Chemistry Classroom Assessment at Chulalongkorn University Secondary Demonstration School in Thailand

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Abstract:

A student-centered approach has been enforced in Thailand as a result of Educational reform. The Science Education Department at Chulalongkorn University Secondary Demonstration School (CUD) has revisited their teaching and students' assessment processes. The results reflected a need for a classroom assessment to improve students' learning abilities and teachers' teaching strategies. Classroom action research was designed for the chemistry class. The teacher conducted his research in two classrooms with the total of 58 students. Data on students' attitude towards science, and students' preparation behavior before attending the class were collected through a questionnaire. A performance rating of students' assignment by the teacher and midterm exam lessons evaluated by each student were collected. An interactive feedback session with individual students was organized based on the classroom assessment result. Results revealed that the classroom assessment techniques did help 60 to 70 percent of the total students who have a negative attitude towards science and performed poorly at midterm to achieve a better grade at the end of the semester.

Introduction:

The Report on Classroom Assessment and the *National Science Education Standards* by the National Research Council, USA (2001) highlighted that:

> "Assessment is a ubiquitous part of classroom life. Most exchanges between teacher and students are an occasion for considering the quality of student work. Often informal, assessment is a natural feature of teaching and learning whether or not it is so identified by teachers or students. A careful look at any classroom offers evidence of the intimate connection between teaching and assessment. It is at times difficult to separate the two."

Classroom assessment differs from tests and other forms of student assessment in that it is aimed at course improvement, rather than at assigning grades. The primary goal is to better understand the students' learning so as to improve the teaching. The approach is based on the assumption that the more we know about what and how students are learning, the better we can plan learning activities to structure teaching methods.

The National Research Council report, which served as a guideline for this study, also highlighted the followings:

1. Regular and high-quality assessment in the classroom can have a positive effect on student achievement.
2. The information generated must be used to inform the teacher and/or the students in deciding the next step.
3. Student participation is a key component of successful assessment strategies at every step.

Darling – Hammond (1994) and Moss, (1996) also have emphasized that the teacher participation in the classroom helps understanding students of their actions, interest, intentions, and motivations that would be difficult to glean from the knowledge tests.

Background:

A student-centered approach has been enforced in Thailand as a result of Educational reform. The Science Education Department at Chulalongkorn University Secondary Demonstration School has revisited their teaching and student assessment processes.

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After many years of teaching chemistry, the researcher has developed a form to gather student background information and evaluate their interest in science, including chemistry, as a student needs assessment. The information gathered was used for redesigning the teaching methods and exercises for the students. Due to the recent literature on Classroom Assessment (CA) concepts, the researcher was eager to learn more about the techniques and their effectiveness. As a result, the classroom action research has been designed as follows:

1) Pilot study phase-
    a. Decide what the teacher wants to learn from a classroom assessment
    b. Choose a Classroom Assessment Activities (CAA) which can be easily implemented in his chemistry class
    c. Explain the purpose of the activity to students and administer the forms.
    d. i) After their midterm exam, ask students to evaluate the lesson related to their experience of studying /preparing for the midterm ii) Ask them to develop a plan indicating what changes, if any, to make
    e. Give feedback to individual students and their parents by discussing information gathered from the CAA.
2) Classroom action research phase-
    a. Develop a research proposal based on the results of the pilot study phase
    b. Set up a formal system to implement a Class Assessment Tool (CAT) for chemistry classes
    c. Evaluate accordingly to measure the effectiveness of the CAT as well as teaching and learning activities.

For this research, the CAT was applied to two Grade 10 chemistry classes at the CUD High School, Chulalongkorn University, as a pilot project to further the establishment of the CAT in this school. Classroom Action Research will also be carried out afterwards.

During the pilot phase, two key research questions were posed**:**

1) How feasible is the CA Tool and activities developed by the teacher for the Grade 10 chemistry class at CUD?
2) Can the CAT help improve a poorly performing student to achieve more in chemistry class?

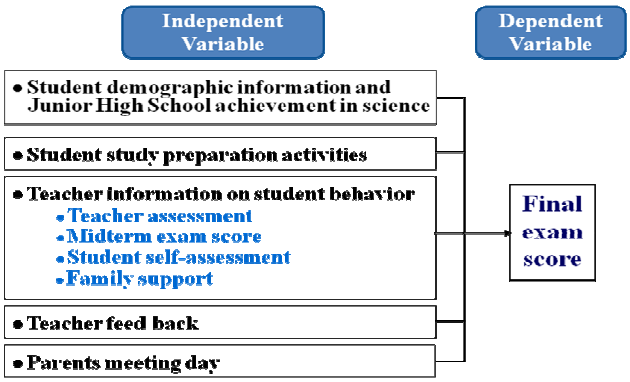
Operational definitions:

Classroom assessment (CA) refers to activities which the teacher carries out in addition to administering the knowledge test and portfolio assessment.

Classroom assessment tool (CAT) refers to the questionnaire, or forms which are used to collect information related to students' behavior, such as student study preparation behavior, student study behavior, etc.

Classroom Assessment Activities (CAA) refer to interventions or measures which the teacher carried out by using information collected by the CA tools and implemented within the school regular activities, such as a feedback session after class, meeting with parents on parents' day, etc.

Research Conceptual Framework



Methods:

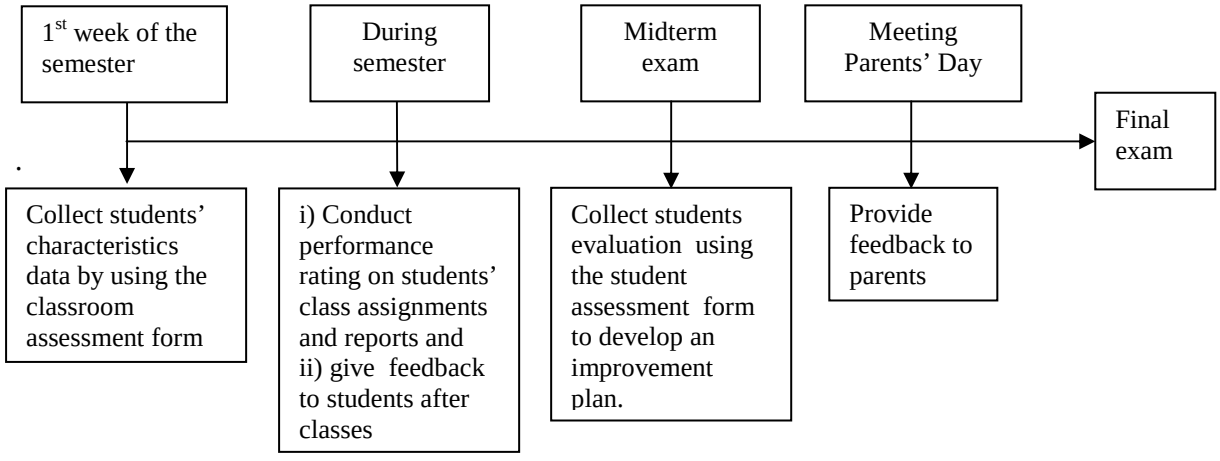
This study was designed as a qualitative, multiple case studies design. Purposive sampling was applied to two grade 10 high school chemistry classes. Grades 10/2 and 10/4 were selected. The differences between the two classes at the demonstration school reflected the phenomena that most students in grade 10/2 were diligent and had good academic performance while the grade 10/4 students had poorer academic performance. A total of 58 student cases were included, 28 in 10/2 and 30 in 10/4.

The researcher developed different CA tools as research instruments:

1) A classroom assessment form to cover four areas of information:
   a. Student demographic information and Junior high school achievement in science
   b. Student study preparation behavior
   c. Student self-assessment of their study behavior and academic performance prior to the midterm exam
   d. Student's attitude towards chemistry

2) A performance rating on a student class assignment and report

Data collection methods and Classroom Assessment activities are presented in the following figure:



Research results

Table 1- Student characteristics and Junior high school achievement in science

Student characteristics	No. of students		Junior High School achievement in Science		
	Male	Female	High score	Moderate score	Low score
Grade 10/2	22	6	26	2	-
Grade 10/4	21	9	25	5	-

Table2: Student study preparation activities: tutoring and reading chemistry textbooks (grades 10/2 and 10/4)

	Grade 10/2 (N=28)								Grade 10/4 (N=30)							
tutoring and reading	Science Score		Science Score		Science Score		Total		Science Score		Science Score		Science Score		Total	
	High	%	Moderate	%	Low	%	Freq.	%	High	%	Moderate	%	Low	%	Freq.	%
Tutoring during summer	3	10.7	3	10.7	1	3.57	7	25	1	3.57	5	17.85	7	25	13	43.33
Tutoring during the semester	2	7.14	4	14.28	2	7.14	8	28.57	2	7.14	5	17.85	6	21.42	13	43.33
Self study	-	-	1	3.57	1	3.57	2	7.14	-		3	10.71	3	10.71	6	20
None	3	10.7	4	14.28	6	21.4	13	46.42	-		3	10.71	4	14.28	7	23.33
Reading	High	%	Moderate	%	Low	%			High	%	Moderate	%	Low	%	Freq.	%
Very often	5	17.37	-	-	-	-	6	10.71	1	3.33	1	3.33	2	6.66	4	13.33
Moderate	4	13.32	6	21.42	10	35.7	20	71.42	-	-	9	29.99	9	29.99	18	60
never	2	6.66	1	3.57	-		3	10.71		-	-		-		-	-

Table 2 shows that between the two classes, grade 10/2 had done lesser than that of the grade 10/4 for their preparation activities regarding attending tutoring class but higher in reading preparation activities.

When classified the two classes on their science score levels, the high science score student group in grade 10/2 were better prepared than those in the 10/4 high science score student group while the moderate science score student group in grade 10/4 were better in all preparatory activities than those in grade 10/2.

Table 3: Teacher assessment on student learning behavior (10/2, 10/4)

	Grade 10/2 (N=28)						Grade 10/4(N=30)					
Student Learning Behavior	High	%	Moderate	%	Low	%	high	%	Moderate	%	Low	%
Class attendance												
1) 100% attendance rate	7	25	7	25	6	21.42	-	-	9	30	7	23.33
2) Miss ≤20%	1	3.57	1	3.57	6	21.42	2	6.66	4	13.33	8	26.66
Responsibility												
On time submission > 80%	6	21.42	6	21.42	5	17.85	1	3.33	7	23.33	4	13.33
On time submission < 80%	2	7.14	2	7.14	7	25	1	3.33	6	20	11	36.66
Handwriting Quality												
Very neat	7	25	5	17.85	1	3.57	1	3.33	3	10	-	-
Fair	1	3.57	3	10.71	8	28.57	1	3.33	7	23.33	7	23.33
Needs improvement	-	-	-	-	3	10.71	-	-	3	10	8	26.66
Report Quality												
Complete and correct	7	25	5	17.85	-	-	3	10	4	13.33	7	23.33
Complete but incorrect	1	3.57	3	10.71	9	32.14	3	10	7	23.33	6	20
Complete but needs improvement	-	-	-	-	3	10.71	-	-	-	-	-	-

Table 4 indicated that Most students in grade 10/4 were better in their class attendance, assignment responsibilities than those in the 10/2 class. However the class 10/2 had more students who submitted a better quality report than those in class 10/4.

Table 4: Student assessment on studying behavior (10/2, 10/4)

Evaluations from the Midterm	Grade 10/2 (N=28)						Grade 10/4(N=30)					
	High	%	Moderate	%	Low	%	High	%	Moderate	%	Low	%
• Exam preparation												
1) no review	1	3.57	-	-	-	-	-	-	-	-	-	-
2) some review	2	7.14	-	-	2	7.14	-	-	2	6.66	5	16.6
• Test taking												
1) careless	2	7.14	-	-	1	3.57	-	-	-	-	2	6.66
2) Forgot some content	1	3.57	-	-	-	-	1	3.33	2	6.66	1	3.57
3) do not understand the questions	-	-	3	10.7	4	14.28	-	-	-	-	2	6.66
• Feeling towards midterm score												
1) less than expected	1	3.57	-	-	3	10.71	-	-	-	-	1	3.33
• level of content understanding												
1) less confident in some topics	-	-	-	-	4	14.28	-	-	2	6.66	-	-
2) cannot comprehend	-	-	-	-	-	-	2	6.66	1	3.33	1	3.33

Data indicated in table 4 that students in low score group reflected through the CAT and CAA more than the high and moderate score groups.

Table 5: Cases of poor midterm score, negative attitude, and final score(10/2)

Number	Case number	Midterm exam score	Final exam score	Attitude towards science	Remarks
1	2	fail	fail	negative	
2	3	fail	pass	negative	
3	4	pass	fail	negative	Borderline passing at midterm
4	5	fail	fail	negative	
5	6	fail	pass	negative	
6	10	pass	pass	negative	Borderline passing at midterm
7	12	fail	pass	positive	
8	13	fail	pass	negative	
9	14	pass	pass	negative	
10	15	fail	pass	negative	
11	16	fail	pass	negative	
12	17	fail	pass	negative	
13	20	fail	pass	negative	
14	24	fail	pass	positive	
15	28	fail	pass	negative	

After comparing the cases, the data revealed that of those 12 cases who failed the midterm exam, 10 were able to get a passing score on the final exam, while only three failed again. The feedback based on CA tools reached a 83.33 percent success rate.

Table 6: Final score for cases of poor midterm and negative attitude(10/4)

number	Case number	Midterm exam Score	Final Exam Score	Attitude
1	1	fail	pass	positive
2	4	fail	pass	negative
3	10	fail	pass	negative
4	11	fail	pass	negative
5	13	fail	pass	positive
6	14	fail	pass	positive
7	16	fail	pass	positive
8	19	fail	pass	negative
9	22	fail	fail	negative
10	23	fail	fail	positive
11	24	fail	fail	neutral
12	26	fail	pass	neutral
13	28	fail	fail	neutral
14	30	fail	pass	positive

After comparing the cases, the data revealed that of those 14 cases who failed the midterm exam, 10 were able to get a passing score on the final exam. The feedback based on CA reached a 71.42 percent success rate.

Table 7: Fail cases after feedback session (10/2)

Case number	Family support	Performance rating by teacher	Study behavior Student Self assessment	Midterm score	Final Score
1	good relationship	good	poor	fail	fail
2	conflict between parents	poor	poor	fail	fail
4	fair support	very good	poor	borderline	fail
5	too much support from the father	poor	poor	fail	fail
11	normal	very good	moderate	borderline	fail
18	normal	fair	good	borderline	fail

As shown in table7, data suggested that the teacher should take into consideration the information from the student self-assessment when preparing for the feedback session and monitor the performance of students who have a borderline score level on their midterm exam.

Table 8: Failing cases after feedback session (10/4)

Case number	Family support	Performance rating by teacher	Study behavior, student self-assessment	Midterm score	Final Score
22	spoiled and has plans to go abroad	fail	poor	fail	fail
23		poor	poor	fail	fail
24	Mother is strict ie., attending tutoring classes during summer	good, attentive	fair	borderline	fail
28	conflict with parents	poor	poor	fail	fail

As shown in this table, it is indicated that the failing cases were those students who had trouble at home, had borderline or poor score level on their midterm exam. They should be labeled as "the risk group" whom the teacher should pay more attention to.
More over the information from the student self-assessment is quiet valid and should be considered to use as a sensitive and valid indicator to provide support.

Conclusion and Discussion

Research question one: How feasible is the CA Tool and activities developed by the teacher for the Grade 10 chemistry class at CUD?

In terms of implementing the forms, and designing the feed back to give to the students and parents, it fitted well with the school's extracurricular activity, Parents' Meeting Day. Moreover, the CA information helps discussion with students and parents to be more focused and substantive than previously. As a result, a better relationship between the teacher and parents was observed.

Based on the researcher's experience in developing the form, it will be better if he develops a separate form and applies the science attitude test suggested by the Institute for Promotion of Teaching Sciences and Technology (2003)**.** Moreover, the criteria of a quality lab report or assignment should also be clarified so that student can do their self assessment accordingly.

Research Question two: Can the CA help poorly performing students to improve in chemistry class?

Key findings from the two classes revealed that the CA helped students who failed their midterm to improve their performance 60-75 percent depending upon their study behavior and attitude. This findings not only supports Brown's emphasis stated since 1994 that "Effective learners operate best when they have insight into their own repertoires of strategies of learning", but also reiterate Butler's findings in 1987 related to the positive effects of giving descriptive feed back on the student's performance.

The CA information also helped the teacher to adjust his teaching strategies by giving feedback and work with the parents in order to facilitate the students to control their improvement plan designed by themselves. (Coveington, 1996; Duschl &Gitomer, 1997) Moreover, the students and parents showed their satisfaction after having substantive conversation based on the CA information which reinforced suggestion give by National Research Council (2001).

In addition, the findings also indicated that the CA tool from this study should be adapted into a formal instrument which would include an attitude test, student self assessment, course description assessment, and performance rating form (Mimi, 1998). Lessons can be drawn from this first attempt that all information should be taken into account when designing the feedback session for every student.

Attention should be given not only to those who failed the midterm but also to those whose self-assessment reflected negatively and the quality of assignments rated as poor by the teacher.

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