Current Practice, Problems and Needs of Primary Teachers for Teaching Selected Science Content

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ABSTRACT

Fifty primary science teachers under the Bangkok Educational Service Area Office were asked to complete a questionnaire asking about their current practice, problems, and needs for teaching sub-strand 6: Processes that Shape the Earth, sub-strand 7: Astronomy and Space, and sub-strand 8: Nature of Science and Technology that were in line with the learning reform emphasizing learners as being most important. The results revealed that the majority of teachers had few experiences in teaching science despite their long teaching career. Most teachers also had more difficulties in understanding the concepts of sub-strand 7 than those of sub-strands 6 and 8, and they needed to gain more understanding about the content of sub-strand 8. The majority of teachers expressed a moderate level of current practice, problems, and needs with respect to teaching, integration among sub-strands, learning atmosphere, learning materials and resources, and assessment. The perceived needs of most teachers aligned with the problems they faced in schools. Problems faced by the teachers in teaching sub-strands 6 and 7 were not remarkably different and there were few teachers who indicated difficulty in integrating sub-strand 8 in their teaching. The three most common problems for teaching sub-strands 6, 7 and 8 were teaching materials, teaching strategies, and content understanding.

Key words: primary teachers, processes that shape the earth, astronomy and space, nature of science and technology

บทคัดย่อ

ครูประถมศึกษาสังกัดสำนักงานการศึกษาขั้นพื้นฐานกรุงเทพมหานคร จำนวน 50 คน ได้ตอบแบบสอบถามสภาพการปฏิบัติ ปัญหา และความต้องการเกี่ยวกับการจัดการเรียนรู้วิทยาศาสตร์สาระที่ 6 กระบวนการเปลี่ยนแปลงของโลก สาระที่ 7 ดาราศาสตร์และอวกาศ และสาระที่ 8 ธรรมชาติของวิทยาศาสตร์และเทคโนโลยี ตามแนวปฏิรูปการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ ผลการวิจัยพบว่า ครูส่วนใหญ่มีอายุค่อนข้างมากแต่มีประสบการณ์การสอนวิทยาศาสตร์น้อย ครูส่วนใหญ่มีความเข้าใจเนื้อหาสาระที่ 7 น้อยกว่าสาระที่ 6 และ 8 และมีความต้องการพัฒนาความเข้าใจเนื้อหาสาระที่ 8 มากกว่าสาระที่ 6 และ 7 ครูส่วนใหญ่มีการปฏิบัติ พบปัญหาและมีความต้องการพัฒนาเกี่ยวกับการจัดการเรียนรู้สาระที่ 6, 7 และ 8 ตามแนวปฏิรูปการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญในระดับปานกลางในด้านการจัดการเรียนรู้ ด้านการบูรการสาระที่ 6, 7 และ 8 ด้านบรรยากาศการเรียนรู้ สื่อการเรียนรู้ และแหล่ง

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การเรียนรู้ และด้านการวัดและประเมินผล โดยความต้องการพัฒนาของครูส่วนใหญ่ในด้านต่าง ๆ สอดคล้องกับปัญหาที่พบในด้านนั้น ๆ จำนวนครูที่ระบุปัญหาเกี่ยวกับการจัดการเรียนรู้ตามแนวปฏิรูปการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญในสาระที่ 7 เมื่อเปรียบเทียบกับสาระที่ 6 ปรากฏว่าไม่แตกต่างกันมากนัก และมีครูจำนวนค่อนข้างน้อยระบุปัญหาเกี่ยวกับการจัดการเรียนรู้สาระที่ 8 ทั้งนี้ครูส่วนใหญ่มีปัญหาในการจัดการเรียนรู้วิทยาศาสตร์สาระที่ 6, 7 และ 8 ในด้านสื่อการเรียนรู้ รองลงมาคือ วิธีสอน และความเข้าใจในเนื้อหา ตามลำดับ

คำสำคัญ: ครูประถมศึกษา, กระบวนการเปลี่ยนแปลงของโลก, ดาราศาสตร์และอวกาศ, ธรรมชาติของวิทยาศาสตร์และเทคโนโลยี

INTRODUCTION

Education reform in Thailand began as a result of the Amendment of the Constitution of the Kingdom of Thailand (1997). This reform stipulates that all individuals have equal rights to receive education provided by the government for the duration of at least 12 years. Education reform led to the proclamation of the National Education Act (1999), which resulted in a large-scale national education reform, especially at a primary level. A student-centered approach is at the heart of this reform. In comparison with the 1978 Primary Education Curriculum (revised version 1990), the reformed curriculum had significant changes, especially in the Life Experiences Strand.

According to the 1978 Primary Education Curriculum (revised version 1990), primary science was not taught as a separate subject. It was incorporated with social studies and health education, and called the Life Experiences Strand, dealing with the study of human lives and the environment. Its content moved from concrete to abstract, and simple to complex. The Life Experiences Strand contained 11 units, which were required to be studied at different grade levels, as shown in Figure 1.

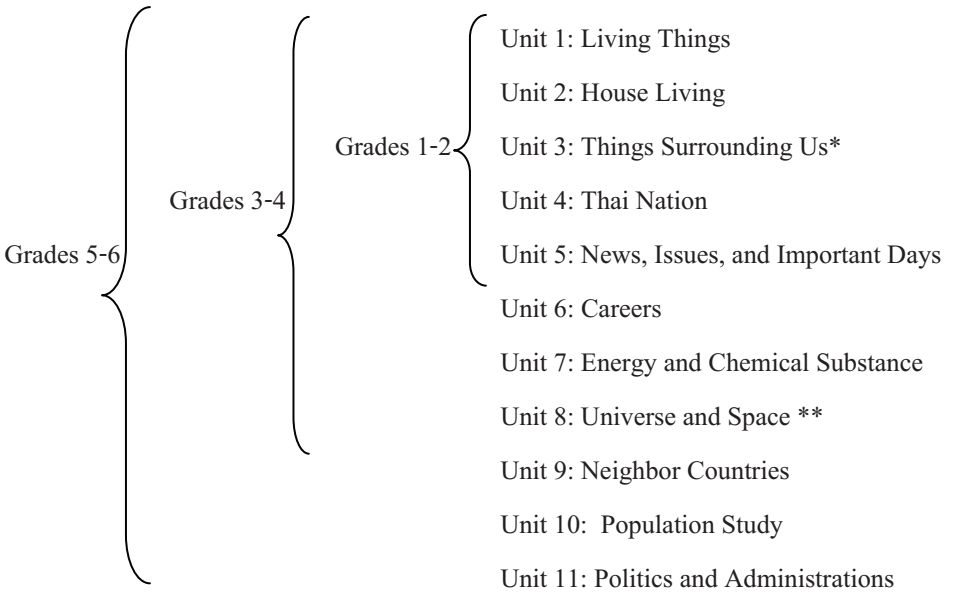

Figure 1 The content structure of the life experiences strand in the 1978 Primary Education Curriculum (revised version 1990)

Note * and ** means the units aligned with sub-stand 6: Processes that Shape the Earth and sub-strand 7: Astronomy and Space in the Basic Education Curriculum (2001).

In contrast to the aforementioned curriculum, the Basic Education Curriculum (2001) separated science as a new strand containing 8 sub-strands: sub-strand 1: Living Things and Living Processes; sub-strand 2: Life and the Environment; sub-strand 3: Matter and Properties of Matter; sub-strand 4: Forces and Motion; sub-strand 5: Energy; sub-strand 6: Processes that Shape the Earth; sub-strand 7: Astronomy and Space; and sub-strand 8: Nature of Science and Technology. Students at all grade levels were assigned to study all sub-strands, in which the contents are arranged from basic to complicated, and concrete to abstract. When comparing contents of sub-strands 6 and 7 of the 1978 Primary Education Curriculum (revised version 1990) with the Basic Education Curriculum (2001), it could be found that the new curriculum has more contents than the previous one and requires students to study astronomy and space from Grade 1. In addition, a new sub-strand called "the Nature of Science and Technology" is launched in the new curriculum. This sub-strand involves the nature, process and social activity of science and technology. Teachers needed to integrate the nature of science and technology into all contents they teach.

In addition to the change of content and content structure, the Basic Education Curriculum (2001) requires teachers to teach by using a student-centered approach. In this approach, each student is seen as an individual, who is able to learn and develop himself/herself, and as being the most important person in the teaching and learning process. Teachers must encourage students to fully develop themselves to their highest potential. To accomplish this aim, teachers have to change their role from a knowledge transmitter to a learning facilitator (Ministry of Education, 2001).

The success of education reform based on the National Education Act (1999) requires attentive participation by all stakeholders: the government, educational organizations, parents, educators, and the teachers, who are especially regarded as the most important element for this success. For the education reform to succeed, teachers need to enhance their knowledge and ability, especially in sub-strands 6, 7 and 8 that are the most significant changes in the new curriculum. To achieve this, in-service primary teacher professional development (PD) is needed. In order to design the appropriate PD that meets teachers' needs, an understanding on the perceived current practice, problems, and needs of teachers in teaching sub-strands 6,7 and 8 regarding the new reform should be first obtained.

PURPOSE OF THE STUDY

The purpose of this study is to explore the perceived current practice, problems, and needs of primary teachers to be successful in the new reform emphasizing students as the most important when teaching sub-strand 6: Processes that Shape the Earth, sub-strand 7: Astronomy and Space, and sub-strand 8: the Nature of Science and Technology.

Scope of the study

This research reported current practice, problems, and needs of 50 primary teachers from schools under the Bangkok Educational Service Area Office. The science content in focus was sub-strand 6: Processes that Shape the Earth, sub-strand 7: Astronomy and Space, and sub-strand 8: the Nature of Science and Technology

METHODOLOGY

Participants

The participants were 50 in-service primary science teachers who taught sub-strands 6, 7 and 8 from 38 schools under the Bangkok Educational Service Area Office.

Research instrument

A multi-faceted questionnaire was designed in order to explore primary science teachers' current practice problems, and needs for teaching sub-strands 6, 7 and 8 following the new reform

emphasizing students as most important. It consisted of three parts. The first part contained seven items asking participants about demographic information. The second part consisted of 29 items, which are 5-level Likert-type scale. The participants were asked to rate each item according to their perceived current practice, problems, and needs for teaching sub-strands 6, 7 and 8 following the new reform emphasizing students as the most important according to: curriculum analysis; lesson plan development; content understanding; teaching; integration among sub-strands; learning culture, materials and resources; and assessment. The final part included one open-ended question asking participants about their urgent problems in teaching sub-strands 6, 7 and 8 following the new reform. To construct items of the questionnaire, the researchers reviewed literature related to sub-strands 6, 7 and 8 and education reform emphasizing students as the most important such as the Basic Education Curriculum (Ministry of Education, 2001), the Handbook of Teaching and Learning Science (Institute for the Promotion of Teaching Science and technology, 2002) and related research studies. The questionnaire items were constructed and subsequently validated their content and construct validity by five science educators.

Data collection

The questionnaires were administered to 50 primary teachers from 38 primary schools under the Bangkok Educational Service Area.

Data analysis

The data were both quantitatively and qualitatively analyzed. The quantitative analysis involved counting for the frequency and calculating for the percentage of responses. Additionally, the qualitative analysis involved categorization. That is, the open-ended responses were read and coded into possible categories. After saturation of coding, the remaining data were categorized using this list of categories. Next, the frequency of comments for each category was counted.

RESULTS AND DISCUSSION

Part I: Demographic information of participants

The majority of participants were female (39 out of 50). It was found that 28 percent of participants were 51-55 years of age, 12 percent were 56-60 years of age, and 10 percent were 41-45 or 46-50 years of age. Twenty-six percent of participants had experience in teaching science less than 6 years, 16 percent had teaching experience of 6-10 or 11-15 years, and 14 percent had teaching experience of 21-25 years. To sum up, the majority of teachers were over 41 years old with less than 6 years experience in teaching science. This may be because science was previously integrated with other contents and had been separated as an isolated subject only since the proclamation of the new curriculum in 2001.

The majority of teachers (72%) had earned a bachelor degree. The remaining held a diploma in teaching profession (12%), a master degree (10%), no response (4%) and a certificate in teaching (2%). Half of the participants taught grades 4-6, while 14 teachers (28%) taught grades 1-3 and 10 teachers (20%) taught grades 1-6 and no response (2%). Seventy percent of the teachers taught both sub-strands 6 and 7, 22 percent taught only sub-strand 7, and 6 percent did not teach either sub-strands 6 and 7, and 2 percent taught only sub-strand 6.

Part II: Current practice, problems, and needs for teaching sub-strands 6, 7 and 8

The current practice, problems, and needs of teachers in developing the lesson plans for sub-strands 6, 7 and 8 can be shown as Table 1.

Teachers expressed a high level of current practice both in reviewing, analyzing, and developing understanding about expected learning outcomes of sub-strands 6, 7 and 8 stated in the IPST Teacher Guide Book, and developing lesson plans aligning with contents and learning standards of those three sub-strands. Regarding perceived problems, teachers had a moderate level of problems in reviewing, analyzing, and developing understanding about

expected learning outcomes of sub-strands 6, 7 and 8, but had a low level of problems in developing lesson plans aligning with the contents and learning standards of those three sub-strands. The possible explanation for the low level of problems in developing lesson plans of sub-strands 6, 7 and 8 is that most teachers practice developing lesson plans regularly because it is one of major responsibilities of teachers. In order to do that, they have to analyze and understand the learning standard of the topic they want to teach, which is stated in the IPST Teacher Guide Book. With respect to perceived needs, teachers had a moderate level of needs both for reviewing, analyzing, and developing understanding about expected learning outcomes of sub-strands 6, 7 and 8, and developing lesson plans aligning with contents and learning standards of those three sub-strands.

Table 2 shows that teachers perceived themselves as having a higher level of content understanding in sub-strands 6 and 8 than sub-strand 7, which was at a moderate level. They had a moderate level of problems of content understanding in sub-strands 7 and 8, but their content understanding in sub-strand 6 was reported as low. Teachers had a high level of need for improving their content understanding of sub-strand 8, but had a moderate need for improving content understanding in sub-strands 6 and 7.

To sum up, most teachers perceived that they

Table 1 Current practice, problems, and needs in developing lesson plans as reported by teachers

(n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
1. Review, analyze, and develop understanding about expected learning outcomes of sub-strands 6,7 and 8 stated in IPST Teacher Guide Book	3.88 high	0.75	2.64 moderate	0.72	2.84 moderate	1.09
2. Develop lesson plans for sub-strands 6, and 7 aligning with contents and learning standards	3.58 high	1.18	2.26 low	1.07	2.72 moderate	1.41

Table 2 Current practice, problems, and needs about content understanding as reported by teachers

(n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
3. Develop content understanding in sub-strand 6: Processes that Shape moderate the Earth	3.62 high	0.99	2.34 low	0.94	2.88 moderate	1.30
4. Develop content understanding in sub-strand 7: Astronomy and Space moderate	3.24 moderate	1.20	2.52 moderate	1.16	3.06 moderate	1.32
5. Develop content understanding in sub-strand 8: Nature of Science and Technology	3.62 high	0.88	2.50 moderate	0.81	3.72 high	5.93

had less understanding of sub-strand 7 than sub-strands 6 and 8 because sub-strand 7 contains some concepts that are not included in the previous science curriculum (1999). These concepts additionally must be taught from Grade 1. The limited content understanding of teachers found in this study was corresponded to the study of Suwaporn (1998) and Prasert (2003).

The majority of teachers reported that they had a moderate level in all items relating to current practice in teaching sub-strands 6, 7 and 8. The top three items were engaging student interest in learning sub-strands 6 and 7 ($\bar{x}$= 3.42), and engaging students in inquiry ($\bar{x}$= 3.40) and hands-on activities ($\bar{x}$= 3.30) in sub-strands 6 and 7. Most teachers had a moderate level in all items relating to problems in teaching sub-strands 6, 7 and 8. The top three items were promoting student understanding in sub-strand 7 ($\bar{x}$= 3.26) and sub-strand 6 ($\bar{x}$= 3.12), and promoting student problem-solving, analytical, critical, and creative thinking in sub-strands 6 and 7 ($\bar{x}$= 2.92). In addition, most teachers demonstrated

Table 3 Current practice, problems, and needs about teaching as reported by teachers

(n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
6. Examine student prior knowledge of sub-strands 6 and 7	3.26 moderate	0.88	2.56 moderate	0.95	2.80 moderate	1.21
7. Engage student interest in learning sub-strands 6 and 7	3.42 moderate	1.07	2.66 moderate	1.12	3.18 moderate	1.34
8. Respect diversity of learners in teaching sub-strands 6 and 7	3.28 moderate	1.01	2.74 moderate	0.92	3.12 moderate	1.14
9. Engage students in inquiry in learning sub-strands 6 and 7	3.40 moderate	1.09	2.70 moderate	1.05	3.10 moderate	1.30
10. Engage students in hands-on activities in learning sub-strands 6 and 7	3.30 moderate	0.99	2.84 moderate	0.93	3.26 moderate	1.10
11. Promote students' problem-solving, and analytical, critical, and creative thinking in sub-strands 6 and 7	3.08 moderate	1.18	2.92 moderate	1.12	3.34 moderate	1.19
12. Promote student science process skills in teaching sub-strands 6 and 7	3.24 moderate	1.15	2.72 moderate	1.05	3.22 moderate	1.13
13. Promote student cooperative learning in sub-strands 6 and 7	3.22 moderate	1.88	2.68 moderate	1.10	3.00 moderate	1.21
14. Encourage students to do science projects in sub-strands 6 and 7	2.64 moderate	1.27	2.92 moderate	1.31	3.20 moderate	1.30
15. Encourage students to apply knowledge in sub-strands 6 and 7 to real-world situations	3.18 moderate	1.32	2.66 moderate	1.12	2.94 moderate	1.22
16. Promote student understanding of sub-strand 6: Processes that Shape the Earth	3.10 moderate	1.23	3.12 moderate	4.45	2.92 moderate	1.24
17. Promote student understanding of sub-strand 7: Astronomy and Space	3.16 moderate	1.27	3.26 moderate	4.43	3.04 moderate	1.32

their needs as a moderate level of all items in teaching sub-strands 6, 7 and 8. The top three items were promoting student problem-solving, analytical, critical, and creative thinking in sub-strands 6 and 7 ($\bar{x}$= 3.34), engaging students in hands-on activities in learning sub-strands 6 and 7 ($\bar{x}$= 3.26), and encouraging student science process skills in sub-strands 6 and 7 ($\bar{x}$= 3.22).

In summary, the majority of teachers expressed a moderate level in current practice, problems, and needs for teaching sub-strands 6, 7 and 8. The needs of teachers for promoting student problem-solving, analytical, critical, and creative thinking, engaging student in hands-on activities, and encouraging students to do science projects in sub-strands 6 and 7 were similar to the study of Prasert (2003). Their problems and needs in teaching by engaging student interest and promoting student cooperative learning also corresponded to Vuttinan's (2001) and Prasert's (2003) findings.

As seen from Table 4, teachers' perceived current practice, problems, and needs for integrating sub-strand 8 into sub-strands 6 and 7. In addition, the teachers' integration of those three sub-strands with other subjects (e.g. social studies, religion, and culture) was at a moderate level which was similar to the findings of Vuthinan (2001).

From Table 5, the majority of teachers had a high level of current practice in organizing a learning atmosphere to support student learning in sub-strands 6 and 7 ($\bar{x}$= 3.64), but reflected other items in a moderate level. The top three items were using learning materials appropriately with learning objectives and contents of sub-strands 6 and 7 ($\bar{x}$ = 3.38), and using information technology ($\bar{x}$= 3.13), and a variety of learning materials ($\bar{x}$= 3.10) in teaching sub-strands 6 and 7. Regarding level of problems, Table 5 shows that organizing a learning atmosphere to support student learning in sub-strands 6 and 7 was the only item ranked at a high level ($\bar{x}$= 3.56), while the others were ranked at a moderate level. The top three items were using interesting learning materials ($\bar{x}$= 2.82), local learning resources ($\bar{x}$= 2.80), and a variety of learning materials ($\bar{x}$= 2.78) in teaching sub-strands 6 and 7. We also found that teachers reported their need of all items in regard to learning atmosphere, materials, and resources at a moderate level. The first three items were using local learning resources ($\bar{x}$= 3.20), a variety of learning materials ($\bar{x}$= 3.12), and interesting learning materials ($\bar{x}$= 3.10) in teaching sub-strands 6 and 7.

In summary, for most items, the teachers reported their current practice, problems, and needs for learning atmosphere, materials, and resources as being at a moderate level. However, the teachers rated their current practice and needs in organizing learning atmosphere to support student learning at a high level. This finding was in line with the findings of Pornthip (2002) and Prasert (2003). In addition, our finding about the utilization of local learning resources was aligned with the studies of

Table 4 Current practice, problems, and needs in integration of sub-strands 6-8 as reported by teachers (n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
18. Integrate sub-strand 8: Nature of Science and Technology into sub-strands 6, and 7 taught	3.06 moderate	1.33	2.60 moderate	1.09	3.00 moderate	1.29
19. Integrate contents of sub-strands 6, 7 and 8 into contents of other subjects e.g. social studies, religion, and culture	2.88 moderate	1.24	2.54 moderate	1.15	2.98 moderate	1.22

Vuthinan (2001) and Prasert (2003). We also found that there was the relationship between teachers' needs for improvement and their problems with respect to using local learning resources and a variety of learning materials in teaching sub-strands 6 and 7.

From Table 6, the majority of teachers expressed a moderate level of current practice in all items regarding assessment of student learning in sub-strands 6 and 7. The first three items were using assessment tools appropriately with learning goals ($\overline{x}$= 3.48), taking assessment results into account for

Table 5 Current practice, problems, and needs in learning atmosphere, materials, and resources as reported by teachers

(n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\overline{x}$	S.D.	$\overline{x}$	S.D.	$\overline{x}$	S.D.
20. Organize learning atmosphere to support student learning in sub-strands 6 and 7	3.64 high	4.33	3.56 high	4.37	3.06 moderate	1.11
21. Use interesting learning materials for teaching sub-strands 6 and 7	3.06 moderate	1.04	2.82 moderate	1.96	3.10 moderate	1.18
22. Use variety of learning materials for teaching sub-strands 6 and 7	3.10 moderate	1.02	2.78 moderate	1.04	3.12 moderate	1.26
23. Use learning materials appropriately with learning objectives and contents of sub-strand 6 and 7	3.38 moderate	0.99	2.68 moderate	0.96	3.06 moderate	1.17
24. Use local learning resources in teaching sub-strands 6 and 7	2.90 moderate	1.07	2.80 moderate	1.12	3.20 moderate	1.18
25. Use information technology in teaching sub-strands 6 and 7	3.13 moderate	1.13	2.68 moderate	1.17	3.06 moderate	1.32

Table 6 Current practice, problems, and needs in assessment as reported by teachers

(n=50)

Item	Level of current practice		Level of problems		Level of needs	
	$\overline{x}$	S.D.	$\overline{x}$	S.D.	$\overline{x}$	S.D.
26. Assess student learning in sub-strands 6 and 7 and provide feedback to individual students	3.18 moderate	1.12	2.70 moderate	1.09	3.08 moderate	1.26
27. Use variety of tools to assess student learning of sub-strands 6 and 7	3.14 moderate	1.07	2.71 moderate	0.94	3.04 moderate	1.14
28. Use assessment tools appropriately with learning goals	3.48 moderate	0.95	2.64 moderate	0.94	2.98 moderate	1.17
29. Take results of student achievement into account to improve teaching sub-strands 6 and 7	3.42 moderate	0.93	2.70 moderate	0.97	3.06 moderate	1.10

improving teaching ($\bar{x}$= 3.42), and assessing student learning of sub-strands 6 and 7 and provide feedback to individual students ($\bar{x}$= 3.18). Most teachers also identified a moderate level of problems in all items in relation to assessment of student learning of sub-strands 6 and 7. The first three items were using a variety of tools to assess student learning ($\bar{x}$= 2.71), taking assessment results into account for improving teaching ($\bar{x}$= 2.70), and assessing and providing feedback to students ($\bar{x}$= 2.70) in learning sub-strands 6 and 7. The majority of teachers reflected that they had a moderate level of needs in all items regarding assessment of student learning in sub-strands 6 and 7. The first three items were assessing and providing feedback to students ($\bar{x}$= 3.08), taking assessment results into account for improving teaching ($\bar{x}$= 3.06), and using a variety of tools to assess student learning in sub-strands 6, and 7 ($\bar{x}$= 3.04).

To sum up, most of the teachers reported a moderate level of current practice, problems, and need in assessment of student learning in sub-strands 6, and 7. The aspects teachers needed to improve that were related to the findings of the study of Prasert (2003) were assessing student learning and providing feedback to students and using assessment tools appropriately with learning goals.

Part III: Urgent problems about teaching and learning of sub-strands 6, 7 and 8

From open-ended questions, 45 participants expressed urgent problems in teaching sub-strands 6, 7 and 8 aligning with the learning reform emphasizing learner as the most important, as shown in Table 7.

Table 7 shows the majority of teachers indicated the urgent problems in teaching contents of sub-strand 7, sub-strand 6, and sub-strand 8. Although, there were similar numbers of teachers who indicated problems in teaching sub-strands 6 and 7 aligning with the learning reform emphasizing

Table 7 Problems in teaching sub-strands 6, 7 and 8 aligning with learning reform as reported by teachers (n=45)

Contents	Frequency	Percent
Sub-strand 7: Astronomy and space	30	66.67
- Learning material (13)		
- Teaching strategies (7)		
- Content understanding (5)		
- Assessment (2)		
- Learning resources (2)		
- Doing science projects (1)		
Sub-strand 6: Processes of the earth	28	62.22
- Learning material (12)		
- Teaching strategies (6)		
- Content understanding (5)		
- Assessment (2)		
- Learning resources (2)		
- Doing science projects (1)		
Sub-strand 8: Nature of science and technology	3	6.67
- Learning material (1)		
- Teaching strategies (1)		
- Content understanding (1)		

Note More than one response is possible for each participant

learner as the most important, there were few teachers who indicated problems in teaching sub-strand 8. This may be because these teachers did not recognize the importance of integration of the Nature of Science and Technology into contents they taught. In addition, Table 7 illustrates the top three urgent problems in teaching sub-strands 6, 7 and 8 aligning with the learning reform emphasizing learner as the most important: that is, learning materials, teaching strategies, and content understanding. The others were assessment of student learning, learning resources, and teaching students to do science projects. The lack of learning materials and resources found in this study corresponded to the findings from the studies of Prasert (2003) and Pornthip (2002).

CONCLUSION

The purpose of this study was to explore the perceived current practice, problems, and needs of primary teachers in teaching sub-strand 6: Processes that Shape the Earth, sub-strand 7: Astronomy and Space, and sub-strand 8: Nature of Science and Technology in line with the new reforms emphasizing the learner as most important. The participants of this study were 50 in-service primary teachers from 38 schools under the Bangkok Educational Service Area Office. Although the majority of teachers had a long teaching career, they had fewer than six years of experience in teaching science. This is because, previously, science was not taught explicitly as a separated subject, but incorporated into the Life Experiences Strand. However, teachers are now required to teach science as a separated strand according to the Basic Education Curriculum (2001). Most of teachers felt their content understanding of sub-strand 7 was less than that of sub-strands 6 and 8. However, they indicated the need to develop their content understanding of sub-strand 8 more than sub-strands 6 and 7. This may be because the Nature of Science and Technology as well as Astronomy and Space are now explicitly mentioned in the new curriculum, and these are new to teachers. Nevertheless, teachers reported that they faced few problems in developing lesson plans for sub-strands 6 and 7 aligning with the new curriculum. This may be because lesson plan development is one of major responsibilities for teachers in their regular practice.

Teachers mostly expressed a moderate level of current practice, problems, and needs in teaching sub-strands 6, 7 and 8 aligning with the learning reform emphasizing learner as the most important with respect to these aspects: teaching; integration among sub-strands 6, 7 and 8; learning atmosphere, materials, and resources; and assessment. Also, we found that teachers' needs for improvement corresponded to problems they faced. For example, teachers faced problems in promoting students' problem-solving, and analytical, critical, and creative thinking. They, therefore, needed professional development to help them address these problems by providing activities and strategies in supporting students to conduct science projects. Although there were similar number of teachers identifying problems in teaching sub-strands 6 and 7, there were only few teachers identifying problems in teaching sub-strand 8. Most teachers identified these urgent problems, i.e. learning materials, teaching strategies, and content understanding.

IMPLICATIONS

Most of the primary teachers in this study had few experiences in teaching sub-strands 6, 7 and 8. They also had limited awareness of integration of sub-strand 8 (the Nature of Science and Technology) in their teaching. For a majority of teachers, three urgent needs for teaching sub-strands 6, 7 and 8 aligning with the new reform emphasizing learner as the most important were: learning materials, teaching strategies, and content understanding. The development of professional development program to help these teachers improve their learning materials, teaching strategies, content understanding, as well as an awareness of integrating the nature of science and technology in their teaching is needed.

The participatory action research (PAR) process potentially helps design an effective professional development program. The PAR process may start with inviting teachers to examine and analyze their problems in teaching sub-strands 6, 7 and 8 aligning with the learning reform emphasizing learners as most important. In relation to their problems, teachers subsequently design methods, activities or tools which can potentially solve their problems, implement them, and finally, reflect on things they have learned from the whole process.

Furthermore, more in-depth information regarding these primary teachers' current practice, problems, and needs for teaching sub-strands 6, 7 and 8 aligning with the learning reform emphasizing learners as most important is needed. This information will help design more quality professional development program that meets teachers' needs and expectations.

The next phase of this research project consequently aim to gain in-depth information regarding primary teachers' current practice, problems, and needs for teaching sub-strands 6, 7 and 8 aligning with the learning reform and integrate this information with the PAR process to help primary teachers improve their teaching of sub-strands 6, 7 and 8 aligning with the learning reform.

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