CHAPTER 2

REVIEW OF RELATED LITERATURE

2.0 Introduction

In recent years, there has been a shift in emphasis in education. The emphasis moves away from simple academic achievement to a much broader goal incorporating a wider preparation for life and work (Rafiq & Fullerton,1996). Cooperative learning in doing Mathematics projects is widely recognized and highly recommended and it has become one important instructional methodology in a Mathematics class. This methodology has challenged the educators to employ innovative approaches in assessing on what students have learned. Hence, group assessment becomes inevitable.

In this chapter, the related literature will be reviewed under the following headings:

- Aspects of assessment
- Group-project and cooperative learning
- Alternative assessment in group-project and cooperative learning
- Peer assessment in the context of group-project
- Methods for rewarding individual effort in group-project

2.1 Aspects of Assessment

The word assessment always conjures images of paper and pencil examination, quiet room with perspiring test-takes and only the sound of rusty paper. This traditional format of 'paper and pencil' assessment continues to be practiced in today's schools. However, in the current dynamic education of the information age, assessment should be extended as a tool for self-understanding and instructional planning. It should be a learner-centered tool which integrate assessment into the cycle of teaching and learning situation (Marta Morgan-Lev, 1997). Students' behaviours and attitudes to learning are highly influenced by the assessment system (Freeman, 1995).

Marlane and Joseph (1993) suggested that teachers should have access to new and innovative concepts in assessment. A combination of tradition and innovative practices should provide educators with a comprehensive profile on students. Thus, teachers should consider a balance between traditional and innovative assessment. They can try a wide repertoire of strategies to assess students. Furthermore, they can promote the use of these strategies and share the ideas with more students, parents and the public.

In addition, assessment should inform teacher by giving the teacher a clearer perspective of the student's stage of development. It should also provide a channel of communication between teacher and student through which socialization can occur (Howard & Sonia, 1994). For students, assessment is the crucial component of an education course because it is a major part of their educational experience that could have a lasting effect on their future careers. As a result, the pressures on assessment

are immense particularly on teachers (Somervell, 1993). Many teachers feel most sensitive as it is in this area that they are inevitably yield power over students. According to Searby and Ewers (1997), changes in assessment from traditional and authoritarian approach to a more progressive method may meet with resistance from student and teachers alike particularly if there is a change in the balance of power between the two parties.

2.2 Group-project and Cooperative Learning

As this study is to explore an alternative assessment system employed in a Mathematics group-project, it will be beneficial to review some aspects of group-project and cooperative learning in Mathematics. The reviews focus on the following areas:

- The cooperative learning methods.
- The understanding of group behaviour.
- Problems in grading group performances.
- Difficulties in assessing individual efforts in groups.

2.2.1   The Cooperative Learning Methods

There are any cooperative learning techniques developed and used in the present educational system. All cooperative learning methods share the idea that students work together to learn and are responsible for their teammates' learning as well as their own.

The widely used cooperative learning methods are those developed and researched by David and Roger Johnson and their colleagues at the University of Minnesot (Johnson, Johnson, Holubec and Roy,1984). These methods emphasize four elements:

i.   Face-to-face interaction: Students work in four-to-five-member groups.

ii. Positive interdependence: Students work together to achieve a group goal.

iii. Individual accountability: Students must show that they have individually mastered the material.

iv. Interpersonal and small-group skill: Students must be taught effective means of working together and of discussing how well their groups are working to achieve goals.

These methods involve heterogeneous learning groups. They also highlight team building and group self-assessment and recommend team grades.

The basic principle behind a group project is to get all group members to participate, and do not allow one or two students in the group to take all responsibility. A group leader is appointed to get group members to participate and lead project discussion but not to be personally responsible for the outcome of the project. In order to get every member to participate, each member is given a specific part of the task to write or present. However, there may be situations whereby some group members do not each feel an individual responsibility for the group product. In this case, they are unlikely to participate fully (Robert Slavin, 1990). Hence, the co-operative method aims to get all group members' participation and make a success of the project.

2.2.2   The Understanding of Group Behaviour

A group is defined as a collection of two or more people who interact and share a common attribute or purpose (Plonik, 1993). The common attribute or purpose constitutes the goal of the group. According to Beatty and Haas (1996), for a group to function, a group cohesion is essential to hold members together. In line with this, there are typical formal group norms of informal rules about how members are expected to behave.

Social psychologists have observed a number of group phenomena that may be important to educator who uses groups in classroom. One such phenomenon is the free rider effect. The free rider is a person who benefits from the group but who gives little in return (Myers, 1990). The free rider constitutes one of the major problems in using groups in classroom activities (William, Bears, and Rymer, 1991). Student always concerns that their efforts are not individually monitored and rewarded because the group's rewards are usually divided equally among members, regardless of how much each contributes (Myers, 1990).

The second phenomenon is social loafing, which is defined as the tendency for some people to exert less effort when they pool their efforts toward a common goal than when they are held individual accountable (Myers, 1990). This phenomenon is a serious problem that occurs frequently in groups when team members diminish their efforts (William et al., 1991).

The third phenomenon involves group leadership. This is the process by which certain individual motivates and guides the group. Sometimes leaders are appointed, at others their role evolves as the group begins to function. Some leaders are able to build

teamwork among group members, mediate conflicts and provide support to other members. Some leaders excel in organising work, setting standards and focusing on attainment of goals. Such leaders are often very positive influences in a group, therefore it is important to identify them and reward them for their performances.

For educators who wish to use group-work or cooperative learning in their instruction, awareness of these various patterns of group behaviour is important because they do occur, at least to some extent, in almost all classroom group projects (Myers, 1990).

2.2.3   Problems in Grading Group Performances and Individual Efforts

Group performances are inherently difficult to grade, with a major problem being the assignment of grades to individual group members (Beatty and Haas, 1996). There are cases involving a number of members whose contributions are inconsistent with the overall group effort. Some students may become very interested in the group effort and very committed to the project, while others may be interested only in the grades they hope to receive. This diversity of objectives and expectations of students in a group is a major concern to both the teachers and students who desire realistic assessment, fair grading and equitable assignment of grades to group members. The concern, according to William et al. (1991) was the initial perceptions of work inequality that translate into perceptions of grade inequality and overall perceptions of unfairness in grading.

A number of factors contribute to the difficulty of grading individual effort in group-work or group-project. There is often an inequality in the quantity and quality of

work performed by the individual group member (Beatty and Haas,1996). Many researchers believe that the problem of inequitable contributions can be solved with a grading system that gives appropriate weight to individual contribution and to group's collective achievement (William et al.,1991). A suggestion is to use a form of peer assessment that permits a teacher to more equitably evaluate and grade individual effort within a group (Earl 1986; Falchikov 1988; Conway and Kember 1993;Beatty and Hass1996; Lopez and Chan 1999).

2.3 Alternative Assessment in Cooperative Learning or Group-work

Cooperative learning or group-work offers valuable opportunities for alternative assessment. It also provides an opportunity for learners to express and build a range of social and intellectual skills. According to Marta (1997), cooperative group-work should reflect the following structures:

- Learners work in positive interdependence.
- Each participant has a clearer specific role.
- The process of working together is an important focus.
- Participant reflects upon and analyses their work together.

Hence, the role of a teacher is to set up these structures and facilitates the formation of the group and observes them in action. Finally, the teacher provides learners with a means to reflect upon and evaluate their group-work by incorporating assessment tools. This tool must help to collect information about learner's skills, learning style and personalities. Teaching and learning are enhanced as learners acquire the habit of reflecting upon their learning and working with others. Teaching

by integrating on going feedback from learners also becomes more relevant and meaningful in learners' lives.

The planning of cooperative work is to think of it as three sets of variables to be sorted and matched:

(a) the content and process of the task to be carried out.

(b) the attributes of the learners to be grouped together and

(c) the assessment component: the tools that learners will use to reflect upon their experiences (Marta, 1997).

Students' learning can be promoted by group assessment task (Freeman, 1995). These tasks may include projects, case studies, research tasks, essays and presentation that carry many potential benefits (Jacques, 1984; Michaelson, 1992). Kurfiss (cited by Michaelson, 1992) saw group-work or group-project as possibly the only means in large classes of building higher-level cognitive skills along with valuable interpersonal skills.

In view of this, reliance on current formal assessment alone does not tap the full range of assessment available to teachers. There is a legitimate and valid place for alternative assessment in reporting student achievement. The alternative assessment movement in United States (NCTM, 1993) supports the need to base judgements of students' achievement in a contemporary mathematics curriculum on more than formal assessment practices.

The review of literature so far indicates that the nature and context of learning have supported the movement towards alternative assessment. Strategies that embody

these principles include open-ended tasks, student self-assessment and peer assessment, and journal writing.

2.4 Peer Assessment in the Context of Group Projects

The changes in assessment from traditional and authoritarian approach to a more progressive method may undoubtedly meet with resistance from student and teachers. In particularly, if there is a change in the balance of power between the two parties. The resistance mainly due to the shift in responsibility from the teacher to the student leading to a greater democracy within the educational community (Somervell, 1993). Peer assessment is one method which can cause such resistance (Searby; Ewers, 1997). In view of this, two categories are reviewed:

- The positive effects of peer assessment in group-work.
- The reservation of peer assessment in group-work.

2.4.1 Research Literatures on the Positive Effects of Peer Assessment in Group-work

In view of cooperative work and group project are widely recognized (Johnson & Johnson, 1985), individual student's contribution to the final product must be identified (Falchikov & Magin, 1997). Several investigators have suggested that peer assessment could be used to provide a measure of each student's contribution (Falchikov, 1986; Kane & Lawler, 1978). Many recent studies have been conducted on the use of peer assessment (Conway Kember & Wu, 1993; Falchikov et al., 1997; Hunter & Russ, 1996).

In the study done by Howard and Sonia (1994) using peer and self-assessment to develop modeling skills with students, the findings indicated that peer assessment had provided a mechanism for acculturation of the student. Participation in peer and self-assessment enables students to negotiate and objectify the nature of a good solution to modeling problem. Students are given the opportunity to express their subjective mathematical constructions linguistically. Peer assessment facilitates and encourages the generation of consensual objectivity by requiring students to discuss, challenge and justify their subjective constructs. Another case study was done in the school of music, Kingston University, as cited by Searby and Ewers (1997) concluded that the introduction of peer assessment seems to improve students' critical faculties and give them a greater ownership of the whole assessment process. This view is shared by Oldfield and MacAlpine(1995).

Searby and Ewers (1997) claimed that the process of peer assessment is encouraging students to become much involved with and concerned about the quality of the work they are undertaking. It encourages the development of skills of self-critical awareness. Skill development through peer assessing other students' work can also be used to analyse critically the students' own work, leading to a clearer understanding of how to improve his or her performance. Peer assessment does not only help to develop the students own skills of reflection (Somervell, 1993), but also develops attitudes of responsibilities towards other group members (Burnett and Cavange, 1980).

The potential for individual group members to get 'free ride' on the efforts of their peer group members is likely to happen without adequate controls. Peer

assessment is one way of controlling free-riders in group related assessment tasks by students assessing the contribution of each member to the group project (Conway et al., 1993; Goldfinch, 1994). In this way, peer assessment assists not only in reducing free-riding, but improving the certification process.

2.4.2   Research Literature on the Reservation on Peer Assessment

Williams (1992) reported that students found peer assessment interesting but felt uncomfortable doing it since they saw it as criticising their friends. Burke (1969) looked at peer and self-assessment in terms of students having displayed "the greatest knowledge of the class material and/or exhibited the greatest skill in applying the class material" in simulated situation (p. 446). He found self-assessment unsuccessful since students were "unable to assign their own grades objectively and realistically" (p.448), not one student allocated themselves a lower grade despite believing they should exist and there was low-agreement with the grade awarded by the staff member.

When the assessments involve certain degree of subjectivity, reliability becomes an important issue. The peer assessment, if used, should have a very low weighting in a student's final grade to reflect the concerns of the community for reliable certification (Beard and Hartley, 1984). Hughes & Large (1993) considered the combined effect of student and teacher assessment of oral presentation contributed 5% towards their final grades.

Concerns are also voiced in relation to the appropriateness, validity and fairness of peer assessment techniques. Investigations that addressed the reliability and validity of peer assessment have typically employed correlational analysis of teacher and peer

marks. Not all such studies produce significant positive correlations between peer and teacher marks. These disparities might suggest that peer assessment is sensitive to the nature of the group task. Where peer assessment makes a significant contribution to the mark, some degree of student over-marking can occur (Boud,1989: Falchikov,1986). The findings from Brindley and Scoffield (1998) research in the peer assessment in two marketing courses revealed some negative elements in peer assessment. Criticisms included the effect of personal bias on the marks awarded, the interpretation of criteria and the ability of the students to assess. Some students felt that it is an unfair system that lacked objectivity. It was also time consuming process for teacher (Brindley and Scoffield,1988).

Correlational analysis comparing teacher and peer marks are not possible where groups of students work in the absence of their teacher. In addressing this problem, Falchikov's (1997) solution was to delegate the responsibility for process assessment to the students themselves.

2.5 Methods for Rewarding Individual Efforts in Group Projects

Having reviewed the contribution of peer assessment in group projects, literatures on the different methods for rewarding individual efforts in group projects are discussed below.

Gibbs, Habeshaw & Habeshaw (1986) suggested that assessment of group projects can result in problems within groups and between groups. Students felt that a group mark is not a fair reflection of individual effort. The between groups problem is the narrow range of marks normally resulting when group marks are given. There are

various schemes for countering the assessment problems by awarding a mark which reflects both the outcome of the project and the contribution of the group members to the work.

2.5.1 Pool of Mark

Gibbs et al. (1986), and in Gibbs (1992) further developed a process for allowing students to distribute a pool of marks between the group members. For example, if a group of four students were to be awarded 60% for a group project, they would be given 4 x 60 =240 total marks to distribute among them base on negotiation. This led to bitter enmity and a shout of foul-play. This method has its disadvantages as Burnett and Cavange (1980) noted that "students feel responsible in marking peer assessment but not necessarily comfortable in doing so". Placing the entire burden of sharing marks upon the student seemed unreasonable unless group negotiation was on specific course objective. It would also introduce an element of competition into what had been a collaborative process. Nevertheless, this approach has formed the basis of other attempts which are effectively the refinements of this method.

2.5.2 Two-Part Weighting Factor

This assessment procedure and methodology was outlined by Goldfinch & Raeside (1990). It required the students to complete a two-part peer assessment questionnaire. Each student marks the other group members privately on the basis of their contributions to the project.

Part 1 of the questionnaire is related to the skills involved in the project tasks. It listed all the tasks that the group should have completed during the project. Each task is clearly identified so that the contribution of a particular member or members of the group can be distinguished and the relevant individuals identified against each task. To analyse Part 1 of the questionnaire, scores are calculated for each student using formulae:

Part 1 score = Number of mentions of individual/Highest possible number of mentions

Part 2 of the questionnaire summarises a list of process skills. These are related to the group activities, collectively carried out during the project. On this form, students were required to award a group mark between 0 to 4 to each group member to reflect the proportion of the person's contribution that part of the process. The scores are calculated for each student using formulae:

Part 2 score = Actual sum scored/Highest possible score*   * (4 x no. of skills)

Part 1 and Part 2 scores are then combined by the formula:

PA score = Part 1 score x 1/3 + part 2 score x 2/3

This score is an individual student's 'peer assessment'. Once the teacher has given a mark to the group's project, each individual student's share of that mark is calculated by using formulae:

Individual student's mark = (PA score)% x (group mark).

Conway & Kember (1993) felt that there were drawbacks to this method. They found that Part 1 did not reflect the relatively even efforts within their group. Goldfinch had some problems with part 1 in later trials (Goldfinch, 1994) and subsequently only applied Part 2. Their findings also indicated the 0-4 scale was not successful. Not a single score of zero was awarded and thus inflated the mean to 3.0

well above the stated 2 as average. The calculations were lengthy and tedious and it delayed feedback to students. Despite the drawbacks in Part 1, the system had much to offer and the concept is very important. Rafiq and Fullerton (1996) felt that Part 1 and Part 2 are of equal importance and should be given equal weighting. They found Part 2 worked well and students were relatively unbiased in their assessment of the group processes.

Lopez and Chan found that ways of allocating an individual mark to each student by using a 'weighting factor' to adjust the group mark by other researchers (Conway et al. 1993; Goldfinch & Raeside, 1990; Goldfinch, 1994; and Rafiq & Fullerton, 1996) involved relative complexity of different Mathematical formulations which also resulted in sharing a 'pool' of marks. The weighting factors are all examples of a 'zero-sum' game. That is, any gain for one student inevitably implies a loss for another student. This introduces competitive elements that run counter to the collaborative philosophy underpinning group work. One further problem with a weighting factor system is that theoretically, it is possible for student to obtain more than 100%. For these reasons, any form of weighting system was deemed unsuitable for assessment (Lopez and Chan, 1999).

2.5.3 Equally Shared Mark with Exceptional Teacher Intervention

This method is quite widespread (Mello, 1993) and involves all group members receiving the group grade, unless there is a problem with a group member which results in the teacher being approached and being made aware of the problem. Mello encouraged student to write comment about the group process and reserves the right to

penalise a group member whose contribution is seen to be defective. The penalty is decided by the teacher. An alternative is for the teacher to call a meeting of a group that is having problems of this nature and negotiate a distribution of mark within the group. This latter process is time consuming and requires good negotiating skills on the part of the teacher.

2.5.4 Separation of Process and Product

Earl (1986) and Lopez and Chan (1999) report a method for assessing a group project in mathematical modeling. A project is assessed in three areas: group activity (process), oral presentation and written report.

This method is in essence of the separation of product and process. The separation is clearly made by Falchikov (1988, 1997) and Lopez and Chan (1999). The assessment of the product (which is performed by the tutor or expert) and assessment of the process (which is performed by student themselves using peer assessment). According to Lopez and Chan, one advantage of keeping process assessment and product assessment separate is one can communicate more definite messages about what is involved in a group project and how students should approach each component. By establishing a process assessment, the students will realise that effective teamwork can be a valued learning goal on a discipline-bases subject. Hence, establishing a uniform group marking to the product we emphasising that this aspect should be a joint responsibility and an integrated whole rather than the sum of the parts done by individual.

2.6 Conclusion

From the review of literatures, it is found that peer assessment is quite a controversial approach to be introduced into a traditionally conservative discipline such as Mathematics. It challenges the orthodoxy that teacher is necessarily the best person to provide feedback on students' work. However, in this new and dynamic education system, peer assessment will soon replace or compliment the traditional teacher based assessment in all methods mentioned above. Nevertheless, numerous studies over the past 40 years on peer assessment in a variety of assessment context have indeed rendered generally favourable verdicts (Kane and Lawler, 1978; Norton, 1992).

In view of this, a study needs to be carried out in Malaysia context to investigate the perception of students towards peer assessment in a Mathematics group project and to explore the process and product elements in of the group project as the focus of peer assessment.