

ALTERNATIVE ASSESSMENT- USE OF SELF-ASSESSMENT AND PEER ASSESSMENT TO IMPROVE STUDENTS' INTEREST AND LEARNING IN SCIENCE

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Abstract

This paper reports on the process of doing classroom action research as part of course requirement in a four weeks- course of action research done at SEAMEO RECSAM, Penang, Malaysia. We choose alternative assessment as our classroom action research topics as this become essential in teaching and learning processes yet was overlooked by teachers. We managed to conduct two cycles of action research and have experienced such hard processes yet meaningful learning journey. Reflections in teaching and on teaching were elaborated as well as reflections on our learning experiences during the conduct of classroom action research. Despite the limitation of the study, it was noted that we have gained a valuable experience in doing classroom action research.

Background of the Study

During group discussion we reflected on the trends and issues of science education in our countries. We come from four different countries of different backgrounds, ranging from a primary teacher, two secondary teachers and a lecturer. We looked at our current practice and tried to identify a strategy that we have not tried before. We were agree and would like to try to use alternative assessment with the aim of making an improvement in the teaching and learning of science.

The group members agreed that assessment is an integral part of the teaching and learning process. Assessment measures the extent to which desired knowledge, skills and attitudes are attained by students. A revolution is happening in the field of educational assessment where assessment is not about stopping teaching and testing students. Teachers are encouraged to move away from the much used summative assessment to the formative assessment. Summative assessment is used to make judgment of student competency at the end of an

instructional unit or programme whereas formative assessment establishes what progress a student is making in learning and to give feedback on it.

From our teaching experiences, we feel that many students who do not perform well in science are also not interested in the subject. This is worsened by the fact that they have to undergo the summative assessment and not getting the grades they would hope to get. Therefore we decided to make use of two alternative assessment techniques, namely self-assessment and peer-assessment to improve students' interest and learning in Science.

Rationale for Action Research

It is common that students who are not interested in science also do not perform well in science. They do not like the usual summative assessments such as the tests and semester examinations conducted by teachers which they have to sit for. The poor results that they often get at the end do not help them in any way to improve in their learning. They get further discouraged. The purpose of this action research is to find out if self-assessment and peer-assessment technique would improve students' interest and learning in Science.

Hence, through this action research, our group hopes to create the opportunity for students to look at assessments differently. In addition it is expected that through the use of self-assessment and peer-assessment techniques, they become more interested in science and learn better.

Significance of Study

From this study, we hope that teachers who are trying to improve students' interest and learning in science may consider the use of alternative assessments, namely, self-assessment and peer-assessment. The study findings may provide evidence on how these assessments help both the teachers and the students in their teaching and learning. Moreover, through this action research, we also hope to encourage teachers to reflect on the purpose as well as the potential of such alternative assessments in the teaching and learning of science.

Limitation of Study

Teachers are not familiar with the group of twenty-five students involved in the study. Due to the short period of time of about two weeks allotted for this study the group was able to do only two cycles of the action research and in a reduced scale. The first cycle of action

research was carried out as a peer try-out. Based on our reflections on the peer tryout, we revised our plan for the next action research cycle to be carried out on the students. Data collected in both action research cycles are analysed and presented in this report.

Review of Literature

Teachers commonly view assessment as something apart from their regular teaching, serving the purpose of assigning grades (Shavelson & Seal, 2003). However, in order for instruction to be effective, teachers must also assess their students *while learning is in progress* to gain information about their developing understanding so that instruction can be adapted accordingly (Black, 1998).

Teachers have the most direct access to information about student learning, and are thus in a timely feedback (Shepard, 2003; Wilson, 2005). Teachers can also use the information to monitor the effectiveness of their own teaching (NRC, 2001); however, formative assessment also involves students since they need to recognize, evaluate, and react to their own learning and/or others' assessments of their learning (Bell & Cowie, 2001; Sadler, 1989).

Black (1998) stated that formative assessment has the potential to affect not only student learning, but also motivation, self-esteem, and participation in self-assessment. Black & William (1998) defined formative assessment as “all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged” (p. 8).

This kind of assessment, called *formative assessment*, can be conceived as assessment *for* learning not *of* learning (Black & William, 1998; Pellegrino, Chudowsky, & Glaser, 2001). Assessment becomes formative in nature – informing teaching and learning – only when the teacher uses that information to adapt instruction, and/or the student uses the information to influence his or her learning (Black, 1998).

Even though there are a number of definitions of the term self-assessment, the definitions are, for the most part, quite general. For example, Rolheiser and Ross (2000) defined self-evaluation as “students judging the quality of their work, based on evidence and explicit criteria for the purpose of doing better work in the future” (p.3). Blatchford (1997) described self-assessment as a specific element of student self-concept, that is, academic achievement

“involve(s) judgments of one’s own attainment in relation to other children” (p. 2). This assumes however, that self-assessment is a more normative judgment, which some may see as contrary to the concept of self-assessment. Other definitions of self-assessment are set in the context of teachers' classroom assessment practices. For example, Gronlund and Cameron (2004) emphasize the importance of formative assessment where the purpose is to “monitor learning progress and to provide corrective prescriptions to improve learning” (p. 14). Montgomery (2000) provided a similar definition of self-assessment as “an appraisal by a student of his or her own work or learning processes” (p. 5). Thus although there are somewhat different definitions of the term 'self-assessment', a common understanding has developed of the purpose of self-assessment.

The benefit of self and peer assessment have been documented in previous research. Peer and self-assessment provide a perspective on the extent to which assessment reform is influencing teachers’ classroom assessment practices. Specifically they provide a basis for examining the usefulness of formative assessment and assessment *for* learning as promoted by Stiggins (2002), Black, Harrison, Lee, Marshall and William (2004) and others. Moreover Butler and Hodge (2001) studying the effects of peer assessment in high school physical education, found that peer assessment had practical applications and value for students. The results of their study emphasized the importance of both feedbacks in peer assessment and in developing trust among peer assessors.

Methodology

Subject of the study

This action research was conducted with twenty-five Form 1 students from SMK Agama Al-Mashor, Penang. According to the students’ teacher, the profiles of the students are as follows:

- English language ability level is from weak to average
- Their learning ability is moderate
- Their behaviours are good, some of the students are playful.
- Each student is about 13 years old.

Instruments

Four main instruments were used for data collection. They are interview, self assessment and peer assessment checklist, classroom observation check-list and questionnaire.

Interviews. The interview protocol was used for gathering information to determine whether the use of self and peer assessment in the teaching and learning activity can increase students' interest in learning science and their understanding. The interview protocol was presented in Appendix I. The interview was conducted in group of five students after the class. Students' responses were recorded.

Self and Peer assessment check-list. Self and Peer assessment checklist as presented in Appendix II was developed to allow students and their fellows assessing their activities. In this checklist, they have to check whether they conducted the right things when they prepared their slide. Students were assigned according to pairs. When the first student of each pair (student A) conducts the activity, he/she assesses his or her performance by checking the list. At the same time, his or her pair (student B) also assessed students A's performance. They then take turn in doing the activity.

The classroom observation check-list. The classroom observation was performed using a checklist for observing students interest while the activity was conducted. The checklists consisted of seven criteria to be observed (See appendix III). The observation was recorded every ten-minutes. For each criterion, we scored students interaction or performance into 4 levels namely; exemplary level 4, accomplished level 3, developing level 2, beginning level 1. Based on these four levels, we inserted the marks every ten minutes, namely 1st ten minute, 2nd ten minute and 3rd ten minute. We added all the marks and calculated the average score.

The questionnaire. The questionnaire was used for the purpose of verifying the students' responses during the interview. The questionnaire consists of 12 items that measures two factors, namely students' Interest in Learning Science and Better Learning in Science. The first six items assess students' interest in learning science, whereas questions 7 to 12 evaluate students experience in their learning (See appendix IV).

Reflection (Cycle 1)

Due to time constraint in this four-week course, our group completed the first action research cycle with a peer try-out. We began by reflecting on our teaching practice and eventually decided to identify a strategy that we have not tried before and would like to try it out with the aim of making an improvement in the teaching and learning of science. Once we decided on our focus, we began our planning and preparation. The technique that we used was two forms of alternative assessment, that is, self assessment and peer assessment.

During the implementation stage, that is, the peer try-out, data collection was done with the use of a self-assessment and peer-assessment checklist, classroom observation, questionnaire and group interview.

Reflection in Teaching

During the teaching of the practical skills in preparing an animal (human cheek cells) specimen slide, the teacher herself was able to identify the following weaknesses of the lesson:

- The dilute iodine solution provided was too pale-coloured and would not stain the human cheek cells clearly. Hence, immediate action was carried out to have it replaced with a more concentrated one that was darker in colour.
- The pointed toothpick, though had its pointed end cut off, was not good enough to help scrape a sufficient number of cheek cells. Thus, her peers who were her 'students' also had problems in getting the cheek cells and viewing them under the microscope. Hence, the teacher herself decided to change the slide preparation to that of onion skin cells for the second action research cycle. This will be easier for the school students because the onion skin cells are bigger and easier to be viewed under the microscope.
- Most 'students' could not avoid trapping some air bubbles when preparing the slide. Hence, the rubric in the self-assessment and peer-assessment checklist will be amended from 'No air bubbles....' to 'Only a few bubbles....'
- The one-sided arrangement of the laboratory was not suitable for all students to do microscopic work together as students were expected to be cramped up. We were

going to rearrange the tables using the other side of the laboratory to maximise the use of space available.

- Time wasted in ‘students’ collecting their apparatus and materials. Layout of these apparatus and materials should be done on their table beforehand.
- Students need stationery for their activity so they must be told to bring them.

Reflection on Teaching

At the end of the try-out, reflection was carried out by the teacher herself, her other group members and peers (‘her students’). The following weaknesses were identified:

- The link from the introduction of cells to the teaching of the preparation of the specimen slide is weak.
- Demonstration of the slide preparation was too long and the focus of the activity seemed to have shifted from the use of the self-assessment and peer-assessment technique to the slide preparation instead.
- Interview protocol was missing in the group interview.
- There may be language and communication problems between the teacher interviewer and the students during the verbal interview.

Hence, based on these reflections, the following plan was revised for the next action research cycle:

- Darker iodine solution will be used for staining of the cells.
- Preparation of the onion skin cells will replace that of the human cheek cells.
- Rubric in the self-assessment and peer-assessment checklist will be amended from ‘No air bubbles....’ to ‘Only a few bubbles....’
- Rearrangement of tables will be made one day in advance, using the other side of the laboratory to maximise the use of space available.
- Layout of apparatus and materials should be done on the students’ table beforehand.
- Students will be informed to bring their own stationery.
- Teacher could link from the introduction of cells to the teaching of the preparation of the specimen slide by asking students how they could view the cells.
- Demonstration of the slide preparation should not be lengthy.
- Interview protocol must be included in the group interview

- To benefit both the teacher interviewer and students, written interview could be done instead of the verbal interview.

With the revised plan, the second action research cycle was carried out on a class of twenty-five students.

Findings

The following are the results of the data collected during the implementation of the action (refer to Appendix V - lesson plan) using the four different data collection instruments.

1. Student Checklist: Self Assessment and Peer Assessment

The action was implemented and carried out with a class of twenty-five students. 100% of the students participated enthusiastically in the action using the Students' Checklist to carry out self assessment and peer assessment on each other. (Appendix II)

2. Classroom Observation

While the action was carried out, two teacher observers made use of a set of teacher classroom observation rubric to make observations of students' interest and learning. The teacher observers made observations in two aspects of students' learning - students engaged in learning and assessment as well as students' ability to carry out the activity. The following data shows the average scores of the students.

Table 1

Average Score of Students for Each Criteria

Criteria	Average Score	Possible Maximum Score
Interest	3.8	4
Engaged in Learning and Assessment	3.8	4
Ability to carry out the ability	3.8	4
Overall Average	3.8	4

The data obtained from the classroom observation indicates that the students show interest and learning taking place when self assessment and peer assessment are carried out. (Appendix III)

3. Group Interview

The twenty-five students were interviewed by four teachers in groups of six, with one group having seven students. Positive comments were obtained from the group interviews.

- a) Students found the activity interesting and said that their interest in learning science will increase. For example, student 1 agreed that the activity boosted his interest to learn science.

*It will be **the best way to learn** more about science in this way. This makes me **interested in science**.*

- b) Students also felt strongly that they learned better when self assessment and peer assessment were carried out during the lesson. For example student 2 felt that his learning was reinforced by the both self assessment and peer assessment during the activity.

*Because I **learn two times**. I do the experiment I learn and when I check my friend, I learn again.*

Thus, the data indicates that students' interest and learning can be improved by self-assessment and peer-assessment.

4. Questionnaire

A set of twelve questions were used in the questionnaire. Statements 1 to 6 were used to find out students' view on whether self-assessment and peer-assessment improve their interest in the learning of science while Statements 7 to 12 aimed to find out whether self-assessment and peer-assessment improve students' learning of science (Appendix IV). Tables 2 and 3 show the data collected.

Table 2.

Descriptive Statistics for Maximum, Minimum, Mean and Standard Deviation scores for Each Item

	N	Minimum	Maximum	Mean	Std. Deviation
Q1	25	3	4	3.72	.46
Q2	25	1	4	2.64	.76
Q3	25	2	4	3.04	.68
Q4	25	2	4	3.72	.54
Q5	25	1	4	2.76	.78
Q6	25	2	4	3.48	.59
Q7	25	3	4	3.72	.46

Q8	25	2	4	3.56	.58
Q9	25	2	4	3.16	.69
Q10	25	2	4	3.40	.58
Q11	25	2	4	3.28	.61
Q12	25	3	4	3.64	.49
Valid (listwise)	N 25				

Table 3.

Descriptive Statistics for Maximum, Minimum, Mean and Standard Deviation scores for Learning and Interest Scales

	N	Minimum	Maximum	Mean	Std. Deviation
LEARNING	25	2.50	4.00	3.4600	.30
INTEREST	25	2.83	3.67	3.2267	.22
Valid (listwise)	N 25				

Table 2 shows that all statements, with the exception of statements 2 and 5, scored a mean of 3 and above. Whereas Table 3 shows that statements 1 to 6 (Interest) scored a mean of 3.2, which is between 3 and 4. This implies that students agree strongly that self-assessment and peer-assessment improve their interest in the learning of science.

Statements 7 to 12 (Learning) scored a mean of 3.4, which is also between 3 and 4. This implies that students agree very strongly that self-assessment and peer-assessment improve their learning in science.

Hence, the data collected in our questionnaire supports our claims made in our students' checklist, classroom observation and group interview that self-assessment and peer-assessment technique will improve students' interest and learning in science.

In conclusion, our action research shows that alternative assessment: self-assessment and peer assessment does improve students' interest and learning in science.

Reflection (Cycle 2)

The group completed the second Action Research Cycle in the morning on Thursday, 17 April 2008 with twenty-five students from SMKA Al Mashoor (L). The group members met

to reflect on the lesson and analyse the data. Below are our reflection on the teaching and suggestions for future teaching.

Reflection on Teaching

All the group members felt that the lesson was much improved compared with the one in the first action cycle (peer try-out). It was a right move to switch to the preparation of onion cells as the students had little difficulty in mounting the slide and viewing it under the microscope. This was essential and important because this enabled the students to carry out both the self assessment and peer assessment smoothly as well as effectively.

The new arrangement of the laboratory also allowed more space for the students to work comfortably.

With the experience from the first action cycle (peer try-out), the group members were clearer about their roles and were more confident in playing their roles in the lesson. This was important in contributing to the smooth running of the whole lesson.

However, we felt there were some areas we had to improve if we were to carry out the third action research cycle. The following are the identified areas for improvement:

- Provide more microscopes and other apparatus (if available) for students to use so the activity can be completed in one round.
- If the class size is big, there should be more teacher observers.
- If students have problems during the interview, teacher interviewer should ask more leading questions so that the data collected will be relevant and can be used.
- There was still some confusion (though not serious) by students in the completion of the students' checklist so it is necessary to check that they are very clear about the procedure before proceeding with the activity.
- Some students could not understand the first statement in the students' checklist 'The staining on the slide is even'. So the rubric needs to be amended to 'The slide is stained by the iodine solution.'
- The giving of instructions was done a bit too slowly. But this was because the teacher was not sure if the students were able to understand her if she had gone faster. The

group members agreed that they would have gone faster if this had been their own students in school.

- Due to time constraint the validity and reliability of the questionnaire were not considered before administering it. This should be done if possible.

Overall Reflection

The group members agreed that this has been a good learning experience. During this one month together, we faced one major problem – communication. Our group members consisted of participants from Indonesia, Malaysia, Myanmar and Singapore. English Language is not the language that three of the participants use in their communication. We could hardly understand each other. Three members could not participate fully during the actual teaching of the lesson in English because of their language problem.

We faced many problems during the brainstorming and discussion sessions thus our progress in the action research getting slow. This was made more difficult when we had about two weeks to complete the entire action research. However, we managed to overcome our difficulties in carrying out the action research with much encouragements and assistance from our course supervisor and lecturers. We managed to achieve more understanding and tolerance for each other and established international friendship.

To all of us, our learning curve has been steep. We are glad that despite the language problem and some of us having no experience in research work, we managed to complete our action research smoothly. To us, the completion of the action research was a success. The findings were encouraging and boosted our morale. The group members felt that action research and alternative assessments are indeed useful in our teaching and would make use of them upon returning to our countries.

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Appendix I

Group Interview

Teacher Interviewer: _____ Date: _____

Alternative Assessment: Using Self and Peer Assessment to improve students' interest and learning in Science
Interview Protocol:

The following may be used to build rapport with the students before the start of the interview:

- Greet the students.
- Introduction of both the teacher interviewer and students
- Explain the purpose of the interview
- Assure students that confidentiality will be kept
- Inform students that their feedback will be valuable in our action research

Interview Questions	Students' Responses
1 Do self-assessment and peer assessment in the activity help you to increase your interest in the learning of Science? If yes, please explain Why. If no, please explain Why not.	
2 Do self-assessment and peer assessment in the activity help you to learn better? If yes, please explain why. If no, please explain Why not.	

Student Worksheet

Name: _____ Date: _____

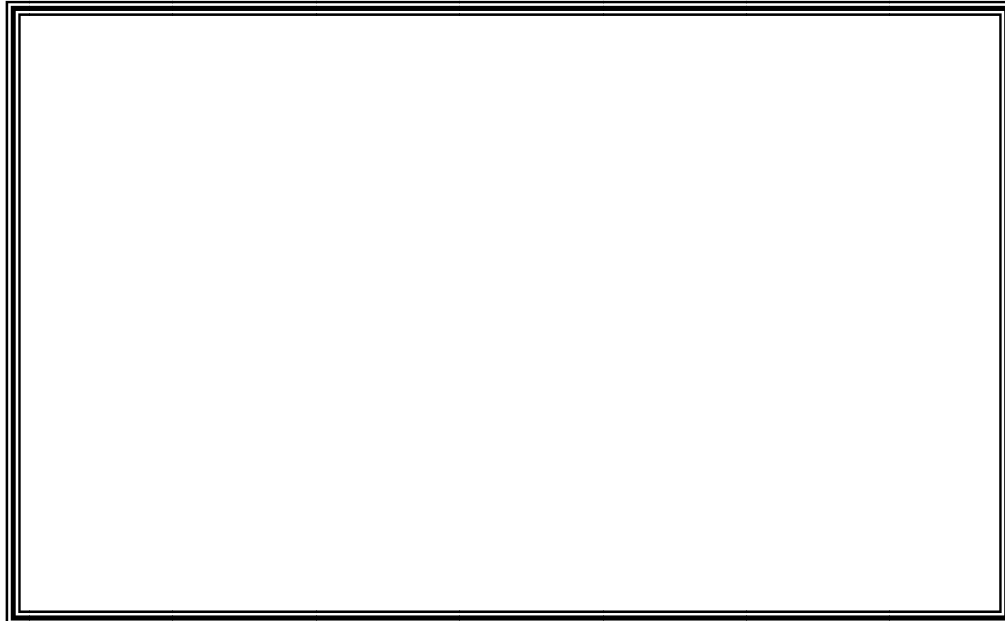
Class: _____

Preparing a Specimen Slide

Aim: To prepare a plant (onion skin cells) specimen slide so that it can be observed under the light microscope.

Activity

- 1 Prepare a plant (onion skin cells) specimen slide and observe under the light microscope.
- 2 Draw a diagram of an onion skin cell.
- 3 Assess your own performance during the preparation of the slide by completing the checklist given below.
- 4 Also, ask your partner to assess your performance during the activity.

My Drawing of an Onion Skin Cell

Self-Assessment and Peer-Assessment Checklist

Checklist completed by:		Self Assessment		My Partner's Name:	
Skills on Slide Preparation		Please Tick (√)		Please Tick (√)	
		Yes	No	Yes	No
1	The staining on the slide is even.				
2	One layer of onion cells is seen under the microscope.				
3	Only a few air bubbles are trapped under the cover slip.				
4	The iodine solution did not wet the stage of the microscope.				
5	The specimen slide is securely held in place by two clips				
T i c k o n e	The details in the onion cells cannot be seen clearly.				
	The details in the onion cells can be seen fairly clearly.				
	The details in the onion cells can be seen very clearly.				
7	The cover slip has not been cracked or broken at the end of the activity.				

Appendix III

Classroom Observation

Name of Teacher Observer: _____ Date: _____

Alternative Assessment: Using Self-Assessment and Peer-Assessment to Improve Students' Interest and Learning in Science
Teacher Classroom Observation Rubric

Criteria	Exemplary Level 4	Accomplished Level 3	Developing Level 2	Beginning Level 1	Score 1 st 10 min	Score 2 nd 10 min	Score 3 rd 10 min	Average Score
Interest	Students show very keen interest in the activity.	Students show keen interest in the activity.	Students show some interest in the activity.	Students show little interest in the activity.				
Engaged in Learning And Assessment	All students are on task.	At least 75% of the students are on task.	At least 50% of the students are on task.	At least 25% of the students are on task.				
Ability to carry out the activity	All students are able to carry out the activity	At least 75% of the students are able to carry out the activity	At least 50% of the students are able to carry out the activity	At least 25% of the students are able to carry out the activity				
Total Score								

Appendix IV

Questionnaire

Name: _____ (optional)

School: _____ Class: _____

Using Self-Assessment and Peer-Assessment as Alternative Assessment

Below are statements which reflect your views on the use of self-assessment and peer-assessment. Check (✓) the column which indicates your degree of agreement or disagreement to each of the statement.

Please use the following scale:

- 4** Strongly Agree
3 Agree
2 Disagree
1 Strongly Disagree

No.	Statement	Scale			
		4	3	2	1
1	I feel that the lesson is interesting because I get to assess myself and my partner also assesses me.				
2	Learning Science is more interesting if teacher does not assess me.				
3	It is so boring to learn Science when I know that teacher will assess and grade me at the end of the topic.				
4	I enjoy assessing myself.				
5	I am frightened to have teacher assessing me.				
6	It is fun to have my friend assessing me.				
7	When I assess myself using the checklist, I learn to do the activity more carefully.				
8	When I assess myself using the checklist, I feel that I have to be more responsible towards my own learning.				
9	Assessing myself makes me feel important.				
10	When I assess myself, I become more aware of whether I have learnt well.				
11	I feel that by assessing myself, I will learn Science better.				
12	When my friend assesses me and gives me feedback, I can learn better.				

Thank You For Your Feedback. ☺

Appendix V

Lesson Plan

- Level:** Form One
- Date:** Thursday, 17 April 2008
- Venue:** Science laboratory
- Topic:** Cells
- Activity:** Preparing a slide
- Duration:** 90 minutes

Previous Knowledge:

Students have been taught:

- 1 how to use a microscope but due to a lack of microscopes in their school, they still do not know how to use them correctly.

Specific Instructional Objectives:

At the end of the lesson, students should be able to

- 1 prepare a plant (onion skin cells) specimen slide so that it can be observed under the light microscope.

Apparatus and Materials:

- a light microscope
- a glass slide
- a cover slip
- a mounted needle
- dilute iodine solution
- strips of filter paper
- forceps
- onion scale leaf
- scissors

Lesson Development

Time Frame	Activity	Resources
15 min	<p>Introduction of cells as the basic building blocks of all living things</p> <p>Teacher demonstration Teacher demonstrates the correct use of a light microscope.</p>	Slides

	Teacher demonstrates the proper technique of peeling the epidermal layer of the onion scale leaf, staining it and mounting the onion skin cells.	
10 min	Explanation of Rubric Teachers explain the use of rubric in the self-assessment and peer-assessment checklist.	Student Worksheet Self-Assessment and Peer-Assessment Checklist
30 min	Activity Pairing of students. Students carry out the activity individually. Student self-assess while his partner does the peer-assessment. Two teacher observers observe the students during the activity as part of the data collection. Students switch roles.	Student Worksheet Self-Assessment and Peer-Assessment Checklist Apparatus and materials needed for the activity.
5 min	Assessment Students complete self-assessment and peer assessment using the rubric provided.	Self-Assessment and Peer-Assessment Checklist

This will be followed by data collection using

- Questionnaire
- Group Interview

Students will be given about ten minutes to complete the questionnaire. This will be followed by group interview to be conducted by four group members. Each group of students will consist of five students. Written interview instead of verbal interview will be conducted on some groups. This may take about twenty minutes.