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The development of classroom assessment system in Mathematics for basic education of Thailand

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Abstract

Classroom assessment in Mathematics is among an instructor’s most essential educational tool. When properly developed and interpreted, assessments can help teachers better understand what their students are learning. However, there was no the system of classroom assessment in Mathematics in Thailand. The purposes of this study were to develop classroom assessment system in Mathematics based on basic education curriculum 2008 approaching participatory action research, and to evaluate the system. This study was a research and development in its nature basing on collaborative action research. The study was carried out in two steps that were step 1 – The gathering of basic data and developing the system, and step 2 – The evaluation of the system by the experts. There were 4 standards for the evaluations of the system, consisted of utility, feasibility, propriety, and accuracy. The result of this study found that the classroom assessment system in Mathematics which has been developed was comprised of action research with four sub-systems namely input, process, output, and outcome. Each of the sub-system also had four operational steps of planning, action, observation, and reflection. The experts evaluated the evaluations standards were at the high level. Furthermore, the system was designed to be operated as a part of normal classroom instruction.

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Keyword: Classroom Assessment System; Mathematics; Basic Education; Authentic Assessment; Assessment for Learning; Collaborative Pyramid Assessment

Introduction

The objectives of Education during Century 21st was to focus on students to be able to solve the problems, have critical thinking, and higher-order thinking which were necessary skills for students in news and information period (Farrington and Small, 2008). Therefore, to develop body of knowledge as well as students’ Mathematics ability were major objectives since Mathematics could help to develop problem solving ability, and logical reasoning as well as foundation of other sciences, and indicator of success in Thai education system for preparing the quality people in the future. So, the educational management in Thailand began to change curriculum in Mathematics learning substance for students to obtain Mathematics knowledge, skill, and desirable characteristic (Office of Academic and Educational Standard, 2008a) relevant to usage enhancing the learning during the 21st Century. However, Thailand was alert in Educational Reform by modifying curriculum to included the same standard throughout the country, and considered the findings of educational reform through output and outcome occurred with students in Mathematics Learning Substance by giving an importance to the measurement and evaluation in both of national and international levels such as the Ordinary National Education (O-NET), evaluation outcome of TIMSS as well as PISA etc. Those kinds of evaluation focused on information technology reflecting the students’ quality as the end of educational management process rather than the improvement of students’
development. However, the questions like “Were the measurement and evaluation focused on the improvement and development, or judging the value at the end?” always occurred. The answer was “assessment for Learning” rather than “assessment of learning”. So, classroom assessment was a key closely with the students most which could improve and develop the students in aligned with classroom instruction.

In practice, Thailand faced with the problems in classroom assessment of Mathematics, especially the assessment of Mathematics thinking and skill. Most of them, 81.50%, emphasized on knowledge measurement through the test only including: before studying, during studying, and after studying (Junpeng & Chnjunteuk, 2009). Furthermore, the real situation of studies by Ministry of Education, found that: 1) teachers lacked of knowledge in assessment, they didn’t have comprehension and skill in classroom assessment, 2) assessment technique, there was no evaluation indicating educational quality as benchmark, or no concrete assessment model, or transparency, or 3) the assessment instrument, the design and construction of instrument couldn’t be performed, there was no quality instrument, 4) educational standard, the teachers’ assessment wasn’t based on educational standard or benchmark, there were different interpretations of authentic assessment leading to students’ different standard of students, 5) there was no unity in rules and regulations, and 6) management, the assessment findings couldn’t be used for student development truly, there were different standards of instructional management which would cause different assessments affecting future study, and learning achievement acceptance (Office of Academic and Educational Standard, 2008a). Those problems reflected that the assessment system wasn’t appropriate with recent Educational management especially the problems occurred with teachers which were important parts in assessment system as the most important mechanism for moving the practical outcome, and occurring with students truly.

According to research studies and related literature regarding to the development of learning assessment of Thailand in the past, although the research studies gave an importance to development of the system in students’ learning achievement, (Kedkomon, 2002; Pinyomana, 2003), found that it always be focused on the other levels which were not basic education level, or considered in overall in every learning substance instead of Mathematics which included unique characteristic. (Toongkasamit, 2007; Ekwarangkoon, 2007). Consequently, it wasn’t congruent with core curriculum of Basic Education 2008 using in the present. Therefore, it was a challenge for Thailand to solve this problem whereas the hope in national and international levels to focus on students’ desirable characteristics not be lower than specified criterion. So, this research aimed to develop the classroom assessment system of Mathematics in basic education level. Since there was no concrete practice and action in school included the expected utilization in 3 levels: The first one, outcomes occurred with students, the second one, outcomes occurred with teacher, and The third one, outcomes occurred with administrators. These 3 levels of outcomes, would lead to development of quality as well as improvement in National Educational Quality in future.

Objectives
1. To develop the classroom assessment system in Mathematics for basic education of Thailand.
2. To evaluate the quality of the classroom assessment system in Mathematics for basic education of Thailand.

Conceptual Framework
Angelo and Cross (1993) stated that the classroom assessment was a technique which could help the teachers to know that what their students were studying in class, and how much did they know. Therefore, the classroom assessment reflecting the students’ ability as well as being information for related persons to use in student development, and learning and teaching as real situation—the classroom assessment and course levels (Toongkasamit, 2007) as well as the principle of classroom assessment needed to perform in aligned with instruction (The Academic and Educational Standard, 2008b). It was also supported by Kanjanawasee (2006) research report in assessment for learning: A proposed policy stated that the classroom assessment was a part of learning and teaching which the teachers had to perform regularly including before, during, and after the instruction.

In this study, the researcher developed classroom assessment system based on approach of System Approach. (Smith, 1982; Lunenburg and Omstein, 1991; kammanee, 2004; Kanjanawasee, 2006). Since it was congruent and covered the context to be studied. The factors of related system were determined including: the Input, Process, and Product as well as Feedback. In sub-factors of system of Process, based on 2 major approaches as: 1) Continuing Professional Development (Gordon; 2004; Feiman-Nemser, 2001 cited in Bednarz, Bockenauer and Walk, 2005) focusing on training process for teachers (An andragogical process model for learning) in the form of process model rather than content model. (Knowles, Holton and Swanson, 2005) 2) the approach in development of classroom assessment model in Mathematics which was an important aspect of system in the process called “collaborative assessment pyramid” through paradigm of new assessment emphasizing on the authentic assessment.
In addition, collaborative action research classified dimensions of assessment into 4 aspects as:  
1) Mathematics knowledge (Grow, 1996; Shafer & Foster, 1997; Black & William, 1998; Romberg, 2004; Her and Webb, 2004; Kaur, 2005; Watt, 2005; Webb, Romberg, Burrill, & Ford, 2005; Dekker & Feijs, 2006; Otero, 2006; Webb, 2009; Rohani, 2009; Boistrup, 2011)  
2) Mathematics thinking (NCTM, 1995; Mavrommatis, 1997; Verhage & de Lange, 1997; Shafer & Foster, 1997)  
3) Mathematics Skill. (Institute of Promotion in Science and Technology Teaching, 2003; Office of Academic and Educational Standard, 2008b), and 
4) desirable characteristic (Institute of Promotion in Science and Technology Teaching, 2003; Office of Academic and Educational Standard, 2008b).

For collaboration, the teachers’ sharing process was administered as well as team working including major purpose of system development for teachers to be able to use the developed assessment system in Mathematics as well as the findings for student development and instructional improvement which the collaborative assessment pyramid was shown in figure 1.

**Figure 1:** Collaborative assessment pyramid

**Methods**

**Procedure**

This study was research and development (R & D) including the following steps:

**Phase 1 (R):** Construct the system from situation, problems, and needs in developing the system in Mathematics learning Substance as well as documentary research to synthesize the definition, and system.

**Phase 2 (D):** Investigate quality of system by 5 experts considering standard of Joint Committee on Standards for Educational Evaluation (1994) including: utility, feasibility, propriety, and accuracy.
The Target Group
The target group in the development of classroom assessment system was administrators, teachers, and students of schools under the jurisdiction of basic education commission.

Instruments
The instrument using for investigating the quality of system included: the Quality Assessment of System by considering 4 possibilities including: utility, feasibility, propriety, and accuracy. It was 5 level rating scale investigating the quality of content validity item-objective congruence (IOC). The analysis congruence was analyzed by the experts in Measurement and Evaluation, and the experts in Mathematics Instruction. The IOC of questions from the Quality Evaluation Form was between 0.6-1.0. The quality of the instrument of content validity from IOC were the value from 0.8 up. For the item with low value, it would be improved and corrected to be appropriate based on the experts’ suggestion.

Data Analysis
Content analysis from documentary research and study of situation, problems, and need for developing the system in order to synthesize the classroom assessment system. For the assessment findings of system, the researcher considered from the Quality Assessment Evaluation Form of the system by the experts. Qualitative data were analyzed by content analysis. Quantitative data were analyzed by using the mean, and standard deviation. The criterion of assessment findings were as follows:

| Mean     | Appropriateness Level of System |
|----------|---------------------------------|
| 4.21-5.00| The Highest                     |
| 3.41-4.20| High                            |
| 2.61-3.40| Moderate                        |
| 1.81-2.60| Low                             |
| 1.00-1.80| The Lowest                      |

Results
1. The system of classroom assessment including 4 components: 1) input consisted of major inputs as the standard-based curriculum based on core curriculum of basic education 2008. The related people included the teachers, administrators, students, supervisors, and school context, 2) process consisted of 2 sub-processes: continuous teaching development, and development the measurement and evaluation model in class by focusing on the power collection through sharing as well as team working of teachers to cover all of 4 aspects: knowledge, Mathematics Process Skill, thinking, and desirable characteristic which would be developed to be a model called collaborative assessment pyramid moving by the approach of authentic assessment, and collaborative action research. 3) product occurred by the input through the process leading to the product including the system, 4) outcome was a study of caused by the findings occurred by the practice following the plans in evaluating for the students’ learning as well as teachers’ teaching in classroom level including: the outcomes occurred with students, teachers, and school administrators, and 5) feedback was an investigation in each part to be used as guidelines for improving and developing the system components to be more efficient. According to the above, cold be shown in figure 3.

2. The findings of evaluation in quality of the system by the experts, found that the developed system included the utility, feasibility, propriety, and accuracy. The evaluation findings were in “high” level which could be concluded in table 2. The experts expressed their additional opinion that the system should focus on the development of Mathematics teachers’ network. The teachers who had been trained should be leaders in extending to their friends in the same school or other schools so that the practice outcomes would be seen in broader area.
Figure 2: The quality of the classroom assessment system

Discussion

Considering the approach in develop the system, found that the approach of collaborative action research was major approach as a part of system, and an important mechanism for putting the outcomes into practice. Since the focus of related persons’ participation especially the collaboration among teachers, the work would be successful. It was supported by Stringer (1996) and Robinson (1994) statement that the larger the school size was, and the more different management structures were, if every knowledgeable and skillful teacher collaborated in their work, the combination of thought as well as extended boundary of research implementation would be broader. It could be stated that the collaborative action research would be mechanism which could move for improvement and changes in measurement and evaluation process in learning achievement of learning achievement in class in aligned with learning and teaching.

However, the system development in this study wasn’t used in school level. The findings from evaluate in quality of obtained system was judge by the experts. Therefore, future research studies should try out the developed system in order to know the results of practice as well as the experts’ additional recommendations that the Input, a major input of system in overall, were remained the same. But, there should be supplementary consideration in school context as the impact from modified structure in work management of the educational service area which separated the secondary education from the former education service area. For the process, found that it should be remained the same. But, the additional considerations should be performed when there was a movement into other school systems such as teachers’ development system, it might be based on network of the educational service area, and the teachers from school as major power for teacher development.

For the Outcome, the outcomes were not occurred only with students, teachers, and administrators, but also might be occurred with the teachers who would be network regarding to the development in body of knowledge as well as network expansion. For the Feedback, it was an important component of system since it would lead to continuous development system, and adjustable in time with the potential changes. The outcomes of system development and improvement were based on rationale of flexible system design in order to develop and improve the system relevant to context of work unit truly.
System Objectives
Teachers unite to apply the system to assess the students coexisting with teaching to assess the progress and also employ the outcomes to improve the students in all 4 dimensions (knowledge, skill, thinking, and desirable characteristics)

- Standard Based Curriculum
- Teachers Competence
- Knowledge Understanding, and Supporting from the Schools, Administrators, Communities, and Parents

Collaborative Pyramid Assessment
Plan Assessment
↓ Gather Evidence
↓ Interpret Evidence
↓ Use Result
Continuing Professional Development

Classroom Assessment Model
The Outcomes Occur to
- Students
- Teachers
- Administrators

Feedback

Figure 3: The system of classroom assessment in Mathematics
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