansyah, 2018). In addition, Barruansyah (2018) stated that "Impromptu Speech" is also called thinking on your feet. It refers to organizing one's ideas quickly and speaking about a subject without being given preparation time in advance. Moreover, Verderber (1997: 231, 232) defined impromptu speech as a speech given on the spur of the moment without prior preparation.

As Barruansyah (2018) noted, impromptu speech often arises during the question-and-answer session (Q&A). Since the questions to be asked should be relevant to the presented topic to a certain extent, this means that the speaker can anticipate possible questions and hence be able to draft the responses. In this study, Hsieh's (2006) impromptu speech strategies were applied in the framework to aid students in preparing for difficult or spontaneous topics/questions, and in responding to unanticipated questions.

Previous Research Studies

Over the course of the past two decades, there has been a dearth of research on the topic of academic oral presentations compared to studies on English for academic purposes (EAP) writing (DiCerbo et al., 2014; Leki, 2007, as cited in Berrett & Lui, 2016). However, a recent focus on academic oral presentation competence has resulted in design principles for instruction, learning, and assessment (Ginkel et al., 2015). Nevertheless, EAP learners still require more specific and language-oriented guidelines (Berrett & Lui, 2016).

Pertaining to the teaching of oral skills in Thailand, previous studies have focused on the teaching of English oral skills and speaking tests (Khamkhien, 2010), the development of non-native English speakers' oral skills (Boonkit, 2010), EFL oral communication teaching practices (Bruner et al., 2015), enhancing the English presentation ability of engineering students using the genre-based approach (Changpueng & Wattanasin, 2018). However, no studies to date have examined teaching scientific presentations through focusing on question-and-answer sessions. This is surprising as students require such skills for their future

education and work prospects, especially for working in multinational corporations or for participating in national and international conferences.

A great number of studies have been published on the topic of oral communication strategies since the year 2000. Some compared and contrasted the use of strategies for students having differing abilities (Chuanchaisit & Praphal, 2009; Hua et al., 2012), while others examined the effects of communication strategy instruction on oral communication skills (Maleki, 2010; Rabab'ah, 2016; Teng, 2012). In the Thai context, the effects of communication strategy instruction on English oral communication ability of undergraduates (Kongsom, 2016), the development of oral communication ability in economics university students given learning and communication strategy instructions (Puripunyavanich & Soontornwipast, 2018), and the impact of attitudes toward oral English communication on English-major students' use of communication strategies (Toomnan & Intaraprasert, 2015), have been investigated.

To date, there has been a scarcity of research on academic oral presentations focused on strategies to cope with the difficulties and problems in question-and-answer sessions. The purpose of this current study, therefore, is to look into how presentation instruction with the focus on teaching strategies can help students deal with question-and-answer sessions, and the students' opinions towards such training initiatives.

Methodology

Since this research aims to investigate the effects of the SPIQA on science high school students' scientific oral presentation competence, both quantitative and qualitative data are required to validate findings. A mixed-methods approach allowing for data triangulation was employed for this purpose, leading to greater data accountability and comprehensiveness.

Participants

A cohort of 72 eleventh-grade students in the high-ability science high school was enrolled in the Effective Presentation course in the Academic Year 2020. The students were divided into 4 classes (17–18 students per class). Two classes (TOEFL-ITP scores ranging from 380 – 490) taught by the researcher were selected as the research samples.

Research Design

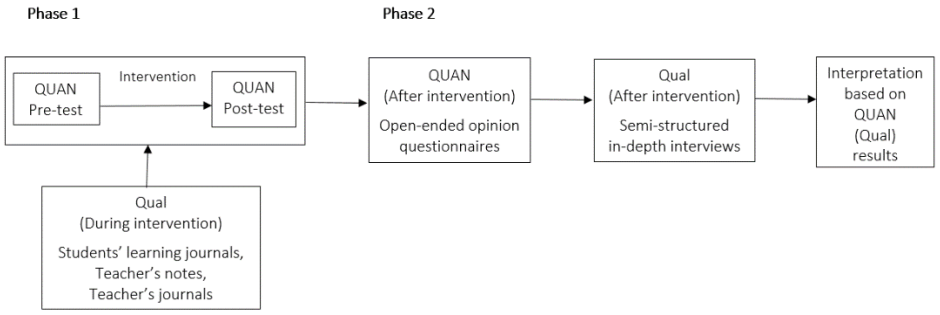
In this study, the total duration of the implementation of the SPIQA was 16 weeks. A one-group pre-test-post-test research design was used to investigate the effects of the SPIQA on science high school students' scientific oral presentation competence. This design enabled the researcher to evaluate the extent of improvements in participants' scientific oral presentation competence and their competence in question-and-answer sessions due to the intervention, by comparing pre-test scores administered at the beginning of the course with post-test scores administered at the end of the intervention. Both pre-and post-test tasks were authentic as they imitated tasks that occur in real life. For each test, students were tasked to deliver a 5-minute scientific presentation and participate in a 5-minute question-and-answer session. Each test had an entire score of 20. Students' pre-and post-tests were rated by two independent experienced science teachers. In addition, the Intraclass Correlation Coefficient (ICC) was used in this study to measure reliabilities induced by human error, and variations among raters. The ICC values for the pre-tests and post-tests were .929 and .853, respectively. As both ICC values were higher than .800, this suggested that the two raters tended to give similar scores in the pre- and post-tests and implied a high level of rater reliability. Moreover, standard deviation (S.D.), mean, frequency, and *t*-test were used to analyze quantitative data obtained from the pre-and post-tests of the scientific oral presentation competence and the competence in a question-and-answer session. The purpose was to determine the effectiveness of the SPIQA in enhancing science high school students' scientific oral presentation competence and their competence in question-and-answer sessions. In other words, this served to determine whether intervention resulted in competency improvements. Next, inferential statistics of Cohen's *d* were calculated to measure the magnitude of the effect.

Qualitative data gathered from students' learning journals, teacher's notes, teacher's journals, open-ended opinion questionnaires, and in-depth interviews were utilized to gain a more in-depth explanation and understanding of the findings. Including the students' learning journals allowed for gathering of information about students' use of strategies and how these strategies promoted and developed their scientific oral presentation competence. The teacher's notes were used by the researcher to collect qualitative data on students' use of strategies that were observable during each task, and during the pre-and post-test tasks. The information obtained from the teacher's notes was then written in detail using the teacher's journals.

In this study, both quantitative and qualitative data were collected in order to answer the research questions. The experimental model showing how data was collected is presented in Figure 1.

Figure 1

The Research Design Model



Framework of Scientific Presentation Instruction: focus on Question-and-Answer Sessions (SPIQA) for Developing Students' Scientific Oral Presentation Competence focusing on Question-and-Answer Sessions Development

The framework of SPIQA consists of six coping strategies for question-and-answer sessions and communication strategies, impromptu speech strategies, and Socratic questioning techniques.

There are six coping strategies for question-and-answer sessions: 1) asking for clarification, 2) asking for an uncertain keyword, 3) coping

with convoluted and/or vague comments, 4) avoidance/evasion, 5) thanking and appeasement, and 6) admission. These coping strategies for question-and-answer sessions were as stipulated by Guest (2018). Although these six coping strategies for question-and-answer sessions could help students in their preparation for question-and-answer session tasks, the strategies did not cover actions to be taken when encountering various kinds of communication problems such as misunderstanding, stumbling, or when more time is required to think of a response. To address these issues, ten communication strategies (CSs): 1) approximation, 2) circumlocution, 3) use of all-purpose words, 4) appeal for help, 5) clarification request, 6) pause fillers and hesitation devices, 7) self-repair, 8) topic avoidance, 9) comprehensible check, and 10) confirmation check, were selected from the studies of Dörnyei and Scott (1997) and subsequently added to the framework. Moreover, Hsieh's (2006) impromptu speech strategies were applied to the framework as impromptu speech is natural, spontaneous, and unplanned, just as the nature of speech used in a question-and-answer session. There are three main strategies for impromptu speech: 1) language which focuses on vocabulary range, word usage, and grammar usage, 2) speaking skills focusing on speech organization, development of key points, and an attention-grabbing opening, and 3) background knowledge which prepares students for difficult topics/questions and for instances where students are faced with unanticipated questions. Not only do students need to be able to cope with question-and-answer questions professionally, but students also need to be able to effectively model and construct questions in advance, to anticipate for questions that the audience may ask. Thus, Paul's and Elder's (2019) five Socratic questioning techniques, including 1) questioning goals and purposes, 2) questioning questions, 3) questioning accuracy, 4) questioning relevance, and 5) questioning depth, were employed as part of the framework.

The SPIQA instruction was carried out over 16 weeks, with one two-hour session per week. This aimed to assist students developing competence in oral presentations by focusing on question-and-answer sessions, thus providing essential skills for use at formal conferences or meetings. Students were taught strategies explicitly, provided with opportunities to put these strategies into practice, and time to reflect on their usefulness in students' learning journals.

SPIQA Instructional Framework

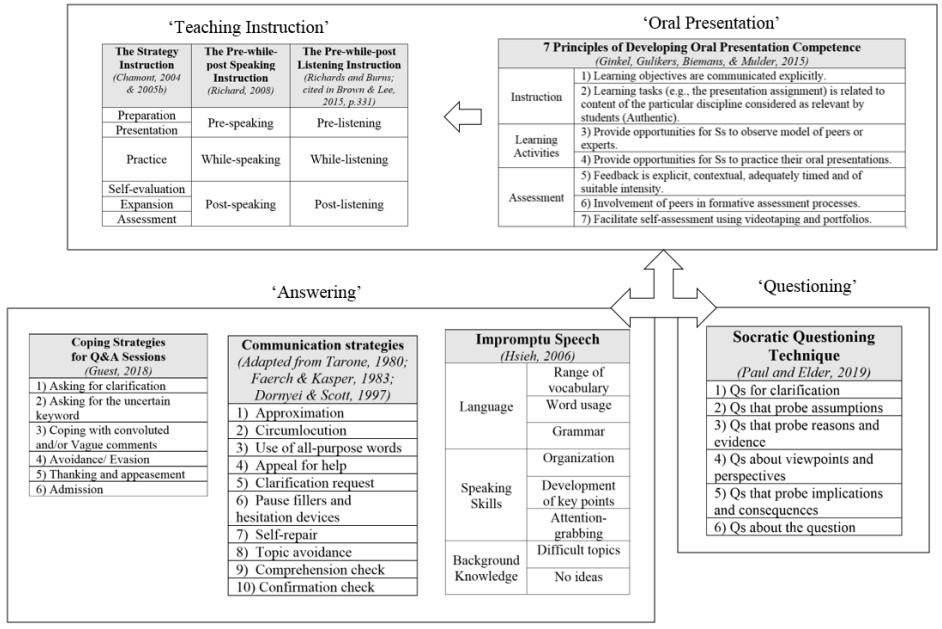
The SPIQA instructional framework of scientific presentation: focus on question-and-answer sessions in this study was designed based on the strategy instructional framework adapted from Chamot (2004, 2005) and the seven principles of developing oral presentation competence (Ginkel et al., 2015). For the strategy instruction, there were three main stages: pre, while, and post. The pre-stage involved two activities: 1) a preparation activity where the teacher identified students' current learning strategies for familiar tasks, and 2) a presentation activity where the teacher modeled, named, and explained the new strategy, and subsequently asked students whether they had used it and how they had used it. The while-stage involved students putting the new strategies into practice, initially under teacher guidance followed by a gradual phase-out of guidance to promote independent learning. Finally, the post-stage included three activities: 1) self-evaluation, as recorded immediately in their learning journals after practice, where students evaluated their use of strategies, focusing on those that facilitated their scientific oral presentation competence and coping strategies for a question-and-answer session, 2) expansion, where students transfer the strategies used in scientific presentation and the question-and-answer session to new tasks, combine strategies into clusters, and develop a repertoire of preferred strategies, and 3) teacher assessment, as recorded in teacher's notes and teacher's journals, where teachers assessed students' use of coping strategies for a question-and-answer session, communication strategies, impromptu speech strategies, and Socratic questioning techniques and how these strategies impacted the students' scientific presentations and question-and-answer sessions.

The Effective Presentation course instructional frameworks were divided into three stages: the pre, while, and post stages. Moreover, the seven principles of developing oral presentation competence (Ginkel et al., 2015) were integrated into lesson design, and these principles were utilized in three sequences of the instructional framework: 1) instruction, 2) learning activities, and 3) assessment strategy. The instruction sequence involved two principles: 1) that learning objectives were explicitly communicated to students; and 2) that all learning tasks – the presentation assignment – were relevant to students and the complexity and context of the tasks were 'authentic.' Secondly, the learning activities

utilized principles: 3) to provide opportunities for students to observe the model of peers or experts; and 4) to provide more opportunities for students to practice their oral presentations to develop their scientific oral presentation skills. Finally, the assessment strategy utilized three principles: 5) to ensure that feedback was explicit, contextual, adequately timed, and of suitable intensity; 6) to encourage the involvement of peers in formative assessment processes, and 7) to facilitate self-assessment using videotaping and portfolios. The Scientific Presentation focusing on a Question-and-Answer Session Instructional Framework is presented in Figure 2.

Figure 2

Scientific Presentation: focus on Question-and-Answer Sessions Instructional Framework



Instrumentation

This section is divided into two main categories – research instrument and instructional instrument. The research instruments used in this study consisted of pre-test and post-test for scientific oral presentation competence, competence in question-and-answer sessions, students' learning journals, teacher's notes, teacher's journals, open-ended opinion questionnaires, and in-depth interviews. In addition, the instructional instrument was used to facilitate the scientific presentation instruction: focus on question-and-answer questions (SPIQA). It is critical to note that the research instruments and instructional instrument were tested for their validity prior to implementation. Prior to implementation, all instruments, along with validation forms were submitted to two experts in the field of developing and evaluating instructional materials and English language teaching. A further expert (who is both a science teacher and a native English speaker), validated the research instruments and instructional instrument and checked for language accuracy.

Research Instruments

Pre-tests and Post-tests for Scientific Oral Presentation Competence Assessment and Scoring Rubrics

The pre-tests and post-tests were constructed to address the first research objective. These tests were implemented on-site, before and after the intervention. Pre- and post-test tasks were authentic as they imitated tasks in real life, where students had opportunities to deliver a scientific presentation and cope with a question-and-answer session. Before the test was implemented and administered to participating students, a pilot testing phase was undertaken to solicit feedback which was incorporated into the research-ready version.

Two sets of scoring rubrics, scientific presentation scoring rubrics and question-and-answer scoring rubrics, were employed during pre-and post-tests to assess overall scientific oral presentation competence for a scientific presentation and competence in question-and-answer sessions. The analytic rubrics for evaluating a scientific presentation and a question-and-answer session were adapted to suit the pre-and post-test tasks.

The criteria of the analytic rubric for an overall scientific presentation involved five dimensions: the content, organization,

grammar, delivery, and question-and-answer session. The descriptors of the dimensions were adapted from the Oral Presentation rubric developed by Purdue University College of Science, which had a similar objective of measuring language learners' scientific oral presentation competence (Richards, 2008). Descriptors were adapted to suit the levels of high school students.

The criteria of the analytic rubric for the question-and-answer session involved eight dimensions: the content/subject knowledge, grammar, listening skills, vocal variety, eye contact, gesture, time management, and coping strategies for question-and-answer sessions. The descriptors of the dimensions were adapted from the Evaluation Form for Question-and-Answer Session developed by Toastmaster International's (2016) guidelines. Descriptors were adapted to suit the genre of a scientific presentation. All tests and the scoring rubrics were validated by three experts.

Students' Learning Journals

Students' learning journals were used to reflect learners' linguistic and non-linguistic performances after implementation of the SPIQA. This instrument was used to provide additional support as to whether the results obtained correlated with responses from questionnaires and interviews. In this study, the students' learning journals were administered at the end of each lesson. The students' learning journals were designed in a semi-structured format by providing a set of open-ended questions to stimulate learners' thinking processes (Hart, 1994). The participating students were assigned to write their own learning journals, in which they were required to report their reflections of learning. Moreover, students were allowed to write their reflections in Thai to mitigate any language barrier effects.

Teacher's Notes

Teacher's notes were used by the researcher to collect qualitative data on students' use of strategies that were observable during each task, and during the pre-and post-test tasks. As the researcher and the teacher took notes as bullet points and highlighted key ideas on students' strategies when engaging in the classroom setting and during pre-and

post-test tasks. The information gained from the teacher's notes was then written in detail using the teacher's journals. The teacher's notes were a useful tool that enabled the researcher to crosscheck the data obtained from students' learning journals, opinion questionnaires, and interviews.

Teacher's Journals

The teacher's journals were the instrument used in collecting qualitative data. It was a free-form instrument with no guiding questions. The teacher's journals were used by the researcher to collect data on students' use of strategies. Thus, the researcher was required to write the teacher's journal as soon as possible after finishing teaching, with completion being required on the same day as the teaching occurred. In addition, teacher's perspectives regarding students' performances and strategy used to engage students in the classroom setting were collected using the teacher's journals. Finally, the teacher's journal was a helpful tool to crosscheck the data obtained from the students' learning journals, opinion questionnaires, and interviews.

Open-ended Opinion Questionnaires

In this study, open-ended opinion questionnaires were used to collect data regarding students' opinions toward the Effective Presentation course based on the scientific presentation instruction: focus on question-and-answer sessions (SPIQA). These were administered at the end of the course, and student responses were anonymous.

The open-ended opinion questionnaires were developed based on coded data from the students' learning journals. The questionnaires consisted of 15 items that were categorized into four parts: 1) the explicit oral presentation, communication strategies, and coping strategies for a question-and-answer session instruction in the classroom; 2) the content of an oral presentation, communication strategies, coping strategies for a question-and-answer session, impromptu speech strategies, and Socratic questioning techniques, and instructional materials for the instruction; 3) the effects of learning strategic competence in SPIQA; and 4) self- and

teacher assessment. All key aspects of students' opinions toward the SPIQA were covered by the questionnaires.

Semi-structured in-depth Interviews

After analyzing the data from the students' learning journals and the open-ended questionnaires, outstanding information or interesting issues that needed more clarification or more explanation would be further investigated through interviews. One-on-one semi-structured interviews were suitable for obtaining insights from individuals, as these allow interviewees to elaborate on issues being investigated (Dörnyei, 2007). A total of 35 in-depth one-on-one semi-structured interviews were conducted, with each person being allocated a ten-minute session. Participants were informed beforehand that they would not be academically and professionally affected by any interview responses.

Instructional Instrument

Sixteen-week Lesson Plans. The content in the coursebook and the lesson plans were developed according to the following key attributes: the course description, course objectives, and the scientific presentation instruction: focus on question-and-answer sessions. Lesson plans were developed based on the instructional frameworks of strategy, speaking, listening, developing scientific oral presentation competence, coping strategies for a question-and-answer session, communication strategies, impromptu speech strategies, and Socratic questioning techniques. The class life cycle went through different stages, as described hereafter.

Each class started with a warm-up activity using Socratic questioning. After that, the pre-stage included two components: preparation and presentation. For preparation, the teacher conducted a review of a vocabulary set together with pronunciation and language use (Impromptu speech strategies) related to science, science research, and authentic inputs from authentic sources, which were necessary for students to perform the speaking tasks related to scientific research. For presentation, the teacher presented new strategies explicitly (Coping strategies for question-and-answer sessions, communication strategies, and Socratic questioning techniques), and finally illustrated to students

on how to select, and when to adopt, the strategies through different learning activities and scientific oral assessment tasks.

In the while stage, which consists of two components: practice and expansion, students were given opportunities to practice selecting and employing different sets of strategies to complete the learning activities in the coursebook and to transfer the use of strategies to other similar tasks such as the scientific oral presentation tasks and question-and-answer-session tasks.

Finally, in the post-stage, which involves two components: self- and teacher assessment, students were encouraged to record their views on the effectiveness of the strategies they employed in their scientific oral presentation and question-and-answer-session in their learning journals. The class life cycle went on in this manner until the end of the semester.

Results

Effects of the SPIQA on Scientific Oral Presentation Competence

This first section reports research results obtained from pre-and post-tests of the scientific oral presentation with a question-and-answer session. It responds to the first research question regarding the effectiveness of the SPIQA in improving science high school students' scientific oral presentation competence.

Pre-and Post-Tests of the Scientific Oral Presentation with a Question-and-Answer Session

The pre-and post-test tasks were authentic as the tasks imitated those that occur in real life, where students had opportunities to deliver a scientific presentation and cope with a question-and-answer session. Students gave a 5-minute scientific presentation and participated in a 5-minute question-and-answer session. The entire score of this test was 20. A paired-samples *t*-test was run on a sample of 35 students.

The findings for the scientific oral presentation with question-and-answer session pre-test and post-test from two experts are shown in Table 1.

Table 1

Findings from the Scientific Oral Presentation with a Question-and-Answer Session Pre- and Post-Tests of Two Experts

Overall Presentation (20)	Pre-test		Pot-test		Pre-to-post change	t	p	d
	x̄	SD	x̄	SD				
Expert 1	14.91	2.16	18.27	1.52	3.36	13.35	.000	1.80
Expert 2	13.11	2.20	17.13	1.93	4.02	13.36	.000	1.94

Note. n = 35; *p < .001

The results of the paired samples t-test of expert 1 in Table 1 show that the pre-test mean score was 14.91 and the post-test mean score was 18.27. The results indicated that after the intervention, the change in score of the post-test mean was positive (3.36 points); $t(34) = 13.35$, $p < .001$ and there was a statistically significant difference in the pre- and post-test mean scores. In addition, Cohen's effect value (d = 1.80) revealed a large practical significance.

In addition, when investigating the results of the paired samples t-test of expert 2, the results show that the pre-test mean score was 13.11 and the post-test mean score was 17.13. The results indicated that after the intervention, the change in score of the post-test mean was positive (4.02 points); $t(34) = 13.36$, $p < .001$ and there was a statistically significant difference in the pre- and post-test mean scores. In addition, Cohen's effect value (d = 1.94) revealed a large practical significance.

In summary, the results of the students' pre- and post-tests in the scientific oral presentation test and Cohen's d indicate that there were significant differences in students' scientific oral presentation competence with a question-and-answer session. Also, the Cohen's effect value indicated a large significance. It can, therefore, be inferred that the SPIQA significantly helped improve the students' scientific oral presentation competence and competence in question-and-answer sessions.

Students' Opinions toward the SPIQA

In addition to the first source of information used to assess students' scientific oral presentation competence and competence in question-and-answer sessions, the second source of data was derived

from students' open-ended questionnaires, semi-structured in-depth interviews, and students' learning journals to respond to the second research question, "*What are the opinions of science high school students toward the scientific presentation instruction: focus on question-and-answer sessions (SPIQA) regarding improving their scientific oral presentation competence?*"

Overall Impressions toward the Course

The results from the open-ended questionnaires reveal that the students had a positive opinion towards the SPIQA. All 35 students (100%) stated that they felt very satisfied with learning process and instruction and indicated that this course helped them prepare and deliver presentations more effectively. They strongly agreed that they gained good experience and were impressed with the course, especially with question-and-answer sessions (35 students, 100%). Similarly, the results from the in-depth interviews show that the students thought the course was well worth studying as it served the students' needs.

> *S8: In this course, I learned the structure of a research presentation and learned how to make a good presentation. I gained in-depth knowledge on how to plan each research part, especially Q&A sessions. The content was specific and was beneficial for students in a science high school.*

Strategies Used for Question-and-Answer Sessions

Learning communication strategies, coping strategies for question-and-answer sessions, and impromptu speech strategies helped students to prepare and cope with question-and-answer sessions more effectively in this course. It was discovered from the questionnaires that all 35 students (100%) agreed that they were able to improve their scientific oral presentation and competence in question-and-answer sessions by using communication strategies, coping strategies for question-and-answer sessions, and impromptu speech strategies.

Coping Strategies for Question-and-Answer Sessions and Communication Strategies

The results from the open-ended questionnaires reveal that all 35 students (100%) identified that they were able to answer questions during question-and-answer sessions fluently and effectively without pause by using multiple strategies, mainly fillers (25 students, 71.4%). Moreover, 18 students (51.4%) mentioned that they could deal with uncomfortable and difficult questions professionally using avoidance and thanking and appeasement strategies. Similarly, results from in-depth interviews show that students thought that the coping strategies for question-and-answer sessions and communication strategies were well worth studying, as these strategies could help them deal with uncomfortable and difficult questions professionally.

> *S18: Communication strategies and coping strategies for Q&A sessions helped me with responding to questions professionally. I gained a lot of confidence, and of course, these strategies could reduce my anxiety. I used fillers to help me with time-gaining during I was thinking of my answers. I could feel that my performance in answering questions looked natural and professional.*

Impromptu Speech Strategies

Results from open-ended questionnaires revealed that 9 students (25.7%) pointed out that the learning of science vocabulary words, pronunciations of those vocabulary words, and grammar related to scientific research assisted them in their preparation of scientific oral presentations and question-and-answer sessions. Similarly, in the in-depth interviews, students cited the benefits of the vocabulary learned in class. Students felt it was beneficial to learn a list of academic words related to science and research which were not frequently used in a regular class. These academic words were frequently used in most academic disciplines and research presentations.

> *S17: My big obstacle is vocabulary. I know that the more vocabulary I know, the more things I would be able to talk about and listen to well. This course provided me with a wide range of vocabulary, especially academic vocabulary and grammar related to science which I could use in my presentations and question-and-answer sessions.*

Socratic Questioning Techniques

To be proficient presenters, students needed to be able to construct, emulate, and employ questions by effective use of Socratic questioning techniques. All 35 students (100%) responded in the open-ended questionnaires that practicing asking questions using Socratic questioning techniques after friends' presentations was beneficial. Similarly, students pointed out during in-depth interviews that practicing asking questions not only helped them with critical thinking but also helped them engage in classroom activities. Moreover, they stated that they also saw the point of view of the questioners and judges – what kind of questions they could possibly ask and how to create an interrogative sentence correctly. These aspects could help them prepare and predict some questions that would be asked on their projects.

> *S32: I like practicing asking questions after friends' presentations. Practicing asking questions made me see the point of view of the judges. Moreover, I could practice creating interrogative sentences using questioning strategies and sets of phrases taught in class as a guide.*

Most Useful Strategies

Results from the open-ended questionnaires reveal that 16 students (45.7%) chose the coping strategies for question-and-answer sessions as being the most useful. Avoidance strategy was selected by the highest number of students as the most useful coping strategy (7 students, 20%), followed by clarification strategies (4 students, 11.4%), returning the question (3 students, 8.6%), and thanking and appeasement (2 students, 5.7%). Fifteen students (42.9%) thought that communication strategies were most useful to them, with the Filler strategy being selected as the most useful communication strategy by this entire group of 15 students. Another 4 students (11.4%) selected impromptu speech strategies as being most useful in their case.

Strategy Training

The open-ended questionnaires reveal that 22 students (62.2%) mentioned the importance of speech rehearsals and strategies training

with mock presentations and learning activities. Similarly, results from in-depth interviews show that rehearsals with mock presentations and learning activities helped students reduce their anxiety, become more confident, and perform better in the scientific oral assessments.

> *S14: In this course, frequent rehearsals with mock scientific presentations and Q&A sessions increased my fluency and helped reduce my anxiety. At the beginning of the course, I did not know what to do and what strategies needed to be used, but the more I practiced, the more I gained confidence because I understood and learned more about what to do.*

Students' Opinions on the Teacher Feedback

The findings from questionnaires show that students valued a high level of teacher feedback in this course. All 35 students (100%) revealed that teacher feedback boosted their confidence. Similarly, results from in-depth interviews showed that teacher feedback had a positive impact on students' scientific presentation competence, as it clearly informed them of what they needed to improve on. In addition, their level of confidence increased as their performance improved.

> *S15*: *Teacher feedback on regularly following up on my learning process significantly boosted my self-confidence. The teacher always pointed out what I needed to work on, and I tried to improve my performance every time I received your comments. I gradually became more confident. The confidence I had greatly helped me speak especially in question-and-answer sessions.*

Discussion

Research Question 1: To what extent does the scientific presentation instruction: focus on question-and-answer sessions (SPIQA) effectively enhance science high school students' scientific oral presentation competence?

Analysis of results based on students' pre-and post-tests for scientific oral presentation competence assessment indicates that there was a significant difference in students' scientific oral presentation

competence and competence in question-and-answer sessions. It can, therefore, be inferred that SPIQA helped improve the students' scientific oral presentation competence and competence in question-and-answer sessions. The findings showed that all four aspects of strategies correlated significantly with students' scientific oral presentation competence and competence in question-and-answer sessions. Moreover, it was found that the more frequently a student practiced and adopted the strategies, the better he/she performed on the scientific oral presentation test. Similarly, the studies of Cohen et al. (1998), Dörnyei (1995), and Kuen et al. (2017) also suggest that the development of communication strategies and the raising of students' awareness of strategies for handling communication problems among less proficient students assists in the honing of communicative skills and leads to the enhancements in oral communication ability.

One more possible factor contributing to such improvements involves explicit teaching of strategies. Teaching strategies explicitly is good practice in language classes or courses, as it directly exposes these strategies to the students. As students become more aware of these strategies, they are able to gain more relevant knowledge and skills, which ultimately leads to improved language proficiency. While some studies argue that there is no need for explicit teaching of communication strategies as the general cognitive processes involved in both native language (L1) and second language (L2) communication strategies are identical (Bialystok, 1990; Bongaerts & Poulisse, 1989; Kellerman, 1991; Paribakht, 1985), the present study's findings are supported by those of Dörnyei and Thurrell (1994), and Rabab'ah (2016), and by Puripunyavanich and Soontornwipast (2018) in the Thailand context, who state that communication strategies instruction is most effective when taught explicitly.

Research Question 2: What are the opinions of science high school students toward the scientific presentation instruction: focus on question-and-answer sessions (SPIQA) regarding improving their scientific oral presentation competence?

Data from the open-ended questionnaires, semi-structured in-depth interviews, and students' learning journals were analyzed to answer this question. The findings showed that students had positive opinions toward the SPIQA. They could appropriately apply all three

aspects of strategies to help them answer during question-and-answer sessions, and that coping strategies for question-and-answer sessions were considered as being the most useful, followed by communication and impromptu speech strategies. Regarding strategic competence, the results of the present study were found to be similar to those of previous research by Tsai (2018) who found that strategic competence plays a significant part in successful and efficient communication. Guest (2018) has also stated that strategic competence has been considered a pillar of overall communicative competence for over thirty years.

The results from the present study demonstrate that students recognize the usefulness of Socratic questioning techniques, in that these help them prepare and predict some questions that would be asked on their projects, and that they help create an engaging and motivating learning environment. This is in line with studies by Reich (2003) and Boa et al. (2018), who found that the Socratic method of teaching engages students with the critical thinking process and helps promote a positive classroom learning environment.

Moreover, findings show that building confidence in speaking to an audience is one of the main factors that strengthens scientific oral presentation competence and competence in question-and-answer sessions. Students participating in this study commonly stated that two factors that would lead to self-confidence in delivering an informative presentation and coping with question-and-answer sessions were 1) strategy training with frequent rehearsals and mock presentations, especially in question-and-answer sessions, and 2) feedback from teachers. These results were consistent with previous literature in that an increase in fluency and a decrease in anxiety are the results of speech rehearsals, allowing students to become more fluent. Students become more fluent and less anxious as they practice more frequently (Goberman et al., 2011). Another key factor relates to teacher feedback, in terms of quality, quantity, timeliness, and strategy used. The findings are congruent with the statement of Porte et al. (2007), which pointed out that verbal feedback from teachers and experts is crucial in student skill development. In addition, teacher feedback allows the teacher to keep track of students' learning and increases the assessment frequency, which results in a higher value of validity and reliability (Stein & Graham, 2014).

Overall, the students obtained higher scores in the scientific oral presentation with question-and-answer session post-test, and they had positive opinions toward the SPIQA since they could professionally select and apply appropriate oral presentation skills, communication strategies, coping strategies for question-and-answer sessions, impromptu speech strategies, and Socratic questioning techniques to build competency. Thus, this present study confirms that SPIQA developed students' scientific oral presentation competence and competence in question-and-answer sessions.

Conclusion

Regarding the effectiveness of the SPIQA in improving science high school students' scientific oral presentation competence, it was revealed that there were statistically significant differences between pre- and post-test results. Findings from the open-ended opinion questionnaires and semi-structured in-depth interviews employed at the end of the course suggest that students were positive about the teaching/learning and assessment of the course. Moreover, as students learned about the importance of English oral presentation competence and competence in question-and-answer sessions for their future education and career goals, students became aware of the areas for improvement through observing their own performance during the lessons and speaking activities and were consequently motivated to actively engage in class activities. In addition, the involvement rate in the learning process was relatively high as the course used and adapted content from students' fields of interest and familiarity.

Implications of the Study

Coping strategies for question-and-answer sessions, communication strategies, impromptu speech strategies, and Socratic questioning techniques should be integrated into an oral presentation course to promote students' speaking skills, oral presentation competence, and especially competence in question-answer sessions.

Moreover, the findings from this study identified raising students' awareness of strategies for coping with communication problems could be a possible method for facilitating the development of students' oral

presentation competence and competence in question-and-answer sessions, particularly for students less proficient in English. Furthermore, a program focused on explicit teaching of communication strategies is required and should be designed specifically for an application in the Thai context. For example, the teacher should be meticulous in selecting strategies to cater for students' needs, contexts, interests, and levels of English proficiency. As Thai students with low English proficiency can be shy and lack confidence, they may feel reluctant to give a presentation and may feel stressed to manage a question-and-answer session. Therefore, the teacher must devise strategies that suit the students' context and needs, and select presentation, communicative tasks and learning activities accordingly.

Additionally, the present study's findings reveal that rehearsals, especially in question-and-answer sessions lead to increased awareness among students of the areas requiring improvement. Thus, rehearsals should be encouraged by teachers to effectively improve students' oral presentation competence and competence in question-and-answer sessions. Moreover, teacher feedback should be integrated into a course to support students' learning and to enhance their oral presentation skills. In addition, English teachers are encouraged to invite experts in each field of knowledge such as physics, chemistry, biology, and engineering to help in evaluating and giving feedback on oral presentation skills to students at least once at the end of the course. Through these efforts, students will gain knowledge of the English language, insights into the selection and use of effective strategies for gaining competence, and valuable feedback from experts in each field to excel in their presentations.

Recommendation for Further Studies

Since the findings of this study are relevant in the context of high school students with high ability in science, it is recommended that further research studies expand the population to include students of other levels of science ability, English proficiency, school level, context, or other specific study fields. Moreover, further research should be conducted with a quasi or true experimental design, consisting of both control and experimental groups, exploring the impacts of the communication strategies and coping strategies for question-and-answer

sessions instruction on students' oral presentation competence and competence in question-and-answer sessions. In addition, this design would enable researchers to compare the results of the explicit strategy instruction between two groups.

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