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A SOFTWARE DEVELOPMENT COURSE
IN A SINGAPORE POLYTECHNIC :
THE ROLE OF TEAMWORK AND MOTIVATION

By

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Abstract

A Software Development Course In A Singapore Polytechnic: The Role of Teamwork And Motivation

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The main aim of this research was to establish the effectiveness of collaborative teamwork in a polytechnic (in Singapore) as an intervention strategy, especially for low performers. Using questionnaire surveys, this study investigated the changes in the students' motivational styles after they had worked in teams to complete a software development assignment. The self-worth related consequences of success and failure for high and low performers working in similar ability and mixed ability teams were also investigated. Another area that was investigated was the students' experience of working in teams and their perspectives on teamwork. Students were interviewed to find out their perceptions, feelings and behaviours when they were working in teams to complete their software development assignment. The motivational problems encountered by the students during the team working process were studied.

While the mastery orientation factor scores of the four groups increased after the team assignment, the self-worth motivation factor scores for all the groups continued to be the highest, indicating that this maladaptive motivational style was still quite strong.

The students continued to remain focused on ability. Ability differences were accentuated when students were allowed to form teams comprising of only low performers. Mixed ability teams also accentuated perceptions of ability differences. Even in high performers teams, high performers were found to be trying to demonstrate their ability to show that they were better than their teammates. Team failures resulted in accentuation of low ability, ability differences when comparing themselves to others, and feelings of shame and guilt, especially among the low performers.

Some of the problems associated with team-working were found to be related to the maladaptive motivational styles of the students. For team work to be effective, teachers should address the potential problems of process and the factors that influence their occurrence. This is where constructivist theories of learning and instruction can provide a useful input to motivation theory.

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List of Abbreviations

HP(s)...High Performer(s)

HPT(s)...High Performers Team(s)

IT...Information Technology

ICT...Information and Communications
Technology

LP(s)...Low Performer(s)

LPT(s)...Low Performers Team(s)

MPT(s)...Mixed Performers Team(s)

OOP...Object Oriented Programming

OS...Operating System

PC...Personal Computer

UML...Unified Modeling Language

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This thesis is dedicated to my parents who I remember as great teachers; and to my brother and sisters for their patience, understanding and encouragement while I was busily doing my research and writing the thesis.

Declarations

This work has not previously been submitted for a higher degree or diploma in a university. To the best of my knowledge and belief, the thesis contains no material, previously published or written by another person, except where due reference is made in the thesis itself.

Signed :

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Date :   10th June 2005

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Chapter 1

Introduction To Thesis

Programming is a core subject in all IT courses that prepare students to join industry as software developers or software engineers. At the polytechnic where this study was conducted, many students, especially those who did not opt to do IT in the first place, did not have any interest in IT or believed that they lacked the ability (intelligence and aptitude) to do the course. They withdrew quickly from the course attributing their poor performance not to their perceived lack of ability but to other reasons that helped protect their self-esteem.

IT students normally encounter great difficulties especially in their first year programming courses. It is true that programming is a totally new subject, one that the students have not been exposed to in secondary schools. Many admit hating programming and feel unable to grasp even the most basic skills and programming concepts (Thomas et al., 2002). Students who struggle with their programming either fail and drop out of the course; or they manage to continue but avoid more challenging programming modules or projects that require them to do programming. Some even manage to graduate from the course but still display very little or no confidence in their programming skills. They finally choose a career path that does not involve software construction. In a profession that requires its members to continue to develop themselves professionally (Chan, 1990) and to develop and to perfect their technical skills, this is not a healthy sign.

Some studies have hypothesized that the students who cannot cope with programming are those who have no aptitude for programming (Jenkins, 2002). Various tests for determining a person's aptitude for programming exist but it has been difficult to provide evidence of their effectiveness (Mazlack, 1980; Davy & Jenkins, 1999). It may not be possible to determine student aptitude for programming, and for polytechnics and universities to use the results of such tests as a basis for the selection of suitable students for their IT courses. In fact it is common knowledge that most, if not all, organizations who hire IT professionals and tertiary education institutions have already stopped using aptitude tests.

Teachers who still attribute low aptitude or poor attitude as the reasons for students' failure are often seen as being defensive since they do not want to be blamed for their students' poor performance. It is also a pessimistic view which suggests that the they have no role to play in motivating to students to learn a new skill and to help them develop an interest in the subject.

The 3-year Diploma in Information Technology course offered by School of ICT at the Ngee Ann Polytechnic, Singapore is practice-oriented one, and the identified core skills are not limited to purely technical skills but also include interpersonal and life skills necessary for success at work (Chan, 1992). An essential core skill is the ability to work effectively with other IT professionals in a team. The course document clearly states that the students should, on satisfactory completion of the course, be able to demonstrate responsibility and confidence in working in a team. The tutors have to impress upon the students that teamwork is necessary for large and complex software development projects, and that it is an essential part of their training. Students must

acquire some experience in team-working and should be given as many opportunities as possible to develop their skills working in a number of project teams throughout the course.

Before the present research started, some tutors had inferred from various behavioural manifestations and grades that the students were generally more motivated to learn when they were working together in small groups. Some students appeared to be willing to put in more effort to complete their assignments. The students met frequently with their team mates for discussions and deliberations, spent more time in the computing laboratories to develop their software and asked more questions during tutorials. They appeared to be more involved in the learning process. The perception of the tutors was that team assignments could be useful in promoting students' interest in learning programming tasks.

Like software development teams in industry, teams of students working on group projects are not free from problems. Sometimes, a team member is not able to carry his share of the load. There are team members who are competent but who do not get along with the others. There are also the super programmers, wanting to do all the work by themselves and not hesitating to tell others how good they are.

There are similar problems when students work in teams. Some of these are: (a) better students not helping the weaker ones; (b) better students doing the work of their teammates; (c) weaker students not participating and performing; (d) personality clashes; (e) sabotages of work by weaker students; (f) weaker students being blamed for non-delivery or failure; (g) inter-group rivalries and competition for resources, etc.; and (h) students being so involved in group work that they neglect other subjects

(skipping lectures and tutorials). The tutors have been unable to explain such problems. If they could, they would be in a better position to decide (and perhaps to advise) if a cooperative learning approach could be used, and how they should design the various team assignments.

The literature on Motivation Theories and Constructivism are reviewed first. Chapter 2 provides a brief review of work of the principle motivation theorists, such as Atkinson, Weiner, Nicholls, Dweck, Covington and Ames. These theories have proposed a large number of different constructs to explain what motivated behaviour is. However, they have important commonalities in terms of motivational outcomes and constructs and therefore allow for some synthesis across theories to be made. Currently, one of the most active areas of achievement motivation research is in goal orientations. Goal orientations are a meaningful way to describe individual achievement goals as well as classroom contexts. They are also important because they influence a number of motivational, cognitive and behavioural outcomes.

The recent developments in goal theory research are highlighted in this chapter. Based on the work of the main motivation theorists three motivational styles have already been identified: mastery orientation, learned helplessness and self-worth motivation (Galloway, 1998). The first is considered adaptive and the other two maladaptive. The concept of motivational style and how it could be changed according to the interactions between the individuals and the contexts (subjects, teachers and schools) is discussed in this chapter. The relevance of the western motivational theories in the local context is also discussed since the value of this research hinges on applicability of these theories to a Singapore education environment.

The literature on constructivist learning theories and environments is reviewed in Chapter 3. Many constructivist ideas are implicit in goal theory formulations. Goal theory posits that learning is enhanced when students see the classroom as stressing mastery orientation rather than performance orientation. Various classroom dimensions can affect motivation and are modifiable. The classroom learning environment can be changed to enhance the probability that students will adopt an adaptive mastery goal orientation. Group assignments and projects that encourage collaboration among learners should foster the adoption of mastery goals and a focus on learning. The research perspectives on cooperative learning are highlighted. Although there is a fair consensus among researchers about the positive effects of cooperative learning on student achievement, as well as a growing number of educators using cooperative learning in all levels and in many subject areas, there remains much confusion and even controversy, about why and how cooperative methods affect motivation and, most importantly, under what conditions cooperative learning has these effects. The experience of cooperative learning in higher education in the Asian Singapore context is also covered in this chapter.

One of the aims of this research project is to find out whether the motivational styles (both adaptive and maladaptive), discussed in recent literature on learning motivation, are apparent and are relevant in a polytechnic learning environment where IT students work in teams to develop computer software. Another aim of this research project is to establish the effectiveness of collaborative teamwork as an intervention strategy especially for low performers. This study involved investigating the motivational styles of the both high and low performers and the changes in their motivational orientations after they had worked together in teams to complete an assignment.

So far, relatively little research has been carried out on the effects of failures on individual members (high and low performers) of the project team, their perceptions, attributions and behaviours. As part of this study, the self-worth related consequences of success and failure for high and low performers working in different mixed and similar-ability teams were investigated. Another area that was investigated was the students' experience of working in teams and their perspectives on teamwork. Recent reviews noted that research focused on outcomes reported different findings from research focused on processes. The latter reported potentially serious problems and factors that influence their occurrences (Good et al., 1992; Bluemenfeld et al., 1996; Webb & Palincsar, 1996).

The main research questions for this study are:

- What were the students' motivational responses to programming both before and after they completed the team assignment?

- How did success and failure in the team assignment affect their self-worth motivation?

- What were the students' perceptions of the team assignment? Were there problems working in teams and what influenced their occurrence?

Motivation research carried out so far has relied heavily on questionnaires or on controlled laboratory-type experiments. The tasks the subjects were engaged in were not authentic group work but were specially constructed tests requiring the subjects to complete questionnaires or to solve irrelevant puzzles; ability levels and outcomes were manipulated. The research aims to confirm whether the results of earlier research (Ames, 1981; Covington, 1992; Harris & Covington, 1989,1993), discussed in Chapters

2 and 3, would apply in a cooperative learning situation (in a polytechnic) in which team interdependence is derived from a real academic task (i.e., software development) which requires the students to work in teams of two to develop a software product.

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To answer the first question, two surveys were carried out, one just before the assignment and the other immediately after the assignment, to see the changes in the students' motivational styles. Another survey was conducted to study the effects of success and failures on the self-worth motivation of both high and low performers who worked in similar-ability and mixed-ability teams. Students had to evaluate themselves and their teammates in terms of ability, deservingness of reward, and the amount of pride (for success) or amount shame (for failure) they were experiencing. Statistically analyses of the data collected and the findings of these surveys are reported in Chapters 5 and 6.

Finally some students were interviewed to study their perspectives on the team working process. It was only through the interviews that it was possible to find out their perceptions, feelings and behaviours when they were working in teams to complete their software development assignment. The problems encountered by the students during their team assignment were noted. The qualitative approach in the collection, including organizing and analysis of interview data, is presented in Chapter 7. The major findings are also reported at the end of that chapter.

In the final chapter, the findings from chapters 5, 6 and 7 are reviewed and discussed. Reference is made to the literature reviewed in chapters 2 and 3. The research questions identified in chapter 4 are used as a basis for discussion. Suggestions of areas for further research are also presented at the end of the Chapter 8.

The findings and conclusions of the research are intended to be useful to teachers involved in the teaching of programming to students at the polytechnic level. They should lead to a better understanding of how students are motivated to learn (and becoming more mastery oriented) using cooperative team assignments and how such collaborative team assignments could be designed to improve the students', especially the low performers', sense of self-worth and perceptions of their own ability.

Chapter 2

Motivation Theories

Introduction

Several perspectives on student motivation will be briefly examined in this chapter. These frameworks are comprehensive enough to provide a general understanding of motivational issues in learning and gaining success in achievement-related settings like schools and universities. Specifically, these frameworks could help teachers to understand and to explain why some students are motivated to learn and to achieve, and why some are not. The frameworks also provide useful principles on the design of classroom structures that will motivate students to succeed in their tasks.

There are many different motivational theories related to achievement and learning and these theories have proposed a large number of different constructs to explain what motivated behaviour is. The large number of motivational constructs with different labels makes it difficult for novices to understand and use the different constructs in their research (Murphy & Alexander, 2000). However, these different theories have some important commonalities in terms of motivational outcomes and constructs that allow for some synthesis across theories.

Motivational constructs are used to explain the instigation (or arousal) of behaviour, the direction of behaviour (choice), the intensity of behaviour (effort, persistence), and

actual achievement or accomplishments (Pintrich, 2003). Ames (1986) suggested that motivation to learn is indicated by the following behaviors: serious attention to learning tasks; effort expended in learning activities; valuing learning for its own sake; deriving satisfaction from the process of learning; the quality of involvement in the learning process; attraction to learning; the extent of individual responsibility; and independence in respect to one's own learning. Sharan and Shaulov (1990) are of the view that motivation is a construct that must be inferred from various behavioural manifestations and cannot be evaluated directly. In their study, they measured the following three behavioral manifestations of motivation to learn: perseverence in carrying out the learning task; deeper involvement in classroom learning; and willingness to invest effort in preparing homework. In fact most motivational theories attempt to explain and predict general outcomes like the student's choice of one activity or task over another; the student's level of activity or involvement in a task; the student's persistence at tasks even in face of difficulty, boredom or fatique; the student's actual achievement or performance; and the student's level of understanding.

Three factors seem to stand out in the various models of motivation and these are: (a) beliefs about one's ability or skill to perform the task (expectancy); (b) beliefs about the importance, interest, and utility of the task (values); and (c) feelings about the self or emotional reactions to task (emotions) (see Pintrich & Schunk, 2002; Pintrich, 2003). Some motivation researchers have considered and have integrated more than one of these into their theories and models.

This chapter reviews the relevant motivational theories and also examines how the various motivational constructs are related to student cognition and learning in classrooms. It looks at how the positive (adaptive) and negative (maladaptive)

motivational patterns are related to differences in students' confidence in their ability to perform well, their self-efficacy, their goal orientations, and their attributions for success and failure at academic tasks. The concept of motivational styles and whether they can be changed will be discussed.

Some Early Conceptions of Motivation

The notion of drive was developed from the concept of instinct. It was considered as the source of energy for human behaviour. Learning explains the direction of the learners' behaviour and drive explains both the intensity and duration of their behaviour (Hull, 1943). Drive was also linked to basic needs and would become stronger or weaker as these needs were met to a greater or lesser extent. Hull saw behaviour as being affected by habit too, i.e. how accustomed learners were to behaving in a particular way. Drive and habit have a multiplicative relationship to each other; a low or zero drive level would mean that there was no appropriate behaviour.

Drive is equated to motivation and the learner's progress is determined by drive level and by the learning that takes place. The latter determines the direction and shape of the behaviour but the former determines the degree of energy that is exerted.

According to drive theory, the teachers' role is to encourage and facilitate learning by providing the right type of learning experiences. The degree to which the learners respond to these is determined by their drive level, or motivation and the teacher's role is only one of directing the available energies of the learners. The notion of drive serves to separate the notions of motivation and learning in a way that encourages

teachers to consider learning as something which they might be able to influence, but motivation (or drive) as something which is much more difficult for them to influence.

Differences between learners can be explained in terms of the degree of motivation (the level of drive they possess) and not the direction of that motivation. Good students are those with strong drive levels and who are responsive to the teachers' efforts at teaching. The good teacher will be more effective at directing these energies in desired ways. On the other hand, even the best teacher has no hope with students who lack the basic motivating drive. These unmotivated students are considered difficult to teach.

The presence of high drive levels provide the necessary, but not sufficient, conditions for learning to take place. The teacher will have to make the most of this high drive level of the students. Learning problems for these students are a problem of ineffective teaching, classroom or school management. A lower drive level indicates that a necessary condition for successful learning has not been met. Many teachers see this as a problem that resides within the student, and one which they can do relatively little to influence.

An alternative conception treats motivation as an integrated component of learning, and both can be affected by the quality of teaching. The development of other approaches or alternative conceptions make it apparent that motivation is important and applies to both high-achieving and low-achieving students. The differences in motivation can be seen in terms of learners adapting to a particular situation rather than in terms of their level of motivation. The development of adaptive motivation could be seen as an educational objective in its own right.

Behaviourist theories offer an alternative approach. Motivation arises from basic drives, instincts or emotions in ways that are predictable. Teachers can plan what they want students to learn and condition their learning. It does not matter whether the students see the purpose or value in learning. The amount of time the students spend on the task indicates their level of motivation. Motivation is therefore a quantifiable variable. Teachers can increase student's motivation through classroom interventions to increase "on task" behaviour. If the right rewards and enough of them are provided, or sufficient punishments are meted out, unmotivated and lazy students can be aroused to higher levels of achievement.

Deci (1975) has highlighted the detrimental effects of external rewards and reinforcement on student's interest in learning and intrinsic motivation. There is also evidence that competition for rewards promotes a surface approach to learning where students attempt to maximize rewards at the expense of time and effort invested in learning and understanding. Behaviourist theory does assume that teachers influence students' behaviour, through their use of reinforcement. It does not consider the fact that students and teachers do interact in the classroom and they influence each other's behaviour.

Need Achievement Theory

Atkinson's (1964) concept of achievement motivation was an influential advance on the early drive theories. The theory maintains the belief that students bring with them into the learning environment basic tendencies which make them respond in certain ways. These dispositions are not easily influenced by the actions of other people like the teachers.

Atkinson, however, believed that motivation can vary depending on how success and failure are seen as relevant and important outcomes. Success can be measured against a defined standard (usually set by teachers) and this provides a criterion to measure whether that standard has been achieved.

All tasks requiring the students to achieve a certain standard can be seen as double headed in the sense that they offer both the prospects of success and the prospects of failure. Any outcome obtained where failure literally was not possible could not be considered a success, and vice versa.

Atkinson's approach-avoidance theory recognized two different motivational strands which are related to the two facets of achievement related activity. According to Atkinson (1964), all individuals can be characterized by either a motive to approach success or a motive to avoid failure. Atkinson regarded the motive to succeed as a basic personality characteristic related to the degree to which individuals have a capacity to experience pride and other positive emotional reactions when they are successful in their tasks. On the other hand, a capacity for experiencing shame and humiliation is thought to drive failure-oriented persons to avoid situations where they believe they would most likely to fail. It is this difference in emotional anticipation (pride vs. shame) that is thought to provide answers to the reasons for learning behaviour.

Some people will experience more pride than others following success and this extra capacity to experience such an emotion leads to greater degree of motivation to engage in those activities which could provide a sense of achievement. This motivation is related to intrinsic satisfaction. Extrinsic sources of satisfaction like praise, approval

and acceptance by peers, prizes or good grades are considered additional inducements. Atkinson added two more factors to his need achievement model which when combined with approach-avoidance tendencies, determine who will be aroused to achieve, to what degree, and in which particular situations. First, whether students will be aroused or not depends on the attractiveness of the achievement goal. Second, students also will be aroused depending on their expectation of attaining the goal. Students will be motivated if there is a reasonable chance that they will get something that they want.

Students are not just either success-oriented or failure avoiding. Students are more likely to share these characteristics to one degree or another. This creates endless permutations of motivational patterns within the same classroom. Atkinson suggested that the motive to approach success and the motive to avoid failure are separate, independent dimensions. Whether individuals are high on the approach dimension or not does not depend on where they are in the avoidance dimension.

Individuals will be inclined to demonstrate either "adaptive" or "maladaptive" motivational patterns based on their basic motivational forces. Adaptiveness here is seen in the formal educational system context and those high in the motive to achieve success are those with an adaptive style. Those with maladaptive patterns of motivation are not lacking in motivation; it is the type and not just simply the quantity of the motivational forces in operation that is of importance. They are motivated or even over-motivated but for the wrong reasons.

For failure-avoiding students, easy assignments are preferred because the chances of failure are low and the anticipation of shame is minimized. Very tough assignments

are also attractive to this group of failure-avoiding students because no one need to feel bad when they fail at a task which is difficult for most students and for which the odds against success are exceedingly high. Failure-avoiding students are predicted to display so-called atypical shifts which might involve choosing even more difficult tasks following a series of failures.

Attribution Theory

Richard de Charms' (1968, 1976, 1983) theoretical approach also placed emphasis on cognition and the environment. According to him, people would like to see themselves as "origins" (the origin or source of their intention to act in a certain way) rather than "pawns" which are powerless, under the control of others. When students feel more like origins and less like pawns, they have higher self-esteem, feel more competent and in charge of their learning, score higher on standardized tests and are absent less (de Charms, 1976). These ideas are somewhat similar to the work of Weiner and the attribution theorists and will be examined in this section.

De Charms is also concerned with the influence of different contexts on motivation. Some situations encourage pawn-like behaviour while others encourage an origin-like response. His school improvement initiatives (De Charms, 1976) demonstrated the effectiveness of interventions which involved changing the context in which students worked and learned rather than trying to influence directly the students themselves. Motivation should improve if students moved to an environment which they perceive as origin inducing. De Charms' work provides an indication that besides individual cognitions, contextual factors need to be taken into consideration in the study of motivation in the classroom.

Bernard Weiner's (1974, 1979) research on motivation has drawn attention to the lack of evidence to support Atkinson's claims regarding task preferences. While there was support for the prediction that tasks of intermediate difficulty levels will be preferred by students who are high in the motive to succeed, there has not been much support for those who are high in the motive to avoid failure to prefer tasks that are either very easy or very difficult. Weiner suggests that the information that students obtain from learning situations are more important in determining their responses. People attribute causes to event and Attribution theory is concerned with analyzing the ways in which people determine the causes of events, and the ways those conclusions might affect a person's reaction or response.

Weiner's radical reinterpretation of Atkinson's theory reasoned that cognitive (thought) processes rather than emotional anticipation are responsible for the quality of achievement. In effect, what people think was given priority over what people feel as the prime mover of achievement. This perhaps is one of the main problems with Attribution theory since people don't normally think before deciding how they feel. They feel emotions such as pride, anger, shame first and then think (as way of rationalizing their feelings).

Attributional theory (Weiner, 1986) proposes that the three dimensions of locus (internal vs. external), controllability (controllable vs. uncontrollable) and stability (stable vs. unstable) can be separated conceptually and empirically and that they have different influences on behaviour. Individuals who tend to attribute success to internal and stable causes like ability or aptitude will tend to expect success in the future. Those who attribute their success to external or unstable causes (e.g., ease of task, luck)

will not expect to do well in the future. For failure situations, the positive motivational pattern consists of attribution of failure to external and unstable causes (e.g., difficult task, lack of effort, bad luck), and the negative motivational pattern consists of attributing failure to internal and stable causes (e.g., ability, intelligence, aptitude).

There are in fact a number of other dimensions to consider when looking at the causes of success and failure. A person's reaction to success or failure is determined by the causes held responsible, that is the location on this network of many dimensions (internal-external, controllable-uncontrollable, stable-unstable, global-specific, and intentional-unintentional) (Forsterling, 2001). Motivational differences are seen to be the result of differences in attributions. This attributional approach has been applied to numerous situations and the motivational dynamics appear to be remarkably robust and similar (Weiner, 1986, 1995).

Individuals' beliefs about the causes of events can be changed through feedback and environmental manipulations to facilitate the adoption of positive control and attributional beliefs. Research on attributional retraining in achievement situations (Forsterling, 1985; Perry & Penner, 1990) suggests that teaching individuals to make appropriate attributions for failure in school tasks (e.g. lack of effort attribution instead of lack of ability) can facilitate future achievements.

Weiner's work is seen as a continuation of the ideas developed by Atkinson. In Weiner's case, the expectations and the affect-laden values are seen as a product of the attributional judgements that have been made earlier. Weiner has moved thinking about motivation into the cognitive arena.

Attributional theory generally takes a situational view of the attributions and beliefs, rather than the view that individuals have relatively consistent attributional patterns across domains and tasks that function somewhat like personality traits. Atkinson's personality component in his theory has been replaced in Weiner's system by an information processing component. Expectations and emotions are still important but they are only indirect response to a particular stimulus. The mediating role of attribution is of paramount importance in the theory.

An important feature of attribution theory is its focus on the role of effort in achievement. Student effort can be controlled by teachers through the application of rewards for trying and punishments for nor trying. Students who study hard are rewarded more in success and reprimanded less in failure than students who do not try. From this pattern of rewards and punishment, attribution theorists have concluded that students should come to value effort and trying hard as a major source of their personal worth. The theory does not explain why there are many students who do not try in school. In fact some are determined not to learn while others hide their efforts or refuse to admit that they studied hard. For answers to these questions, the concept of "learned helplessness" will be considered first before the discussion on self-worth theory in the next section.

An important contribution of attribution theory concerns a maladaptive motivational response called "learned helplessness" (Seligman, 1975). It has been described as a state of depression or loss of hope which accompanies a belief that no matter how hard or how well one tries, failure is the inevitable outcome. A sense of despair is not necessarily that the individual tried hard and failed anyway (that is, not being in control) but rather the implication that one is incompetent. The sense of hopelessness

occurs when the helpless student repeatedly ascribes failure to a stable, internal cause – low ability. With these attributions come feelings of despair, frustration and even self-loathing.

Learned helplessness appears to cause three types of deficits : motivational, cognitive and affective. Students who feel hopeless will be unmotivated and reluctant to work. They expect to fail, so they do not even want to try. Because they are pessimistic about learning, these students miss opportunities to practice and improve skills and abilities, so they develop cognitive deficits. They also often suffer from affective problems like depression, anxiety and listlessness (Alloy & Seligman, 1979). Learned helplessness is probably the best known maladaptive motivational style. It is considered maladaptive since the gaining of success and working towards the gaining of success are not the prime concern of the learned helpless in achievement-related settings.

Self-Worth Theory

Covington (1992) argued that it is not success or failure per se which are critical but their implications for the individual's sense of self-worth. Research on student learning shows that self-esteem or sense of self-worth has often been implicated in models of performance in school (Covington, 1992; Covington & Beery, 1976). Covington (1992) has suggested that individuals are always motivated to establish, maintain and promote a positive self-image. Individuals may develop a variety of coping strategies to maintain self-worth. However, these strategies may actually be self-defeating and can have debilitating effects on student performance.

Many of these coping strategies hinge on the role of effort and the fact that effort can be a double-edged sword (Covington & Omelich, 1979). Students believe that the brighter students need not put in too much effort and only the weaker ones need to work very hard in order to succeed. Students who try harder will increase the probability of their success but they also increase risk of giving an impression of low ability whether they succeed or fail. Covington suggests that students will often try to hide how much effort they put in so that others (especially their peers) will think they simply have high ability. If they then do well, the usual attributional logic is that they must have high ability because they did not study that hard (Covington, 1992, 1998).

Having high ability is, according to Covington and Omelich (1979), socially very desirable. The assumption that one is in possession of high ability also gives rise to the expectation of success in the future. From this perspective, it seems plausible that individuals prefer to succeed due to their high ability with minimum effort. What this means is that if a student has a choice, he will prefer to be successful because of high ability and low effort. He will not want to be a student who has failed because of low ability in spite of high effort.

Students use several classic failure-avoiding tactics in order to maintain a sense of self-worth. One strategy is to avoid risks and challenges by choosing easy tasks that guarantee success although the tasks do not really test the individuals' actual skill levels. Students may choose this strategy by continually avoiding risk by electing easy tasks, easy options and electives, or easy courses. A second failure-avoiding strategy, which is also a self-handicapping strategy, involves procrastination. A student who does not prepare for a test because of lack of time, can – if they are successful – attribute it to superior aptitude and intelligence, or high ability. On the other hand, if

the student is unsuccessful, he or she can attribute the failure to lack of time, not to poor skill or low ability. This type of effort-avoiding strategy increases the probability of failure over time which will result in lowered perception of self-worth. This self-handicapping strategy is therefore self-defeating and maladaptive.

Unlike self-handicapping strategies that are generally guided by the desire to make others think that a controllable cause (e.g. lack of effort) rather than an uncontrollable cause (e.g. lack of ability) was responsible for failure, excuses are almost always guided by trying to communicate that uncontrollable rather than controllable causes are the reasons for unsuccessful outcome. Sometimes, the excuse communicates the real reason, and sometimes the excuse is a lie and involves communicating a cause that actually was not present (e.g., a sick parent) was responsible (Forsterling, 2001).

Juvonen and Murdoch (1993) found that adolescents tend to communicate to authority figures (teachers or parents) that failure was due to lack of ability rather than lack of effort and that success is due to effort rather than ability. They will be praised for their success and not reprimanded for failures. To their peers, however, adolescents convey that lack of effort rather than ability was the cause for failure and that success would be due to high ability rather than effort. They are more concerned with protection of self-worth in front of peers. This means that adolescents will be more prone to using excuses to explain their failures to teachers and parents, and using self-handicapping to convince their peers that failure is due to controllable cause (i.e. low effort).

Goal Orientation Theory

Another conception of achievement motivation that has emerged over the past several decades considers motivation in terms of goals that draw, not drive, individuals towards action. This tradition assumes that all actions are given meaning and purpose by the goals that individuals seek out, and that the quality and intensity of their actions and behaviour will change as their goals change. An achievement goal therefore concerns the purposes of achievement behaviour. It defines an integrated pattern of beliefs, attributions, and affect that produces the intentions of behaviour (Weiner, 1986) and that is represented by different ways of approaching, engaging in, and responding to achievement-type activities (Ames, 1992b; Dweck & Leggett, 1988). Elliot and Dweck defined an achievement goal as involving a "program" of cognitive processes that have "cognitive, affective, and behavioural consequences" (1988: 11).

There are a number of different models of goal orientation advanced by different achievement motivation researchers and they vary somewhat in their definition of goal orientation and the use of different labels for similar constructs. Most models propose two contrasting achievement goal constructs that concern the reasons or purposes individuals are pursuing when approaching and engaging in a task. These two goals have been differentiated by their linkage to contrasting patterns of motivational processes and have been alternatively labeled as learning and performance goals (Dweck, 1986; Dweck & Leggett, 1988; Elliot & Dweck, 1988); task-involvement and ego-involvement goals (Maehr & Nicholls, 1980; Nicholls, 1984a); and mastery and

performance goals (Ames & Archer, 1988). The distinction between these two types of goals parallels, to some extent, the distinction between the more general and trait-like intrinsic and extrinsic motivation constructs. However, the focus on goal-orientation theories is on cognitive goals that are more situational and context dependent.

All these different models focus on the concern of learners over their ability or the lack of it. They have direct applicability to classrooms and student motivation. They explain achievement behaviour specifically and have been tested in many experimental and classroom field studies with both children and adults performing various learning tasks. Goal theory is currently the most active area of research on student motivation in classrooms and has direct implications for both students and teachers.

One of the more important dimensions in Weiner's attributional network is that of stability. Stable causes, such as ability give rise to a more confident expectation of more of the same outcome than do unstable causes, like effort (Weiner, 1979). Nicholls (1989) demonstrated that this view of ability as a stable cause is not applicable in all circumstances. Young children believe that ability, like effort, is extensible. Abilities can increase with practice and application (Nicholls, 1978; Nicholls and Miller, 1983).

Nicholls (1978) in his work on the concept of ability argues that students hold three relatively independent orientations to achievements. First, students vary in the degree of task-orientation, that is their concern with the focus on achievement. This focus is reflected in feeling pleased and satisfied that learning and progress have taken place. Progress and learning are valued for their own sakes, and not for other advantages they might offer in other respects. Second, those who are highly ego-oriented are concerned

with their standing in relation to other people and doing better than others is what makes them feel good. They measure progress by how good they are compared to others rather than how much of the task has been accomplished and mastered. Finally, those who are oriented towards "work avoidance" feel good in getting away with doing as little work as possible.

In his model, Nicholls proposed that individuals' goal orientation will be related to their beliefs about the causes of success. Nicholls assumed that the goal orientation an individual adopts will become the general standard for judging success and, therefore, goal orientation should predict beliefs about the causes of success (the attributions that are made). Nicholl's work complements that of Carol Dweck. In Dweck's model, the two goal orientations are labeled learning and performance goals (Dweck & Legett, 1988), with learning goals reflecting a focus on increasing competence and performance goals involving either the avoidance of negative judgements of competence or attainment of positive judgements of competence.

Mary Bandura and Carol Dweck (1985) identified two theories that students can have about their intelligence – a fixed, entity theory and a malleable, incremental theory. In the entity theory, intelligence is a fixed, concrete, internal entity, whereas in the incremental theory, intelligence is a more dynamic quality that can be increased. They found that students with an entity theory of intelligence are concerned with showing they are smart and so will adopt performance goals. Those who believe in an incremental theory of malleable intelligence are concerned with getting smarter and so should adopt learning (mastery) goals. This causal link between theories of intelligence and goal orientation in Dweck's model is just the opposite causal relation proposed by

Nicholls, who assumes goal orientation influences beliefs and attributions about success.

In their studies, Dweck, et al. (1983; 1988) found a clear and significant relationship between the students' theories of intelligence and their goal choices. The belief in fixed intelligence seems to orient students toward performance goals, and the belief in malleable intelligence seems to orient them toward learning goals. With an incremental theory, a failure just means that the present strategy or present skills are inadequate, but within an entity theory, a failure can cast doubt on the student's global permanent intelligence – definitely something to avoid. Stone (1998) found in his study that students who held an incremental theory of intelligence agreed strongly with the idea that the tasks they were doing would measure only their task-specific ability, but disagreed with the idea that it would measure their overall intelligence. They also rejected the idea that it would measure anything about their future intelligence.

Ability attributions made within an entity theory of intelligence may refer to a fixed global ability, in which case one would expect a setback attributed to ability to create shame, low expectations of success, and a helpless response. Successful students with an entity view of intelligence have to keep on proving to themselves that they have the ability. Every assessment becomes the more threatening. If they do not perform well, they will lose the respect of their peers and teachers. They will not focus on seeking challenges and on the love of learning. Validating their intelligence and trying not to invalidate it is paramount.

Ames has adopted the mastery and performance goal labels (Ames & Archer, 1988; Ames, 1992c). Elliot and his colleagues (e.g., Elliot, 1997; Elliot & Church, 1997,

Elliot & Harackiewicz, 1996) have also used these constructs in their theoretical model. The mastery and performance goals labels will be used in the rest of the discussion in this section.

Those with a mastery goal believe that effort and outcome co-vary, and it is this attributional belief that maintains achievement-directed behaviour over time (Weiner, 1979, 1986). The focus of attention is on the intrinsic value of learning (Butler, 1887; Nicholls, 1984b), as well as effort utilization. One's sense of efficacy is based on the belief that effort will lead to success or a sense of mastery (see Ames, 1992a; Ames & Archer, 1988).

With mastery goals, individuals are oriented toward developing new skills, trying to understand their work, improving their level of competence, or achieving a sense of mastery based on self-referenced standards (Ames, 1992b; Brophy, 1983; Meece, Blumenfeld & Hoyle, 1988; Nicholls, 1989). Compatible with this goal construct is Brophy's (1983) description of a "motivation to learn" whereby individuals are focused on mastering and understanding content and demonstrating a willingness to engage in the process of learning.

With a performance goal, there is a focus on one's ability and a sense of self-worth (see Covington, 1984; Dweck, 1986; Nicholls, 1984b), and ability is evidenced by doing better than others, by surpassing normative-based standards, or by achieving success with little effort (Ames, 1984b; Covington, 1984). Especially important to a performance orientation is public recognition that one has done better than others or performed in a superior manner (Covington & Beery, 1976; Meece, et al., 1988).

When a person adopts a performance goal, a perceived ability-outcome linkage guides his or her behaviour so that the person's self-worth is determined by a perception of his or her ability to perform (see Covington & Beery, 1976; Covington & Omelich, 1984). As a consequence, the expenditure of effort can threaten self-concept of ability when trying hard does not lead to success. In this way, effort becomes the double-edged sword, and success or failure due to effort are equally harmful to self-worth (Covington & Omelich, 1979).

Research has identified patterns of cognitive-based, as well as affective-based, processes that are "set in motion" when a particular goal is adopted over the short- or long-term (Elliot & Dweck, 1988 : 11). A mastery goal elicits a motivational pattern that is associated with a quality of involvement likely to maintain achievement behaviour, whereas a performance goal fosters a failure-avoiding pattern of motivation (see Covington, 1984; Dweck, 1986; Dweck & Leggett, 1988; Elliot & Dweck, 1988; Nicholls, 1984b, 1989).

Of particular importance is evidence that links mastery goals to an attributional belief that effort leads to success, supporting an effort-outcome perception that is central to the attributional model of achievement-directed behaviour (Weiner, 1979). When mastery goals are adopted, pride and satisfaction are associated with successful effort and guilt is associated with inadequate effort. Mastery goals have also been associated with a preference for challenging work and risk taking (Ames & Archer, 1988; Elliot & Dweck, 1988), an intrinsic interest in learning activities (Butler, 1987; Meece et al., 1988; Stipek & Kowalski, 1989), and positive attitudes toward learning (Ames & Archer, 1988; Meece et al., 1988).

Studies have found that students who endorse a mastery goal are more likely to spend more time on learning tasks (Butler, 1987); are persistent in face of difficulty (Elliot & Dweck, 1988); are "failure tolerant" (see Clifford, Kim and McDonald, 1988), and are actively engaged in learning. Active engagement is characterized by the application of effective learning and problem-solving strategies. They self-monitor their cognition and seek ways to become aware of their understanding and learning, such as checking for understanding and comprehension (Ames & Archer, 1988; Newton, 2000). Students' use of these strategies is dependent on a belief that effort leads to success and that failure can be remedied by a change in strategy (Garner, 1990; McCombs, 1984; Pintrich & De Groot, 1990). Of course, students' ability to use self-regulatory strategies is also related to their awareness and knowledge of appropriate strategies and knowing when and how to apply them.

In contrast to a mastery goal, a performance goal orientation has been associated with a pattern of motivation that includes, for example, an avoidance of challenging tasks; negative affect (shame) following failure, accompanied by a judgment that one lacks ability; positive affect following success with little effort; and the use of superficial or short-term learning strategies, such as memorizing and rehearsing.

When a performance goal is adopted, self-concept of ability becomes an important determinant of students' achievement-related behaviours (see Dweck, 1986). Because the focus is on ability and normative performance, students with low self-concept of ability are less likely to choose challenging tasks or use self-regulatory strategies (Dweck, 1986; Pintrich & De Groot, 1990). Self-concept of ability, then, is a significant mediator of cognitive, affective, and behavioural variables when students are focused on doing better than others (Covington & Omelich, 1984; Dweck, 1986).

Therefore the general theoretical assumption in the literature has been that mastery goals foster a host of adaptive motivational, cognitive and achievement outcomes, whereas performance goals generate less adaptive or even maladaptive outcomes.

Recent Research on Goal Theory

The research on the role of performance goals in learning and performance does not appear to be so straightforward. Early research on goal theory generally found negative relations between performance goals and various behavioral and cognitive outcomes (Ames, 1992; Dweck & Legett, 1988). There was, however, no discrimination between approach and avoidance performance goals.

In fact most of the research on performance goals that did not make such a distinction finds that performance goals are negatively related to students' use of deep cognitive strategies (e.g. Meece et al, 1988; Nolen, 1988). This finding would not be unexpected since students who are concerned with doing better than others, as well as those trying to avoid looking stupid, would be disinclined to use deeper cognitive strategies. Students focused on besting others may be less likely to exert the time and effort needed to use deeper processing strategies because the effort needed to use these strategies would suggest to others that they lack the ability, given that the inverse relation between effort and ability is usually operative under performance goals. For students avoiding appearing stupid, the same self-worth mechanism (Covington, 1992) applies. Students do not exert effort in their strategy use in order to have a face-saving reason for doing poorly – lack of effort or poor strategy use is an explanation of their failure and not that they are stupid or incompetent.

The more recent research, however, does show some differential relations between approaching a task focused on doing better than others and avoiding a task that would make one looks stupid or incompetent. It appears that there could be some positive aspects of an approach performance orientation. If students are approaching a task trying to promote certain goals and strategies, it might lead them to be more involved in the task (using deeper cognitive strategies and more regulatory strategy) than students who are trying to avoid certain tasks, which could lead to more withdrawal and less engagement (Harackiewicz et al., 1998; Higgins, 1997; Pintrich, 2000c).

There are differences in the results of these studies and they stem from the use of different measures, classroom contexts, and participants. There is certainly more research work to be done in this area to determine how approach and avoidance performance goals may differently relate to cognitive self-regulation activities (Pintrich, 2000b, 2000c, 2003).

Elliot and Thrash (2001) have even suggested that there might be situations/scenarios where individuals simultaneously adopt both approach and avoidance goals. This is likely to produce a great deal of conflict in the process of self-regulation because the individuals focus their attention on incompatible outcomes.

A factor that adds to the complexity of the results in discussing approach and avoidance performance goals is that in Dweck's original model (Dweck, 1986; Dweck & Legett, 1988), the links between performance goals and cognitive and achievement outcomes were assumed to be moderated by self-efficacy beliefs (Bandura, 1997). If students have high perceptions of their competence to complete a task, then performance goals

should not be detrimental for cognition, motivation and achievement (the behavioral pattern will be a mastery one), and these students should show the same basic behavioral pattern as mastery-oriented students. Students who have low self-efficacy and who are concerned with doing better than others or want to avoid looking incompetent will show the maladaptive pattern of cognition, motivation and behaviour (Dweck, 1986; Dweck & Leggett, 1988).

The pattern that seems to emerge from research is that mastery goals are not always related to performance or achievement in the classroom, usually measured by grades. In contrast, in some of the studies, approach performance goals (trying to be better than others) are associated with better grades (Elliot et al., 1999; Harackiewicz et al., 1998).

In fact the recent research on the role of performance goals has led some researchers to propose and develop a revised goal theory perspective (Elliot, 1997; Harackiewicz et al., 1998; Pintrich, 2000c). They have suggested that there is no simple dichotomy of mastery goals as good-adaptive versus performance goals as bad-maladaptive. Goals may be adaptive or maladaptive depending on what outcome (cognitive, motivational, affective or behavioural) is being considered. Mastery goals might lead to more interest and intrinsic motivation, but approach performance goals might lead to better performance (Harackiewicz et al., 1998). The main revision proposed is that approach performance goals may be adaptive for some outcomes. The revised perspective on goal theory, however, is in complete agreement with the normative perspective about the detrimental effects of avoidance performance goals.

Midgley, Kaplan and Middleton (2001) have, on the other hand, argued that there is no need to revise goal theory and that the basic assumption that mastery goals are adaptive

and performance goals are maladaptive is still the most valid (best) generalization from goal theory. They suggested that most research on the positive effects of approach performance goals are for special cases, such as for students high in self-efficacy (Dweck & Leggett, 1988), for students high in both mastery goals as well as approach performance goals (Pintrich, 2000c), or in contexts such as competitive college classrooms (Harackiewicz et al., 1998) in which there may be an advantage to adopting performance goals.

Changing Goal Orientation and Motivational Style

Motivation, according to Ames (1987), is the systematic, qualitative response which people make to various challenges and threats arising from situations in which success or failure is possible. If within a particular context, responses are systematic, as opposed to arbitrary or random, the notion of style is quite plausible (Galloway et al., 1998).

Based on the work of the main motivation theorists covered in this chapter, three motivational styles have already been identified: mastery orientation, learned helplessness and self-worth motivation. Dweck, Covington and Nicholls argue that the pattern of motivation displayed by an individual is a function of the beliefs and goals that the person adheres to at that time. The style of the individual will be subject to change as they move from one context to another. A set of beliefs that apply to one subject in class, with one teacher or even with one school, need not apply when the context changes. Such a view is optimistic since it suggests the possibility of teachers influencing or changing the motivational styles of those they teach. Classroom

structures could be changed or enhanced to suit this purpose; these structures will be discussed in the next chapter.

Ames' definition of motivation does not indicate whether style is a property of the learner, something which he or she brings to the situation and which determines the way they respond. Style therefore may be a function of personality and may, once established relatively early in life, become quite stable across different contexts. Style may be a function of the context itself. While a context may produce a mastery oriented response, those same students will not necessarily demonstrate the same positive style in less favorable contexts. Style may be the result of interactions between personal and situational interactions. Individuals bring with them orientations which might dispose them towards one style or another, but those orientations are subject to the influence of situational features.

When the classroom stresses a performance orientation, most students may adopt this orientation regardless of their initial level of a mastery orientation. In the absence of strong environmental cues, personal goal orientations may take precedence. In addition, there may be developmental differences such that younger primary school children may not have formed stable goal orientations and may therefore be more susceptible to the classroom context. On the other hand, older students in secondary schools who have formed more stable goal orientations are perhaps less likely to be influenced by the classroom context. The degree to which effective change is judged to be possible will depend largely on the extent to which informational and attributional patterns have become entrenched.

The Relevance of Motivational Theories in the Singapore Context

It is also appropriate to study the social and cultural context of learning in Singapore, a progressive society still steeped in Asian cultures and traditions. Children born into a particular society gradually acquire the beliefs, values and attitudes held by its members and use them to explain and interpret their world. Stevenson and others (Stevenson and Stigler, 1992; Azuma, Kashiwagi and Hess, 1981) found that Western children, teachers and parents emphasize innate abilities as an important component of success more strongly than their Chinese and Japanese counterparts do. All three cultures acknowledge that accomplishment cannot occur without effort, but differ in their beliefs about what people can achieve through work alone.

The strong emphasis on education in Singapore is reinforced by the importance which Confucian culture has traditionally placed in education. The emphasis on effort and the relative disregard for innate abilities are derived from Confucian philosophy. Confucius rejected the categorization of human beings as good or bad, and stressed the potential for improving moral conduct through the creation of favorable environmental conditions. His views was gradually extended to all aspects of human behaviour including learning. Human beings were considered to be malleable. Differences among individuals in innate abilities were recognized. But more important was the degree to which a person was willing to maximize these abilities through hard work. Lack of achievement is attributable to insufficient effort rather than to a lack of ability or to uncontrollable personal or environmental obstacles. There is a strong assumption that it is effort rather than innate ability which yields rewards in schooling.

Many have simply assumed that Asian cultural values and beliefs and practices are responsible for their academic achievements. According to Sue and Okazaki (1990) achievement patterns are influenced by many factors, and studies that examine the relation between cultural values and achievements may yield low correlations. These factors, however, may influence mediators of achievement such as motivation and effort. Sue and Okazaki (1990) proposed that cultural values are weakly related to achievement, inasmuch as cultural values are often too global, or distal to achievement. They posited that cultural values or socialization patterns affect a mediator (a more proximal variable such as effort or motivation), which is likely to show a stronger correlation with achievements. Education is increasingly functional as a means for social mobility and for obtaining lucrative jobs, and cultural values and practices can affect educational attainments. Sue and Kitano (1973) have found that many social scientists attribute the educational success of Asian Americans to cultural values that promote upward mobility – values that emphasized hard work, family cohesion, patience, and thrift.

Asian students who are confident that the time they invest in their learning will lead to mastery of the academic curriculum, work hard at their studies. Regardless of one's current level of performance, opportunities for advancement are always believed to be available through more effort.

Having said this, there is a concern in Singapore that the unwholesome aspects of westernization have led to the erosion of traditional Asian values. During the late 1980s the political leadership set themselves to revitalize Asian values. It was felt that the values of Singaporeans were being transformed as a result of daily exposure to external influences. It was believed that with increased acculturation to undesirable

western values, Asian values of hard work, discipline, and respect for education had eroded.

There was a belief that "there has been a clear shift in our values" (Goh, 1988 : 13-14) from communitarianism to individualism, especially among younger Singaporeans. The value-transformation of Singaporeans was viewed with concern by the government because it would affect the country's competitiveness, and hence the nation's prosperity and survival. Singapore wanted to preserve Singaporeans' core values of hard work, thrift and sacrifice and therefore formulated a set of shared values, a national ideology.

Some courses in moral education were also introduced into the schools. Although many Chinese classified themselves as following Buddhism or Taoism, in practice they observed a form of Confucianism transmitted informally (as part of primary socialization) from parents to children. Confucian ethics was introduced into all schools in 1984.

In their surveys of 1,407 students from Junior Colleges, the Institute of Technical Education and the Nanyang Technological University in 1995 and 1996, Chew et al. (1998) found that Singapore's youths believe strongly in the importance of education, including tertiary education. As high as 87.4% of the respondents believed strongly in education, and 75.5% believed strongly in tertiary education. Another Confucian value that had been imparted to the older generations of Singaporeans both at home and at school was the virtue of hard work. The survey found that this core value continued to be shared by young Singaporeans. The intensity of belief in hard work was rated at 5.05 (6.0 was the maximum); this high degree of intensity was explained by the fact that 75.1% of Singapore's youth believed strongly in hard work.

Singapore students who are confident that the time they invest in their learning will lead to mastery of the academic curriculum, work hard at their studies. Regardless of one's current level of performance, opportunities for advancement are always believed to be available through more effort. Good grades are interpreted as a sign of diligence. Low grades are not a sign of stupidity, but simply an indication that the student had not been concentrating in their work and had been lazy. The student has not yet learned what will ultimately be possible through persistence and hard work.

Within the incremental framework, effort is in the service of learning and growth. That is what is valued. However, for many parents and their children, learning and growth are secondary to getting the highest grades and getting into the best universities/schools. Dweck (2000) is therefore hesitant to extol the practices in some Asian cultures. Although the methods of classroom instruction are often impressive (Stigler, Lee & Stevenson, 1987), as is the emphasis on malleable intelligence and effort, Asian students are performance oriented. The achievement results are enviable. However, the emphasis on malleable intelligence and effort is often not accompanied by an emphasis on learning and the enjoyment of challenge. Instead, many students tend to experience negative aspects of coping like great anxiety over their grades and test scores, great pressure not to shame their families, and depression or humiliation over poor performance (Dweck, 2000; Grant & Dweck, 2001). This is quite a burden for a student to carry and is not consistent with the incremental theory and learning goal framework that Dweck has propounded.

Also, although persistence is a highly desirable tendency, there are times when persistence can be undesirable. If the task is really beyond the students' current skills

and no amount of effort and strategizing can bear fruit, persistence is undesirable. Dweck's (2000) view is that an incremental theory does encourage persistence, but it doesn't compel persistence. There is nothing in an incremental theory that prevents students from deciding that they lack the skills a problem requires. In fact, it allows students to give up without shame or fear that they are revealing a deep and abiding deficiency. An incremental theory, with its emphasis on learning over time, enables students to put something on hold until they have acquired the skills and knowledge to tackle it successfully.

Bandura (1997) believes that perceived self-efficacy is a better predictor of intellectual performance than cognitive skills alone. When successes are hard to come by, individuals of high efficacy persist and those of low efficacy rapidly quit (Bandura & Schunk, 1981). However, research on self-perceptions of competence among ethnic groups has found that such perceptions often are not linked to academic performance. Stigler, Smith and Mao (1985) found Chinese children rated themselves significantly lower on the cognitive subscales of Harter's (1982) Perceived Competence Scale for Children, yet academically these children outperformed the American students. Similarly, Whang and Hancock (1994) discovered Asian American students reported significantly lower self-concepts for mathematics ability compared with non-Asian students, even though their scores were higher on standardized mathematics achievement tests.

Research has shown that there is a trend for Singapore students to feel less efficacious about their course achievements than non-Asian students. In their study of Singapore and non-Asian Engineering and Teacher Education students, Smith and Chang (2000) found that modest Singapore students tended to be less efficacious about their course

achievements than non-Asian students. Their level of self-efficacy about their performance in the course they were studying was significantly lower than that of the Australian students. Perhaps they had underestimated their level of self-efficacy.

Eaton and Dembo (1997) found that Asian American 9th grade students outperformed their non-Asian peers on an achievement task, despite reporting lower levels of self-efficacy. They found that fear of failure better explained achievement motivation for Asian American students than did self-efficacy beliefs. Asian students relied less on their efficacy beliefs when they approached a learning task. Pleasing one's parents by achieving good academic results and not disappointing them by failing the task was a strong motivator to study (Hess, McDevitt and Chang, 1987). At the same time fear of failure drove many students to work hard to achieve their learning goals. Cross-cultural research therefore challenges Bandura's (1986) assumption that low appraisal of self-efficacy has deleterious consequences; such research provides evidence for the relative importance of the larger cultural and social context.

Asian American students illustrate the adaptive consequences of failure avoidance tendencies in contrast to success-approach tendencies. Atkinson (1964) explained achievement motivation as the tendency to approach success (need for achievement) or avoid tasks (fear of failure) as opposing forces with failure-avoidant behaviour resulting in negative academic outcomes. Covington (1992) viewed these propensities as interdependent constructs. It appears that Asian American students simultaneously possess a high need to approach success, because of the cultural value of educational achievement, and a strong need to avoid punishment, because of a fear of academic failure.

The valence dimension (Elliot & Thrash, 2001) of achievement goals comprises two separate categories: positive/desirable (approach) and negative/undesirable (avoidance). Clearly, individuals at times regulate themselves according to end states that they simultaneously construe as desirable and undesirable. There are situations/scenarios where there is simultaneous adoption of both approach and avoidance goals, with the approach goal focused on the positive, desirable aspects of the end state, and the avoidance goal focused on the negative, undesirable aspects of the end state. Perhaps this is how the concept of ambivalence (literally "both valences") should be conceptualized. This simultaneous adoption of approach and avoidance goals is likely to produce a great deal of conflict in the process of self-regulation, because individuals variously focus their attention on incompatible possibilities/outcomes.

Asians youngsters act in more success-oriented ways as evidenced by their greater tendency to attribute academic success to effort and failure to the lack of it (Hess, Chang & McDevitt, 1987). When failure occurs, they conclude that they have not tried hard enough or perhaps in the right ways (using the wrong strategies, techniques or approaches). This interpretation removes the threat from failure. Failure no longer implies incompetency but rather ignorance (simply not knowing or understanding), something that can be corrected by stepping up one's effort (Covington, 1998).

Conclusion

This chapter has explored how different motivational beliefs can facilitate or constrain cognition and learning in educational environments. It is clear from the review of the literature on motivational theories that mastery goals are related to an adaptive motivational style and positive student outcomes. Students who adopt a mastery goal

and who focus on learning, understanding, and self-improvement are more likely to use adaptive cognitive and self-regulatory strategies and to be deeply engaged in learning. Student goal orientation is affected by classroom environment or context. The classroom context may encourage students to adopt mastery goals, performance goals, or a combination of both types of goals. Accordingly, classroom contexts that foster the adoption of mastery goals by students should facilitate motivation and learning. Whether the adoption of a collaborative learning strategy can change students' maladaptive motivational patterns to adaptive ones is something that will be investigated in this research project. The role of various classroom contextual features and how they shape the development of student motivation will be discussed in the next chapter.

Chapter 3

Constructivism, Cooperative Learning and Motivation

Introduction

Classroom structures can make different types of achievement goals salient and consequently affect how students think about themselves, their tasks and others (Ames and Ames, 1984). Different goals elicit qualitatively different patterns of motivation (Ames, 1992c). Task, evaluation and recognition, and authority dimensions of classrooms are examples of structures that can influence the learner's orientation toward different achievement goals. Ames (1992c) argued for the identification of classroom structures that can contribute to a mastery orientation. These structures relate to each other and interventions to influence student motivation must address the interdependency among these structures. Different classroom structures are theoretically related to different goals. They are manipulable by teachers and can be designed to achieve desired goals.

There is enough research evidence in the literature (as can be seen in the previous chapter) to suggest that it is a mastery goal orientation that promotes a motivational pattern likely to promote long term and high quality involvement in learning. Although the particular goal a student adopts may be influenced by certain prior experiences, achievement history (Wentzel, 1991), or parents' goals and beliefs (Ames & Archer, 1987), Ames (1992c) is of the view that classroom structures can influence the salience of a particular goal and hence its adoption. These are important considerations because

they contribute to our understanding of the ways in which achievement orientations develop and change, and because they can contribute to good teaching/classroom practice.

Constructivist theories of learning and instruction have made significant contributions to motivation theory. Research on motivation has gained from the consideration of constructivist frameworks about learning and instruction (e.g. Brown, Collins & Duguid, 1989; Resnick, 1987). The two areas of research, goal theory and constructivism, have developed independently but have much to offer each other (Blumenfeld, 1992). A blending of the different views has added to theory, helped clarify constructs, and sharpened the focus of research in both motivation and learning. This chapter will first look at constructivist ideas and especially the cognitive perspective that interactions among students will in themselves increase student achievement. It will then consider the features of constructivist learning environments in which cooperative learning approaches are emphasized. The instructional guidelines and classroom structures that motivation researchers have proposed will then be presented to see how much constructivist theory has contributed to the design of classroom structures and practices proposed by achievement motivation researchers. A discussion on cooperative learning, its essential elements and its benefits in motivation and learning will be provided. The current research findings on cooperative learning in the literature on motivation will also be presented.

Constructivist Learning Theories

Although innovative ideas on teaching and learning have been progressively introduced over the past few decades, traditional views have been difficult to change. Such views

often consider students as "empty vessels" waiting to be filled with knowledge. Students are now learners who come to the classroom with their unique backgrounds, experience, conceptual understanding, learning styles and personal circumstances. Teachers now become learning facilitators rather than reservoirs of knowledge. The last few decades have seen theories of learning shift from behaviorism to cognitivism to constructivism.

The guiding principle of constructivist learning theories is the learner's own active initiative and control in learning, and personal knowledge construction, i.e. the self-regulation of learning. The student does not passively take in knowledge, but actively constructs it on the basis of his/her prior knowledge and experiences (Piaget, 1972). From the pedagogical point of view, the learner's learning activities should be directed at examining his own prior conceptions and relating it to the new knowledge. The learning environment should provide the learner with opportunities to test and try out his new conceptual understanding in various applied circumstances like problem solving. Constructivism can therefore be contrasted with objectivism, the traditional view that knowledge is an external entity with an absolute value which can be transferred from teacher to learner (CTGV, 1993; Duffy and Jonassen, 1992; Clayden et al., 1994).

It was Vygotsky (1978) who pioneered a sociocultural approach to understanding cognitive processes in childhood development. Instead of focusing his research on uncovering the dynamics of mental activity in a person, he studied how social and cultural interactions were critical to cognitive functions. By highlighting the effects of social interactions on cognitive development, Vygotsky revealed a critical role that external activities play in sparking internal mental constructions.

Vygotsky's (1978) *Zone of Proximal Development* (ZPD) emphasises his belief that learning is fundamentally a socially mediated activity. This zone is defined as the distance between a child's "actual developmental level as determined by independent problem solving" and the higher level of "potential development as determined through problem solving" under adult guidance or in cooperation with more capable peers (Vygotsky, 1978: 86). Vygotsky argued that instruction should be tied more closely to the level of potential development than to the level of actual development.

The recent ideas on situated learning (Brown, Collins & Duguid, 1989) have inspired researchers to consider the significance of the environment as a motivating factor. The research based on the sociocultural tradition (Lave and Wenger, 1991; Rogoff, 1990) has criticised the fact that knowledge and skills learned in school are not directly, as such, applicable to situations outside school. Instead they propose learning should take place in authentic and complex social contexts.

The academic usage of the word constructionism expands on the concept of constructivism (Shaw, 1996). Constructionists claim that learners construct knowledge most naturally and completely while they are constructing some artifacts. Constructionism therefore differs from constructivism in that "it looks more closely .... at the idea of mental construction. It attaches special importance to the role of constructions in the world as a support for those in the head, thereby becoming less of a purely mentalist doctrine" (Papert, 1993: 143). Thus constructionism involves two intertwined types of construction: the construction of knowledge in the context of building personally meaningful artifacts (Kafai & Resnick, 1996).

Constructionism places a critical emphasis on particular constructions of the learner that are external and shareable (Papert, 1990). Constructionism highlights the notion that through the construction of shared outcomes and artifacts, a learner engages in a developmental cycle in the social setting. Constructionism offers an important bridge for the sociocultural and constructivist viewpoints by arguing that individual development cycles are enhanced by shared constructive activities in the social setting. Social constructionism shows the interplay of sociocultural and constructivist views by revealing that the social setting is also enhanced by the developmental activity of the individual (Shaw, 1996).

Incorporating Ideas from Constructivism into Motivation Theory

It can be seen that at the very broad level, the two theories (motivational theory discussed in Chapter 2, and constructivism) differ in assumptions about how classrooms influence student motivation. Essentially goal theory posits that if teaching practices and structures minimize the focus on ability, students will be active learners willing to exert effort and become more cognitively engaged. Constructivist theory assumes that when teachers stress meaningful learning and scaffold instruction, students will be motivated to reconsider their own understanding, meld prior knowledge and experience with new learning, and develop rich knowledge and thinking strategies to apply to real-world problems. Motivation comes from attempts to complete authentic tasks, social interaction, personal dissatisfaction with current conceptions, and recognition of the superior explanatory power of new ideas. Ability perceptions and other individual differences central to goal theory are absent from constructivist theory.

It is probably fair to say that many constructivist ideas are implicit in goal theory formulations. For instance, goal theory posits that learning is enhanced when students perceive the classroom as stressing mastery orientations rather than performance. Constructivist ideas about learning, the role of meaningful tasks, and the role of instruction are somewhat different from, but not incompatible with those in goal theory. However, the definition of learning is not well developed in goal theory as it is in constructivist approaches.

Constructivist theories of learning and instruction have made significant contributions to motivation theory. Constructivist theory has offered motivation researchers insight into ideas about tasks, meaning and support (Ames, 1992c). In constructivist theory, meaningfulness comes from working with others on authentic tasks. By definition, authentic tasks require students to use tools and practice self-regulation, and are diverse and challenging. Authentic tasks also necessitate that students represent and apply knowledge in ways that are responsive to and transfer across situations. Under these circumstances, instructional support involves scaffolding, coaching, and modeling. The teacher becomes a facilitator who relinquishes considerable control to learners.

Constructivist theory can add to goal theory's assumption about the processes of developing an environment that is perceived to be mastery oriented by students. Marshall has noted that one limitation of current motivation research is that "these traditions look at the social context of learning as a background factor rather than recognizing the complex interactions among participants that occur in the construction of shared goals and meanings of learning" (1992: 22). Constructivist approaches provide insight into how features of task, authority and evaluation are built through dynamic interactions among participants in classrooms.

Motivation researchers could also add to the teaching-for-understanding literature by investigating ways to design and implement classroom tasks that are real and conceptually rich enough that, in seeking answers and representing their understanding, students gain understanding of significant subject-matter concepts but that are not so difficult in content or execution that the tasks overwhelm the novices, make them feel incompetent or fail to sustain cognitive engagement over time (Blumenfeld, 1992; Blumenfeld et al., 1991).

Classroom Structures and Achievement Goals

The classroom learning environment should be changed to enhance the probability that students will adopt a mastery goal orientation. To design such an intervention the structures need to be identified and described with respect to how they can be modified to reflect a mastery orientation. In this respect, the literature on achievement motivation and learning environments offers many principles and strategies that are conceptually consistent with a mastery goal orientation and that when mapped on to classroom structures, could contribute to the definition and design of a mastery-oriented classroom (Ames, 1992a, 1992c; Brophy, 1987).

The literature on constructivist learning environments provides an indication of what rich and meaningful environments are. Johnassen, et al. (1995) suggest focusing on four general systems attributes: context, construction, collaboration and conversation. Grabinger and Dunlap's (1995) "rich environment for learning" is characterised by: authentic assessment; student responsibility and initiative; generative learning strategies; authentic learning contexts; and co-operative support. To Jonassen, Peck and

Wilson (1999), learning should also be meaningful. Meaningful learning has to be: (a) active, (b) constructive, (c) intentional, (d) authentic, and (e) cooperative.

Covington (1998), like other motivation researchers, has come up with his set of instructional guidelines which essentially are ways to encourage what he called egalitarian goals and to achieve motivational equity. Like other motivational researchers, Covington's prescription include: providing engaging assignments, rewarding positive reasons for learning, putting students in control, promoting positive beliefs about ability, and improving teacher-student relationship. Two sources of motivational equity are mastery learning and cooperative learning (Covington, 1998). Pintrich and Schunk (2002) have offered strategies that will help teachers to facilitate the adoption of mastery goals. These include : focusing on meaningful aspects of learning activities; designing tasks for novelty, variety, diversity and interest; designing task that are challenging but reasonable in terms of students' capabilities; providing opportunities for students to have some choice and control over the activities; focusing on individual improvement, learning, progress and mastery; striving to make evaluation private, not public; recognizing students effort; helping students see mistakes as opportunities for learning; using heterogeneous cooperative groups to foster peer interaction; focusing on individual improvement and progress; adjusting time on task requirements for students having trouble to completing work; and allowing students to plan work schedules and time lines for progress.

Epstein (1989) has identified six dimensions of classrooms structures that affect motivation and that are modifiable : task design, distribution of authority, recognition of students, grouping arrangements, evaluation practices, and time allocation. The acronym TARGET has been used to represent these dimensions. Ames (1992c) and

Maehr and Midgley (1996) have used some of these dimensions to summarize research on how classroom characteristics or structures can influence the adoption of different goals. Ames (1992c) pointed out the structures that have been found to impact on a range of motivational variables, especially how students view their ability and the degree to which ability becomes an evaluative dimension of the classroom. Newton (2000) has proposed that in designing such classroom structures, "a triad of motivational concerns" should be considered. These are in fact the three general motivational components (expectancy, value and emotions) which are found in the different motivational models covered in Chapter 2.

It is evident that most, if not all, researchers have recommended collaborative work groups and activities as a classroom structure with the potential to enhance the probability that students will adopt a mastery goal orientation. It is especially useful for low achievers and allows them to assume more responsibility for their learning. Besides using small groups, the overall classroom culture can be designed to foster a "community of learners" where the emphasis in the classroom as a whole (or even the school as a whole) is on learning together. This type of classroom culture would include norms and expectations about collaboration among students and teachers as well as structures that foster collaboration (Brophy, 1998), and should foster the adoption of mastery goals and a focus on learning (Maehr & Midgley, 1996).

The goal orientation experienced by students in the classroom can be shaped by specific structures or dimensions. The salience of specific goals in classroom structures can orient students toward qualitatively different patterns of motivational responses. Classroom structures are interdependent, which argues for an integrative approach to the study of classroom environment (Marshall & Weinstein, 1984). However, the issue

of exactly how these structures relate to each other remains. If structures operate in a multiplicative (instead of additive or complementary) manner, they cannot compensate for each other.

The impact of mastery-oriented structures on students motivation may be enhanced or even subverted by school policies and programmes that, for example, make performance salient, attempt to exert considerable external control over behaviour, or encourage social comparison. Changing classroom structures may also require changing teachers' goals for students' learning, belief systems or broader views about school learning (Johnnasen, 2001). In considering approaches to motivation enhancement, it is important to note that motivation is too often equated with quantitative changes in behaviour (see Sharan and Shaulov, 1990) rather than with qualitative changes in the ways students view themselves in relation to the task, engage in the process of learning, and then respond to the learning activities and situations.

Research Perspectives on Cooperative Learning

Slavin (1989, 1992, 1995) identified motivationalist, social cohesion, cognitive-development and cognitive-elaboration as the four major theoretical perspectives on the positive effects of cooperative learning. From a strictly motivational perspective (Johnson & Johnson, 1992; Slavin, 1983a, 1983b, 1995), cooperative incentive structures create a situation in which the only way group members can attain their own personal goals is if the group is successful. Therefore to meet their personal goals, group members must both help their group mates to do whatever enables the group to succeed, and perhaps even more important, encourage their group mates to exert maximum effort.

When students work together toward a common goal, they may be motivated to express norms favouring academic achievement, to reinforce one another for academic effort. Motivation theorists therefore build group rewards into their cooperative learning methods. The theoretical rationale for these group rewards is that if students value the success of the group, they will encourage and help one another to achieve.

The use of group goals or group rewards enhances the achievement outcomes of cooperative learning if and only if group rewards are based on the individual learning of all group members (Slavin, 1995). The only way the team can succeed is to ensure that all team members have learned, so team members' activities focus on explaining concepts to one another, helping one another practise, and encouraging one another to achieve. If group rewards are given based on a single group product, there appears to be little incentive for group members to explain concepts to one another, and one or two members may do all the work (see Slavin, 1995) unless individual team members can account for contributions made and can demonstrate understanding of the work done.

The social cohesion perspective holds that the effects of cooperative learning on achievement are strongly mediated by group cohesiveness. The quality of a group's interactions is thought to be largely determined by group cohesion. Students will engage in a task and help one another learn because they identify with the group and want one another to succeed. This view is different from the motivational theorists' who hold that students help their group members learn because it is in their own interests to do so.

A distinctive feature of the social cohesion perspective is the emphasis on team-building activities in preparation for cooperative learning. The effects of cooperative learning on students and on students achievement depend substantially on the quality of the group's level of cohesion and interaction (Battisch et al., 1993). Cohen's view is that "if the task is challenging and interesting, and if students are sufficiently prepared for skills in group process, students will experience the process of group work itself as highly rewarding..." (1986 : 69-70). He added that teachers should never grade or evaluate students on their individual contributions to the group product. Social cohesion theorists have tended to downplay or reject group incentives and individual accountability held by motivationalist researchers to be essential.

Interdependence among group members has to be created and this can be done through role/task specialization among group members. The idea is that if students value their group mates, as a result of team building and other cohesiveness building activities, and are dependent on one another, they are likely to encourage and help one another succeed. Johnson and Johnson's (1989, 1994, 1999) work straddles the social cohesion and motivation perspectives. Their methods do use group goals and individual accountability and these are considered means to the development of social interdependence (group cohesion). Their prescriptive writings also emphasize team building, group self-evaluation and other means for developing social cohesion.

While the motivation and social cohesion perspectives on cooperative learning focus on group norms and interpersonal influence, the cognitive perspective holds that interactions among students will in themselves increase student achievement for reasons that have to do with mental processing of information. They involve neither group goals nor the building of group cohesiveness. There are two cognitive

perspectives : a developmental perspective and a cognitive elaboration perspective. The fundamental assumption of the developmental perspective on cooperative learning is that interaction among learners around appropriate tasks increases their mastery of critical concepts.

Constructivists' view on cooperation and collaborative learning is that interaction among learners around appropriately designed learning tasks increases their mastery of the subject (Piaget, 1926; Vygotsky, 1978). Constructivism and especially social constructivism stress the social nature of learning. Peer collaboration is integral to the learning process and to the accomplishment of authentic tasks. Students construct their knowledge and understanding through actively participating in a community of learners, and peers are seen as sources of information and "scaffolds" rather than as a threat to one's self-worth (Resnick, 1987). Such sharing is not likely to occur profitably in a performance-oriented environment in which ability, competition and comparison predominate (Blumenfeld, 1992). Completing authentic and meaningful tasks like the development of large software systems often requires several people to work together and to coordinate their effort over a reasonable stretch of time. Another benefit of working and learning in groups is that collaboratively generated solutions to problems are often superior to individually generated ones (Sharan, 1980).

On the basis of these and other findings, many constructivists (e.g Damon, 1984; Murray, 1982; Wadsworth, 1984) have called for an increased use of cooperative activities in schools. They argue that interaction among students on learning tasks will lead in itself to improved students achievement. Opportunities for students to discuss, to argue, and to present and hear one another's viewpoints are the critical element of cooperative learning with respect to student achievement. The cognitive processes

described by developmental theorists are important mediating variables that can help explain the positive outcomes of effective cooperative learning methods (Slavin, 1987, 1995, 2003).

From the development perspective, the effects of cooperative learning on student achievement would be largely or entirely due to the use of cooperative tasks. Damon rejected the use of "extrinsic incentives as part of the group learning situation" arguing that "there is no compelling reason to believe that such inducements are an important ingredient in peer learning." (1984: 337).

Research in cognitive psychology has long held that if information is to be retained in memory and related to information already in memory, the learner must engage in some sort of cognitive restructuring, or elaboration, of the material (Wittrock, 1986). One of the most effective means of elaboration is explaining the material to someone else. This is the cognitive elaboration perspective. Research on peer tutoring has long found achievement benefits for the tutor as well as the tutee (Topping, 1988). Another approach is the use of peer response groups where students evaluate their peers' work and become better themselves. This is a variant of cognitive elaboration explanation (Graves, 1983). However, students who could gain the most from such cooperative activities are those who provide elaborated explanations to others (Webb, 1989, 1992).

Motivational Processes of Cooperative Learning Situations

Aside from the compelling and pragmatic goal of enhancing simple academic achievements, another important justification for the widespread use of cooperation learning techniques in education is that they have been associated with a number of

affective, non-achievement effects. These include increases (or improvements) in all of the following areas: intrinsic motivation, epistemic curiosity, continuing motivation, commitment to educational attainment, time on task, and persistence, willingness to take on difficult tasks, long-term retention, creative problem solving, self-esteem, and even emotional intelligence.

The positive interdependence found in cooperative learning situations results in promotive interaction among individuals. Promotive interaction is characterized by giving and receiving help, being encouraged and encouraging others to achieve, and positive interpersonal interaction. These interaction patterns influence the motivation of students to achieve academically (Johnson & Johnson, 1985).

Assessment of ability within a team are based on perceptions of directly relevant abilities (such as computer programming) and related abilities required for coordination of efforts and organization of the joint work. There is multi-dimensional view of one's own and others' competencies. Even when their task performances are markedly discrepant, members view themselves and their collaborators as being similar in overall ability and equally deserving of reward (Ames & Felker, 1979; Ames & McKelvie, 1982). This is often reflected in the self assessment and peer assessment reports submitted by the students.

Carol Ames (1981) in one of her studies found that under conditions of cooperative success, the high-performing member of each team evaluated both his own ability and that of their less productive team member as essentially the same and most importantly believed both to be equally deserving of the reward. Abi Harris and Martin Covington (1989; 1993) were able to confirm these positive findings in a study using a similar

methodology. Their study showed that low performing members of the successful teams have a positive view of their own ability; their rating of their own ability was even higher than the personal ability rating of those who succeeded by winning over others in competitive learning. Moreover, these low-performing students from successful teams believed themselves more worthy of a reward.

Cooperation appears to be able to create a climate for perceived similarity where peers (and superiors) are less likely to translate performance differences into ability differences (Ames, 1981). Low performing group members feel satisfied with their level of performance as high performers are. They view themselves (and are viewed by their group members) as competent group members who have contributed to the accomplishment of the group's goals. Group members share responsibility for the outcome or product such that the probability of success of one individual is increased by the presence of capable others.

Within cooperative situations, success is partially attributed to the joint abilities of members of their group. There is evidence that in cooperative situations individuals tend to attribute their performance to ability (Bird, Foster & Maruyama, 1980; Roberts, 1978) and they attribute as high and even higher ability to their collaborators as to themselves (Bird & Brame, 1978; Roberts, 1975). While cooperators have a very accurate perception of each other's abilities directly-related to the task at hand, they also have a very accurate perception of other related abilities that each member brings to the group effort.

Collaborative Learning : Issues and Concerns

Indeed if cooperative learning strategies are so effective in motivating students to achieve, one would wonder why it is still not being widely adopted in all classrooms. Although there is a fair consensus among researchers about the positive effects of cooperative learning on student achievement, as well as a growing number of educators using cooperative learning in all levels and in many subject areas, there remains much confusion and even controversy, about why and how cooperative methods affect motivation and, most importantly, under what conditions cooperative learning has these effects.

It can be seen in the different theoretical perspectives discussed earlier that different groups of researchers investigating cooperative learning effects on achievements begin with different assumptions. They conclude by explaining the achievement effects of cooperative learning in terms that are substantially unrelated or contradictory. Each perspective tends to approach the topic without reference to the body of similar work from other perspectives and without attending to the larger picture.

The disagreements among cooperative learning perspectives could have resulted in the problems of confusion, skepticism, and divergent expectations among policy makers, administrators, practitioners and the general public. Most researchers, authors and even journal editors have a strong tendency only to publish positive results of cooperative learning. Recent reviews note that research focused on outcomes report very different findings from those focused on processes. The latter report potentially serious problems and identify the factors that influence their occurrences (Good, Mulryan and McCaslin, 1992; Webb & Palincsar, 1996). Adding cooperative work to classroom

instruction is very difficult and teachers need to have clear purposes when using group work. They need to be aware of some of the many limitations and considerations in order to make group activities successful.

One of the most compelling and pragmatic reason for the use of cooperative learning techniques is the enhancement of academic achievement. This is the result that policy makers, school administrators, parents and even students want to see. In fact seeing students getting good grades appear to be more important than the host of positive affective, non-achievement effects like willingness to take on challenges; long-term retention; higher order thinking; creative problem solving; understanding of concepts; positive attitudes towards school and schoolwork; self-esteem; and emotional intelligence. Teams can fail to achieve their grade goals, whether these were imposed on them or set by themselves. As Ames (1981) has shown, when cooperative groups fail, there is a tendency to fix blame, and the weaker group members typically receive the blame. This situation magnifies the perception of ability differences, and adversely affects self-efficacy and overall motivation to achieve amongst weaker group members.

Also, placing students in groups does not mean that they will cooperate. In most classrooms, students are used to working individually, being rewarded for individual excellence in performance, and competing with each other for high grades. There is considerable and disturbing evidence that students often do not behave pro-socially when working in groups. One problem is failure to contribute. It has been reported that when groups create a single product and receive one grade, students sometimes do not do their fair share. They try to get a free ride or engage in social loafing. Those who do

most of the work feel exploited and reduce their efforts or work on their own (Blumenfeld, 1996).

Some students may dominate discussions, pressure others to accept their perspective or force their conclusions and views on others in the group. Others may ridicule and exclude group members or discount their contributions. Rejected members are likely to be humiliated and withdrawn. Managing interpersonal relations often detracts from learning. The promotion of positive group norms requires pre-training for cooperation, including listening and resolving conflicts, teaching students to appreciate the skills and abilities of others, and using rewards that promote interdependency.

Appropriate interpersonal and specific team-working skills and strategies should be taught and employed (Cohen, 1986). Students should be taught the skills in group process for effective collaboration and be motivated to use them. Ashman and Gillies (1997) found that those trained in cooperative skills were consistently more helpful and collaborative. There is evidence to suggest that a combination of group rewards and skills training produces much better outcomes than does either alone (Fantuzzo et al., 1992; Slavin et al., 2003). Cohen stated that "if the task is challenging and interesting, and if students are sufficiently prepared for skills in group processes, students will experience the process of group work itself as highly rewarding ..." (1986 : 69).

Tasks influence student interactions and the opportunities for learning that result. Students will benefit when they share ideas, accommodate others' perspectives, and give and receive help. This is likely to occur when tasks entail problem solving and involve more than one right answer or approach. Such desirable interchanges are uncommon and Palinscar, Anderson and David (1993) have shown that students need

considerable assistance in the process of argumentation. They need to know how to discuss, explain, provide elaborated responses and offer justifications for their reasoning. Also, complex tasks require considerable skills to plan, coordinate, monitor, and to evaluate progress. Students need to be equipped with such skills.

Giving and seeking help are central to learning in groups. The help must be timely, elaborated, comprehensible, cogent, and must be correct to avoid reinforcing misconceptions. Students may not know how to help effectively and may require training to learn how to elaborate their thinking and craft good explanations. Students may not be aware that they need help nor seek it when needed. They might not know how to ask questions that identify their problem, nor they may be unable to make use of the help they receive. More troubling are those students who remain silent or withdrawn because they believe that needing and seeking help indicates that they are incompetent (Nelson-LeGall, 1985) and would avoid seeking help (Butler, 1998; Ryan et al., 2001).

In his attributional analysis of helping behaviour, Weiner (1995) assumes that after a person has perceived the individual's need for help, the person asks why the individual has got into trouble. Weiner assumes that persons are disposed to help an individual if the cause if his/her need for help is perceived to be uncontrollable. Help is denied if the individual possesses control over the reason for his/her need for help.

Weiner (1995) had established that individuals who attribute another person's weak performance to lack of effort (or more generally to controllable causes) tend to blame the other person, to refuse help, and to experience anger towards this person. In contrast, if failure to perform is attributed to low ability (i.e. uncontrollable causes) the

person is not blamed, he receives help, and others will feel sympathy (rather than anger) towards this person. To help an individual who is in trouble may contain unintended indirect communications about ability. Persons who receive unsought help (or special attention) when attempting a task (e.g. to solve a problem) feel that they are regarded by the helper as possessing less ability than individuals who receive no help in the same situation (Meyer, 1982, 1992).

There must be individual accountability for increased understanding and mastering new skills. The purpose of instruction is to maximize the learning of each individual student. Feedback mechanisms for determining the level of each student's learning are necessary for students to provide support and assistance to each other. The importance of group goals and individual accountability is in providing students with an incentive to help each other and to encourage each other to put in maximum effort (Slavin, 1995). Without individual accountability, one or two students in the group may do all the work, while others engage in free-riding and social loafing (Williams, Harkins & Latane, 1979, 1981).

In order for the learning situation to be cooperative, students must perceive that they are positively interdependent with other members of their learning group. Positive interdependence has numerous effects on students' motivation and learning. The efforts of all group members are needed for group success. When members of the learning group see their efforts as dispensable for the group's success, they may reduce their efforts. Only when goal, task, resource and role interdependence are clearly understood will students realize that their efforts are required in order for the group to succeed (i.e. there can be no free riders) and that their contributions are often unique. Also, unless

tasks and rewards are interdependent, high performers in the groups may view interactions as wasteful and unnecessary.

Ironically it is this source of performance superiority – the interdependence of team members – that also represents the greatest potential danger inherent in teamwork. Weaker students may fear reprisals from more able team members, despite having done their best. More able and ego-involved students may be driven to help those less able more out of self interest than for the sake of the team (Covington, 1992).

To have meaningful face-to-face interaction, the size of the group needs to be small (from 2 to 6 members). A perception that one's participation and effort are needed increases as the size of the group decreases. As the size of the group increases, the amount of pressure peers may place on unmotivated group members increases (Asch, 1951; Festinger, 1950). For larger groups, more time and effort are needed for communication and co-ordination. Large projects will require the formation of many sub-groups.

Blumenfeld's (1996) view is that generally groups are more successful when members are drawn from high and middle or middle and low achievement levels or where students are all in the middle. When three levels are included, middle students benefit less because they are less likely to be the ones to give explanations. One study did find that while low-ability students achieved most in mixed-ability groups, high-ability students achieved most in homogeneous groups (Hooper & Hannafin, 1991). In mixed ability teams, high achievers could be held back by having to explain materials to their low-achieving group members.

However, it could be possible to argue that because students who give elaborated explanations typically learn more than those who receive them (Webb, 1992), high achievers should be the ones to benefit most. Low performers are sometimes stigmatized in heterogeneous-ability groups. High performers may dominate discussion; low performers may lack the necessary skills to interpret and carry on with the assigned tasks. When speed is important, more able students may even take over if they resent students who slow down work.

In the literature, relatively little attention has been paid to failures in team working. Proponents of cooperative learning tend to ignore the possibilities of failure. Indeed teams can fail and failure can take a variety of forms. It can refer to the team's failure to complete the project on time; the inability to solve a collective problem; the project not meeting the minimum criteria/standard required or even not getting the grade they aimed for.

Results of Harris and Covington's study their study (1993) indicated that regardless of reward contingencies, success or failure played a critical role in perception of individual differences. Success raised students' perception of their team-mates abilities. Failure was associated with indicators of a threat to self-worth for both high and low performers (i.e. lower perceptions of ability by team members).

From a self-worth perspective, members of a failing team may be placed in double jeopardy. Team failure not only implies that the low performer is incompetent, thereby arousing shame, but irresponsible as well, thereby eliciting feelings of guilt (Ames, 1981; Ames & Felker, 1979). Harris and Covington (1993) were able to replicate the results of Ames's work in their investigation to support the hypothesis that low

performers in cooperative failure would be in double jeopardy. However, they also reported that this happened only when the reward structure (or criterion) was based on actual achievement rather than on self-improvement.

Harris and Covington (1993) raised the question of whether past findings on the positive effects of using cooperative reward structure were a consequence of the reward structure per se or of the higher probability of success for low performers working cooperatively in teams. The negative effects of cooperative failure may be offset by the increased likelihood of success afforded by the use of a cooperative learning strategies. However, without the use of a cooperative reward structure, low performers stand little chance of being among the successful. The chances of success for low performers are greatly increased if their success is based on (personal) improvement or they are teamed with high performers.

Teachers need to make many decisions about how to promote group norms, help students develop skills and habits to learn with peers, design and select tasks and group students in a way that promotes learning, determine ways to hold students accountable, and above all be fully aware of the motivational process of teamwork and the consequences of failure. Collaborative learning is therefore not easy to implement and does require teachers to be facilitative, and to ensure that collaboration is meaningful and successful.

Cooperative Learning in Higher Education in Singapore

Owens (1983) reported that students with a positive social orientation toward cooperation with peers in the learning process, such as willingness to share information

sources, to share ideas with others and to make decisions collectively preferred cooperative learning more than those who expressed a competitive social orientation. Studies have also shown that besides personal orientation, those from certain ethnic-cultural backgrounds (Asians, for example) also have a more cooperative orientation (Kagan, Zahn and Gealy, 1977; Kagan et al., 1985; Stevenson & Stigler, 1992). The Asian collectivist cultures which tend to be group-oriented and place very high value on human relationships and the preservation of group harmony have already been introduced in Chapter 2.

Students with a more cooperative orientation toward working with peers and who work in a cooperative learning environment are likely to display greater motivation to learn and will achieve more academically than pupils with a less cooperative orientation (Sharan and Shaulov, 1990). This also means that not all students are inclined to cooperate with their peers on learning tasks, especially those who are too ego-involved. However, Sharan and Shaulov (1990) found in their study that all students benefited from working in groups, even those whose expressed social orientation was not directed toward cooperation with peers. The cooperative reward structure will also make students more mastery oriented and motivated to achieve.

Singapore has a strong education system, one that is widely recognised for having produced generally high levels of academic achievements among students at all levels. However, there has been a concern among the political leaders with regards to the kinds of students produced by the educational system in Singapore. The general perception is that the system was producing students who were muggers rather than thinkers. The increasing number of students scoring distinctions at the "O" and "A" level examinations indicated that the students were only "exam smart", extrinsically

motivated by grades, and who relied heavily on teachers' notes and home tutors. While a small number of Singapore's top students have participated in international competitions and have succeeded, there are also many more students who are lagging behind in the schools. Gardner has lamented that "successful" students, in spite of their high grades and accolades from their teachers, "typically do not display an adequate understanding of the material and concepts with which they have been working" (1991: 3).

In Singapore, the very bright and academically inclined students will join the Junior Colleges after their "O' level examinations. These colleges prepare students to sit for the "A" level examinations and to join the local universities later. Students who join the polytechnics are those who prefer practice-oriented courses or who are unable to get a place in the Junior colleges. They are generally considered as the less academically bright. When a polytechnic student picks a course to study, he typically chooses one with good market value. The polytechnics prepare them for jobs in engineering, IT and business. In fact the employment rates of their graduates are used as a measure of their effectiveness. The Junior colleges, on the other hand, are measured by the number of their students who can get a place in the university.

Although the local polytechnics are supposed to be providing training and hands-on approaches, lectures and tutorials dominated by "talk and chalk" still persist. Many lecturers have remarked negatively about their experience of asking students to work on learning tasks in groups during and outside classes. Lecturers often interpret the difficulties they experience as evidence of resistance to more constructivist approaches on the part of students in Singapore (Ball, 1995). This perceived resistance is attributed to a variety of sources. Students who have made it to higher education have been

successful in a very competitive educational system in Singapore. They are unwilling to share and cooperate with peers. Frustrations with using group work have also been attributed to the perceived shyness or modesty of many local students, resulting in low levels of involvement and participation.

Resistance to group work is also attributed to the passive and surface learning approaches to learning thought to characterize many Asian students. They prefer to hear everything they need to know from their lecturers or tutors, rather than spending time in discussion and learning with their classmates. Some lecturers also perceived students as simply unwilling to take group work seriously and treat group work like a game that they have been forced to participate in. A result of these attributions is the persistent use of lectures and tutorials for instruction in local higher education.

There is a tendency among lecturers to attribute the source of difficulties when students work in groups to polytechnic students' characteristics (Ball, 1995). This prevents them from modifying their approaches to group work in ways that might produce more satisfying outcomes.

For students working individually on a task, the outcome (whether they succeed or fail) will affect only themselves. For those working in a team, the outcome has ramifications not only for the individual but for all team members. If one feels a sense of responsibility to a group for one's performance then even effort-oriented Asian students can no longer avoid focusing on the importance of a single outcome. According to Triandis (1989), people are likely to act from a collective sense of self not only when they are in interdependent collectivistic cultures but also when an individual shares a "common fate" with other members of his group.

Grant and Dweck (2001) reported on the findings of their study in which they used this idea of "common fate" to create a sense of responsibility in students for their group's failure, and hence a heightened focus on the importance of a single outcome. They found that performance-oriented Asian students (regardless of whether they focused on effort or ability) expressed feelings of anxiousness, embarrassment, guilt and humiliation. These students also indicated that others in the group would be contemptuous, disapproving, disappointed, and punitive toward them.

In another study, Grant and Dweck (2001) found that effort-focused Asian students working in groups were less efficient than those working individually and they believe that it might be the anxiety-provoking implications of responsibility to others that actually interfered with performance. When one's own failure has repercussions for others as well as oneself, and leads to a performance goal rather than a learning goal orientation, the persistence and high efficacy characteristic of an effort-orientation are expected to be accompanied by negative affect (guilt, embarrassment, anxiety) and self-reproach. The results of their study suggest that these Asian students experienced a kind of hybrid of the master-oriented and helpless patterns of responding to failure. These students demonstrated the persistence characteristic of mastery-orientation, and the negative self-evaluation and affect of helplessness.

Grant and Dweck (2001) also argued that self-handicapping would not work in a group context. If a group were dependent on a student's performance, he might not try to arrange for effort attributions so that others in the group would think he failed them because of lack of effort. The fact that effort is within his control makes it, in some ways, more deserving of criticism to withhold effort than to lack ability. To avoid

blame in these circumstances, students might resort to attributing their lack of success to low ability rather than limited effort.

Conclusion

This and the previous chapter have looked at how motivation theories could be used to provide useful general frameworks for understanding how students think and behave when working in teams instead of competing with one another. They are well-formulated theories and they can be used to help explain why team assignments under the right conditions can help motivate students to learn and to achieve, and to provide some guidelines on how teachers should design team projects and assessment. It would be naïve to think that cooperative methods will solve all the motivation problems in schools and universities and that pedagogies should be adopted which would encourage co-operation among students rather than competition. Some of the difficulties encountered in cooperative learning (through team assignments) have already been highlighted.

Research in the United States has shown the damaging effects of competition on motivation. It should, however, be noted that the negative effects associated with competitive learning environments were reported mainly in small-scale experiments which lack ecological validity. Also, education policies in many countries reflect different cultural values, like competition improves performance and promotes excellence. This encourages ego-orientation rather than mastery or task orientation. According to Galloway, et al. (1998), to make sense of motivation, an interaction between cultural, contextual and individual factors has to be assumed. Personality does not solely determine a students' motivation -- contextual influences (the nature of

the tasks in different subjects of the curriculum, the school they are attending and the teacher who happens to be teaching them) are also critically important.

This research project will study the motivational effects of cooperative learning when polytechnic students are engaged in their first group assignment to develop software. The effects of success and failure on high and low performers in similar- and mixed-ability teams will be studied. So far, relatively little research has been carried out on the effects of failures on individual members (high and low performers) in the project team, their perceptions, attributions and behaviours. Research carried out so far has been based largely on controlled laboratory-type experiments. The tasks the subjects were engaged in were not authentic group work but were specially constructed tests requiring the subjects to solve irrelevant puzzles.

This research project will help to confirm whether the results of earlier research (Ames, 1981; Ames & Ames, 1981; Ames & Felker, 1979; Covington, 1992; Harris & Covington, 1993) discussed earlier will apply in a cooperative learning situation in Singapore in which team interdependence is derived from a real academic task (that is, software development).

The research will also consider whether the motivational styles (both adaptive and maladaptive), discussed in recent literature on learning motivation, are apparent and are relevant in the real environment where students work in teams to develop computer software. The research will also examine the relevance of constructivist learning theories and the motivational consequences of involving students in constructivist learning tasks (e.g. cooperative team assignments) and working in constructivist learning environments.

The findings and conclusions of this research project will be beneficial to those involved in teaching programming or software engineering. The teachers will have a better understanding of how students are motivated to learn in a cooperative team assignment and will be able to adopt suitable intervention strategies to improve low performers' sense of self-worth and the perception of their own ability.

Chapter 4

Research Methodology

Introduction

At the Ngee Ann Polytechnic in Singapore, the major assignment planned for first year Diploma in Information Technology (IT) students in semester two was one that required them to work in teams to develop a software product. This assignment provided the opportunity for students to have control in deciding who they wanted to work with in a team; which individual software components they wanted to write; the additional work that the team chose to work on; the amount of time they wanted to spend on the various tasks; and so on. The teams were also asked to define their grade goals; realistic setting of grade goals (in terms of individual and team grades) was encouraged. They were encouraged to work towards achieving the team grade that they wanted. Team success would be defined in terms of whether they were able to get the team grades that they wanted. The study involved looking into the motivational responses of both high performers and low performers, both before and after their team assignment. The self-worth related effects of the collaborative team assignment on low and high performers in successful and unsuccessful teams were measured. The research also examined the process of team working, the perspectives of students on team work and the benefits and problems of the collaborative assignment. This chapter identifies the research questions, discusses the choice of research methodology and the methods of analysis.

Research Questions

This research project examined the motivational effects of cooperative learning when these students were engaged in their first group assignment in software development. The effects of success and failure on high and low performers working in teams with students of mixed ability levels and teams with students of similar ability levels, were studied. Relatively little research had been carried out on the effects of failures on the motivational responses of individual members of the project team, that is whether failure will bring about changes in their beliefs, attributions and behaviours. Also very little research had been done on team members with similar ability levels working together.

Research on the motivational effects of cooperative learning carried out so far has been based on controlled laboratory-type experiments; performance was experimentally manipulated to produce high and low performers in each team, and successful and unsuccessful teams. The tasks the subjects were engaged in were also not authentic group assignments but were specially constructed tests requiring them to solve puzzles or complete very simple tasks. Successes and failures were artificially created and so were individual performance levels (Ames, 1981; Harris and Covington, 1993). These experimental and laboratory work are considered by some researchers to have lower ecological validity since it is difficult to assess the participants' motivation for doing a laboratory task, and the findings, therefore, are not generalizable.

One of the aims of this field research project is to establish whether the motivational styles (both adaptive and maladaptive), discussed in recent literature on learning

motivation, are apparent and are relevant in a real classroom learning environment where students worked in teams to develop computer software.

Another aim of this research project is to establish the effectiveness of collaborative teamwork as an intervention strategy especially for low performers. This study involved investigating the motivational styles of the both high and low performers and the changes in their motivational orientations after they had worked together in teams to complete an assignment.

The outcome of the team assignment was expected to have an influence on the self-worth motivation of the students. This study investigated the self-worth related consequences of success and failure for high and low performers working in different team types (MPTs, LPTs and HPTs). To do this, students had to evaluate themselves and their teammates in terms of ability, deservingness of reward, and the amount of pride (for success) or amount shame (for failure) they were experiencing.

Another area that was investigated was the students' experience of working in teams and their perspectives on teamwork. Recent reviews noted that research focused on outcomes reported different findings from research focused on processes. The latter report potentially serious problems and factors that influence their occurrences (Good et al., 1992; Bluemenfeld et al., 1996; Webb & Palincsar, 1996). Students had to be interviewed in order to find out their perceptions, feelings and behaviours when they were working in teams to complete their software development assignment. The problems of team-working will be identified and explained so that team assignments or projects may be better designed.

Therefore the main research questions of this study are:

1. What were the students' motivational responses to programming both before and after they completed the team assignment?

2. How did success and failure in the team assignment affect their self-worth motivation?

3. What were the students' perceptions of the team assignment? Were there problems working in teams and what influenced their occurrences?

The research also aimed to confirm whether the results of earlier research (reviewed in Chapter 3) would apply in a cooperative learning situation in which team interdependence is derived from working on a real academic task which required the students to work in teams of two to develop a software product.

Choice of Methodology

To answer the first research question, two surveys were administered, one just before the assignment and the other immediately after the assignment, to see the changes in the students' motivational styles. Another survey was conducted to study the effects of success and failures on the self-worth motivation of both high and low performers who worked in mixed performers, low performers and high performers teams. Finally some students were interviewed to study their perspectives on the team working process and to identify the problems of students working in teams.

The findings and conclusions of the present research should be beneficial to those involved in teaching programming and software development. It aims to give them a

better understanding of how students are motivated to learn (and becoming more mastery oriented) using cooperative team assignments and how collaborative team projects could be designed to help improve students' sense of self-worth and perceptions of their own ability.

Surveys are among the most frequently used research methods in the social sciences. This popularity is not surprising given that much of the contemporary literature, particularly in psychology, involves the study of individuals' perception of and beliefs about themselves and their immediate situation, and the relationship of these perceptions and beliefs to behaviour. A survey is a method of collecting information from people for descriptive or predictive purposes. We can observe people to obtain the needed information only if the information needed is behavioual. We cannot observe attitudes, opinions or beliefs, but we can ask people about their attitudes, opinions, beliefs and even feelings by using a survey.

The most commonly used forms of surveys are questionnaires and interviews. Questionnaires are written surveys containing items that address the goals of the investigation. They can be self-administered or administered to groups of people by an administrator who explains the purpose of the survey, answers questions about the survey items on the spot, and ensures that proper survey procedures are followed. The questions in a questionnaire are carefully constructed to yield the precise information that the investigator is seeking. A limitation of questionnaires is that the items are preset. The respondents are required to choose between response alternatives that are supplied by the researcher and this makes the surveys highly structured. Respondents therefore cannot fully express their views and opinions unless questions are open-ended.

It would not be adequate to use only questionnaires in a study which sought students' perceptions on team-working and how they would feel and behave in different situations and circumstances. It would be more useful to obtain through interviews with the students, their actual responses to processes and tasks in which motivation was important.

Interviews share many of the features of questionnaires in that there may be a set of items (standard questions) the researcher uses to gather information. With less structured interviews, however, it is possible to ask for explanations and clarifications, and to provide information on the reactions of the respondents that cannot be obtained from questionnaires.

Although interviewing can be time-consuming, it has many other advantages, including (a) allowing the respondents to reveal otherwise concealed thoughts and emotions; (b) revealing problems and their potential solutions through conversation and discussion; (c) encouraging free expression; (d) discovery of additional contextual information, attitudes, beliefs and perceptions that a questionnaire survey might not uncover; (e) getting the full attention of the respondents; and (f) getting clarifications, explanations and elaborations from the interviewees at any point during the interview. As Tuckman (1972) puts it, "By providing access to what is 'inside a person's head', [it] makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (values and preferences), and what a person thinks (attitudes and beliefs)." (cited in Cohen & Manion, 1994 : 272).

Both questionnaires and unstructured interviews were employed in this investigation. While the questionnaires were administered to 130 students, only 20 students were interviewed either individually or in pairs. It was recognized at the outset that interviewing just twenty students and analyses of the qualitative information collected, would take up a large amount of the researcher's time.

Participants' Background

The participants in this study were first year Diploma in IT students at the Ngee Ann Polytechnic in Singapore. The had completed an introductory programming course in the first semester and were taking the mandatory OOP (Object Oriented Programming) Using Java module in the second semester. Java is the name of a popular programming language used in the IT industry. Programming is an essential skill that all IT students should be competent in when they join the industry later as Programmers or Systems Analysts. Therefore there was an emphasis in programming and software development in the course.

The average age of the students was seventeen, and more than 70 per cent were boys. They completed their "O" level examinations before coming in to the polytechnic and most of them had done fairly well in the examinations, scoring at least a B grade in their best five subjects, including Elementary Mathematics and a Science subject. They had chosen to join the polytechnic and to take up the Diploma in Information Technology course because of the bright career prospects for IT graduates and because the course was practice-oriented and vocational in nature. Most of the subjects in the course were new to them in the sense that they had not done these at the secondary school level. Programming, for example, was a totally new skill that they

had to pick up. It was also an important skill because the main aim of the Diploma course was to prepare them to be entry level programmers and systems analysts in industry.

Grouping of Students and Team Types

Students who had performed well (getting grade a A or B) in programming the previous semester (semester one of their Diploma course) were considered high performers. Those who had not done too well (getting grade C, D or F) were considered low performers. The students were asked to form their own teams with two members in each team. Three team types would emerge: High Performers Teams (HPTs) were teams with two high performers (HPs) in each team; Low Performers Teams (LPTs) were teams with two low performers (LPs) in each team; and Mixed performers Teams (MPTs) were teams with one high performer and one low performer in each team.

Success and Failure in the Collaborative Team Assignment

The assignment (see Assignment Brief in Appendix A which was handed out to the students) required the students to work together in teams to develop a piece of software which would simulate the working of a fare-card vending machine. The assignment had two components – a Team Component and an Individual Component. Two grades would be awarded: a grade for the team component, the Team Grade; and a grade for individual component, the Individual Grade.

Both students in the team were expected to work closely to complete the team components of the assignment. In order to get a higher team grade, the students were

asked to complete the additional requirements stated in the assignment sheet. They were asked to choose the tasks they wanted to do individually; this formed the individual component of the assignment. Students were asked to identify and report on the tasks they were involved in. Students were told that they would be called up later, after they had submitted their assignments, to demonstrate their products, and to explain the functions and intricacies of their software. Students were asked to indicate their team grade goals and individual grade goals before they began working on their assignment. These were recorded.

The team component grade was awarded based on the work the team members had done together and submitted, and their performance at the demonstration. The tutors compared the team grade goal with the team grade that students were awarded and the team was then informed whether they had been successful or unsuccessful in achieving their goal.

Ethical Considerations

The methodology adopted in this research project was approved by the University of Durham Ethics Advisory Committee.

There were over 400 students in the first year IT cohort. The School had placed them in 28 classes, each with 15 to 20 students. All classes were mixed ability and mixed gender. There were seven tutors and each had responsibility for teaching 4 classes. One class was selected on a random arbitrary basis from each of the tutor's classes. Altogether, 130 students from seven classes were invited to participate in this research project. Their tutors explained to them the purpose of the project, that is to find out whether students would benefit from collaborative team assignments. They were also

informed that they would be asked to complete three survey questionnaires at various stages of the assignment. The purpose of the surveys was explained to the students. They were assured that the information they provided was meant for research and would not be divulged to anybody. They were told that they could opt out of the survey but no one did.

All the questionnaires were completed by the students in class and were collected back as soon as they were completed. The students took about 15 minutes to complete each questionnaire.

The students were asked to indicate their individual and team grade goals before the assignments began. There were three questionnaires. The first two questionnaires (pre- and post-assignment questionnaires) were meant to measure the motivational responses of the students before and after their team assignment.

Since team grades had not yet been given out when the students completed the post assignment questionnaire, their reactions would not be influenced by outcome, that is success or failure in getting the team grades that they wanted. Reactions would be based entirely on their actual experience of teamwork.

Just before they completed the third (final) questionnaire which required them to evaluate themselves as well as their teammates in terms of ability, deservingness of rewards, and pride or shame, the teams were given their team grades. The team grades were the actual grades awarded to them by their tutors. Success and failures were therefore not manipulated. The purpose of giving students their team grades was to elicit the reactions of high and low performers to success or failure. It was, however,

expected that the students would be responding to the outcome (success or failure in achieving their team grade goals) as much as to the actual experience of team work when they completed this final questionnaire.

At the end of the assignment, twenty students who volunteered to be interviewed were invited to share their views on their experience of working in teams to complete the software project. It was anticipated that some students would make very bold/negative comments on the quality of teaching, their tutors and their team mates. They had to be assured that the information they provided would not be divulged. Their tutors were also informed of the interviews and the participation of the students from their classes. During the analyses and in the thesis, the real names of the students and tutors would not be disclosed.

Procedures

One week before the assignment began, the students were asked to form their own teams, each team to have two members. Students who had done well in the previous semester were considered High Performers (HPs) and those who had not done well were considered Low Performers (LPs). Teams with two high performers in each are called High Performers Teams (HPTs) and teams with two low performers in each are called Low Performers Teams (LPTs). Mixed Performers Teams (MPTs) were those which had one high performer and one low performer in each. Students were not and need not be aware of these designations.

Although students were given the freedom to choose their team-mates and form their own teams, it was imperative for this research that all three team types were formed.

It was anticipated that high performers would not be willing to work with low performers. On the other hand, low performers might not want to work with other low performers. High performers were, however, not forced to team up with the low performers but the tutors were asked to encourage those stronger in programming to team up with the weaker ones. This was to ensure that there would be responses from students in Mixed Performers Teams available for the study. Students who could not find suitable team-mates would have to pair up with other classmates that they might not prefer to work with. Students need not be forced to work with total strangers since they were supposed to team with their classmates. It was decided by the researcher that if not enough teams of a particular type were formed (e.g. MPTs), then such teams from other classes (in addition to the original seven classes) would be invited to participate in the study. This was later found to be unnecessary.

Students were given the assignment handout which provided details on what the team was expected to do within two weeks. The assessment criteria were also included in the handout. Before they began their assignment, they were asked to complete the Pre-Assignment Survey Questionnaire in class. In it, students had to indicate the individual and team grades they were aiming for. Immediately after they had submitted their completed assignment, the students were asked to complete the Post-Assignment Questionnaire. No grades were awarded at that stage and their responses were expected to be their reactions to the experience of working in a team.

Two weeks after they had submitted their assignments, the students met in their classes and each team was given a slip of paper before the final survey began. The paper contained the following details : (1) their team grade goals, (2) the actual team grades awarded to their teams, and (3) a note confirming that their teams were successful or

unsuccessful in meeting their team grade goals. Immediately after knowing whether their teams had been successful, the students were asked to individually complete the Evaluation of Self and Team-mate questionnaire.

All students who participated in the questionnaire surveys were invited to attend a short interview (lasting 30 to 45 minutes each) with the researcher. They were to be interviewed either individually or together with their team-mates. In the end, only twenty students volunteered and turned up for the interviews. Since there were both high and low performers among these twenty students and all the three team types were represented, there was no necessity to invite more students to attend the interviews. All interviews were conducted solely by the researcher involved in this research project.

The Questionnaires

Pre-Assignment Survey on Motivational Styles

The questionnaire consisted of two sections (see Appendix B). In the first section, students were asked to indicate the marks they were aiming for in the individual component and the team components of the team assignment.

The first three questions in Section B sought the initial reaction of the students to team-working. They were asked to indicate whether they strongly agree, agree, disagree or strongly disagree that they were looking forward to work with another person, that team-mates should support each other and that their team-mates' programming skills were better than their's. They were then asked to indicate, again on a four-point scale,

whether they strongly disagree, disagree, agree or strongly agree with eighteen statements (motivational responses), each one a measurement item for a specific variable. The variables were theoretically derived, that is they were taken from the literature on achievement motivation.

Post-Assignment Survey on Motivational Styles

This questionnaire also had two sections (see Appendix C). The first section asked students to indicate the marks they and their team-mates deserved for the individual component and the marks they deserved for the team component of the assignment. In the second section, they were asked to indicate whether they strongly agree, agree, disagree or strongly disagree that it was fair that they and their team-mates should get the same marks for the team component; that their team-mates had other talents besides ability in programming; and they and their team-mates worked well as a team. They were then asked to indicate, again on a four-point scale, whether they strongly disagree, disagree, agree or strongly agree with the same eighteen statements (motivational responses) as those found in the Pre-Assignment Survey Questionnaire.

Survey on Self-worth Related Effects of Collaborative Teamwork

Participants responded to a questionnaire which had 3 sections (see Appendix D). In the first section, participants were first asked to confirm whether their teams were successful in getting the marks they expected to get. They were then asked to evaluate their own performance. They were asked to assess their programming ability (How capable do you think you are in programming?). To assess perceptions of deservingness of reward, students were asked "How much reward do you think you

deserve for how you have performed?". Participants from unsuccessful teams were asked to indicate how much shame they felt at their performance. Conversely, participants from successful teams were asked how proud they felt with their performance. For each of these self-evaluation questions, students responded on rating scales consisting of nine points, coded 1 through 9. The end points of each scale were labeled as follows : not at all capable – very capable, no reward – maximum reward, not at all proud – very proud, no shame – lots of shame.

In the second section of the questionnaire, students were asked to respond to a parallel set of questions regarding the performance, deservingness of reward, and feelings of their teammate. Students were asked to rate the performance of their teammate with this question : "How capable do you think your team-mate is in programming?" Similarly, students were asked to rate the deservingness of reward and feelings of shame or pride of the other member of their team. The scales that were used were identical to those of the previous section of the questionnaire.

The questions for all the three survey questionnaires were adapted from those found in the literature on achievement motivation (for example, see Ames, 1981; Dweck, 2000; Harris & Covington, 1993; Nicholls, 1989).

Pilot Testing the Questionnaires

The questionnaires were tried out with a small sample (ten students) similar to the intended group of respondents. The pilot respondents were informed when each of the questionnaires would be administered. They were asked to read the instructions, the questions (or statements) and then complete the questionnaires. At the end of the

session, the researcher went through the questionnaires with each of the respondents to see whether they had interpreted the questions or statements correctly. The researcher also looked out for blanks and unexpected answers in the questionnaires because these would indicate ambiguities in the phrasing of the questions or statements. The questionnaires were then revised accordingly.

Questionnaire Surveys Participation

A total of 130 students (or 65 teams) participated in the surveys. Both high and low performers and all the three team types were represented. At the end of the surveys, it was found that only 112 sets of questionnaires from 56 teams were valid and were therefore accepted. Some questionnaires were either incomplete or found missing (perhaps not returned). This sample of 112 students represents slightly over 25 % of the first year Diploma in IT cohort.

The Interviews

Students were invited to share their experience of working in teams to complete their assignments. Only twenty students showed an interest and in the end all the twenty students agreed to be interviewed. The volunteers comprised of high and low performers from MPTs, HPTs and LPTs. These students either attended the interviews together with their teammates or came alone. Before the interview began, they were informed that the session would be audio-taped. The explanation given to the students was that this would allow the interviewer to concentrate on the conversation without having to make too many notes. Again the interviewees were assured that

nothing they said would be divulged and they were asked to speak up freely on any issues or topics being discussed.

A simple interview schedule, which consisted of only a list of topic areas and issues to be covered was drawn up. This schedule was referred to during the interview sessions. In qualitative interviews, a rigid adherence to a detailed interview schedule, addressing every issue can only intimidate interviewees or fail to follow their train of associations and perspectives. Since the researcher was interested in divergence and variety, rather than convergence and replicability, the questions asked were oriented to the particular situations or positions of the interviewees.

The broad aims of the interviews with the students were to investigate:

1. how they coped with the assignment, the problems and difficulties faced working in teams, and how they resolved them.

2. what they had gained through the experience.

3. what they attributed their past success and failure to.

4. their thoughts about the collaborative assignment in general.

The interview schedule is shown in Appendix E.

Participants in the interviews were encouraged to speak up freely on any issues or topics raised during the interview.

Quantitative Analysis Methods

Motivational Effects of Collaborative Assignment

We wanted to find out the motivational effect of collaborative teamwork on students who were working together in teams to develop a piece of software. We wanted to investigate the effectiveness of collaborative teamwork as an intervention strategy for high and low performers working in either Mixed Performers Teams, High Performers Teams, or Low Performers. We wanted to find out whether there were changes in their motivational responses (styles) after they had worked together in teams to complete an assignment. Did they become more mastery oriented? Did they become more learned helpless or more protective of their self-worth after their experience working together on a collaborative assignment?

Self-Worth-Related Effects of Collaborative Assignment

First of all, we attempted to discover if individual performance level and outcome had an effect on the ratings (ability, deservingness of rewards) that students in Mixed Performance Teams gave themselves and their teammates. We also wanted to discover the difference in the level of pride (or shame) high and low performers in MPTs indicated for themselves and for their teammates.

We also wanted to find out the self-worth related effects of outcome on four categories of students (HPs in HPTs, LPs in LPTs, HPs in MPTs and LPs in MPTs). Essentially we wanted to find out how the students evaluated themselves and their

teammates in terms of ability, deservingness of reward, and the amount of pride (for success) or the amount of shame (for failure) they were experiencing.

Several statistical methods were used in data analyses. These include : t tests and tests of significance; correlation analysis; Cronbach reliability analysis; factor analysis; effect size measures; one-way ANOVA; and pairwise comparisons using Tukey HSD (Aron & Aron, 1999; George & Mallery, 2001; Hopkins et al., 1996; Howitt & Cramer, 2000). A statistical package, SPSS 11.5 (SPSS, 2002) was employed to analyze the data.

Qualitative Analysis of Interview Data

The interviews were transcribed from audio recordings into text to facilitate analysis. We wanted to find out from the interviews the students' thoughts and feelings about the collaborative assignments. We also wanted to identify the problems with team-working that were related to the students' motivational styles.

Tools and techniques employed in the analysis of interview data in the research were those adapted from the grounded theory methodology (Glaser and Strauss, 1967; Strauss & Corbin, 1998). These were useful for analysis of the interview data even though the objective was not for theory generation but more to look for evidence to verify and validate current motivational theories and the hypotheses discussed in the two literature survey chapters.

The huge volume of interview data which was predominantly text-based necessitated some form of organizing and ordering. An indexing system is needed which is

consistent across the massive collection of data generated during the interviews. The system should also allow the researcher to locate and retrieve relevant portions (or slices) of text for the purposes of answering our research questions and using quotations to help in illustration, explanation, and presentation of evidence.

In our research project, we were concerned with the interviewee's words or phrases in his replies to questions and coding them. Since the purpose was not to generate a new theory, the concepts and terminologies discussed in the current literature on achievement motivation theories were used as "categories" for coding purposes.

Each script was read and sections of the script (quotations) were coded according to which categories of information they were providing. This procedure was like marking sections of the script that were relevant to the research focus. Since the interview was unstructured and informal, we could expect many parts of the scripts to have very little relation to the task at hand. Going through the script the second time, we went through the categories one by one and coded the quotations again but this time using codes that were narrower and more specialized. The relationships between the codes were also identified. If necessary, notes (explanations, clarifications or additional information) were made for the quotations.

These tasks were facilitated by the use of a computer software ATLAS.ti (Scientific Software Development, 1997) which was specially developed for researchers using a qualitative methodology such as grounded theory. It was a convenient tool for storing, analyzing and retrieving information and was certainly helpful in the analysis of more than 150 pages of the transcribed interviews. It facilitated the activities involved in qualitative analysis, particularly selecting, coding, annotating and

comparing noteworthy segments of texts. The coding functions allowed quotations (words, phrases or sentences) to be linked to codes. Comments and explanations could be provided for the categories which were used for coding purposes. This commenting facility allowed the researcher to clarify the meaning of a code or to explain how it was used for coding.

There was no restriction on the number of codes assigned to a quotation and a code could be used to refer to any arbitrary number of quotations. It also provided the researcher with the capability of graphically representing relationships in the data. Categories were depicted as nodes and could be connected by lines and arrows to other nodes to indicate relationships. These relationships could be defined and specified using user-selected symbols or abbreviations. A text search facility is provided for searching for occurrence of specific text strings, and a query tool is available for the retrieval of coded text. How helpful the software could be for analysis depends almost entirely on the sophistication of the coding system built by the researcher. It has to be noted that the software cannot create the categories for the researcher, or decide which slices of text they apply.

Conclusion

The purpose of the first two questionnaire surveys was to find out the motivational effects of the collaborative assignment on high and low performers working in similar-performance level and mixed performance level teams. Essentially the main aim was to establish whether there was a change in the students motivational styles after the assignment. Were they more mastery oriented? Were they less protective of their self-worth? Did they become less helpless? Chapter 5 discusses how the surveys were

administered and the statistical analyses that were carried out. It also reports the interesting findings of this part of the study. Outcome was expected to have an effect on the self-worth motivation of students. Therefore the next part of the present investigation was the study the self-worth related effects of success and failures on high performers and low performers in Mixed Performance Teams, High Performance Teams and Low Performance Teams. The students were asked to rate their ability, indicate what rewards they deserved, and also the level of pride (if successful) or shame (if unsuccessful) they felt. They were also asked to rate their teammate's ability, indicate the amount of rewards their teammate deserved, and the level of shame or pride they thought their teammate was experiencing. Chapter 6 provides the details of the data analyses carried out and the significant findings of this part of the investigation. In order to study the problems of students working in teams and the students' perceptions on team-working, informal interviews with the students were conducted. Qualitative analysis of the huge amount of interview data is described in Chapter 7. The findings from the interviews are also reported in that chapter. Discussion of the findings in Chapters 5, 6 and 7 is done in the concluding chapter (Chapter 8) of this thesis.

Chapter 5

Students' Motivational Styles and Effects of the Cooperative Team Assignment

Introduction

Students will adopt the goal orientations that are emphasized in their classrooms (Ames, 1992b; Ames & Archer, 1988; Maehr & Midgley, 1991). Given that the research is very clear that mastery goal orientation is linked to a positive and adaptive pattern of attributions and is associated with positive affective, cognitive and behavioural outcomes (as discussed in Chapter 2), it would be interesting to find out whether cooperative learning, like the team assignment in our present study, would facilitate the adoption of mastery goals by students.

In Chapter 3, the classroom structures that influence students' adoption of a mastery goal were examined. Ames (1992b) and Maehr & Midgley (1991) have suggested a number of strategies that teachers might use in their classroom. These strategies cut across six dimensions and their strategies clearly reflect attempts to change these dimensions to facilitate the adoption of mastery goals or an adaptive motivational style which would in turn affects the quality of students' engagement in learning. The use of cooperative learning as an effective strategy has been recommended by many motivation researchers (e.g. Ames, 1981; Blumenfeld et al., 1996; Covington, 1992; Johnson & Johnson, 1989, 1992; Slavin, 1995; Pintrich & Schunk, 2002).

This chapter reports on the investigation into the motivational responses of the students before and after completing their cooperative team assignment. The specific research questions for this part of the study were :

1. Did the team assignment affect the students' motivational responses?

2. Did the students become more mastery oriented?

3. Was the team assignment effective as intervention strategy especially for low performers?

The effects of the team assignment on high and low performers working in mixed ability teams and in same ability teams were investigated. This field research project sought to confirm whether the motivational styles (both adaptive and maladaptive), discussed in recent literature on motivation, are apparent and are relevant in a real learning environment where students worked in teams to develop computer software. The research also studied the changes, if any, in the students' motivational styles after they had worked together in teams to complete the software development assignment.

The Questionnaires

Two questionnaires were administered, one just before the team assignment began and one immediately after the students had submitted their work for marking. In the pre-assignment questionnaire (see Appendix B), students were asked to indicate, on a four-point scale, whether they strongly disagree, disagree, agree or strongly agree with eighteen statements (motivational responses), each one a measurement item for a specific variable. In the post-assignment questionnaire (see Appendix C), the students were again asked to indicate whether they strongly disagree, disagree, agree or

strongly agree with the same eighteen statements (and also in the same order) as those found in the pre-assignment survey questionnaire.

The measurement items and the 18 motivational variables that they were designed to measure are shown in **Table 5.1.** Where each of the measurement item appears in the two questionnaires (that is the question number in the questionnaire) is also indicated in **Table 5.1.** Variable 1 is the Entity View of Ability (see Bandura & Dweck, 1985) variable and the measurement item is: "I believe that some people have more ability than others and that means that there will always be differences between them." This item appears as Question 6 in the pre-assignment questionnaire and Question 7 in the post-assignment questionnaire. Variable 2 is the Self-Efficacy (Bandura, 1997) variable and the measurement item is the statement: "I believe that I am good at problem solving and competent in programming." The next four measurement items were designed to find out where the students see themselves on the approach and the avoidance dimensions (see Atkinson, 1964 ; Covington, 1992). Students could be success striving (variable 3), failure avoiding (variable 4), failure accepting/ learned helpless (variable 5) or overstriving (variable 6). Measurement items 7 and 8 were used to establish the goal orientations (see Ames & Archer, 1988) of the students. Measurement items 9 to 12 were designed to find out what students attributed their past successes to. Measurement items 13 to 18, on the other hand, were designed to find out what the students attributed their past failures to (see Weiner, 1986).

Summary of Data Collected

Data collected from from the pre- and post-assignment surveys were tabulated. The means and standard deviations of the measurement items for four groups of students

Table 5.1 : Variables, Measurement Items and References to Questions In Motivation Style Survey Questionnaires

Item No.	Variables	Measurement Items (Statements in the Questionnaires)	References to questions in Pre Assignment Questionnaire (Question Number)	References to questions in Post Assignment Questionnaire (Question Number)
1	Entity View of Ability	I believe that some people have more ability than others and this means that there will always be differences between them.	6	7
2	Self-Efficacy	I believe that I am good at problem solving and competent in programming.	7	8
3	Success Striving	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	8	9
4	Failure Avoiding	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	9	10
5	Failure Accepting / Learned Helpless	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	10	11
6	Overstriving	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	11	12
7	Performance Goal	To me, success means getting better grades than most students.	12	13
8	Mastery Goal	Success means that I have shown improvement in my work and that I have mastered my programming skills.	13	14
9	Attribution of Success to Effort	My success in programming assignments in the past has largely been due to hard work.	14	15
10	Attribution of Success to Ability	My ability in programming has largely contributed to success in my assignments.	15	16
11	Attribution of Success to Luck	Luck has a lot to do with the success in my programming assignments.	16	17
12	Attribution of Success to Easy Task	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	17	18
13	Attribution of Failure to Insufficient Effort	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	18	19
14	Attribution of Failure to Lack of Ability	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	19	20
15	Attribution of Failure to Bad Luck	When I didn't do well in my programming assignment, it was because luck was not on my side.	20	21
16	Attribution of Failure to Difficult Task	When I was not successful in the past, it was because the programming assignment was too tough for many students.	21	22
17	Attribution of Failure to Quality of Effort	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	22	23
18	Attribution of Failure to Lack of Autonomy	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	23	24

(HPs in HPTs, LPs in LPTs, HPs in MPTs and LPs in MPTs) were calculated and they are shown in **Tables 5.2.1 to 5.2.4**. The differences between the means of the pre- and post assignment surveys and the significance of the differences are also indicated in these tables.

The 18 variables were inter-correlated using the Pearson product-moment correlation procedure. The correlation matrix of the 18 variables is shown in **Table 5.3**. The figures shown in the correlation matrix are the correlation coefficients between the pairs of variables. Large correlation coefficients (r) indicate that the variables involved are significantly related to each other (or overlap) in what they measure. Negative correlations are indicated by the minus sign in front of the coefficients. The significances of the correlations at 0.01 or 0.05 level (two-tailed) are also indicated in the **Table 5.3**.

For instance, Self-Efficacy (variable 2) is positively correlated with Success Striving (variable 3) $(r = 0.517, p = 0.01)$ but negatively correlated to Learned Helplessness (variable 5) $(r = -0.461, p = 0.01)$. The correlations are strong and significant in both cases. It can be seen that even with only 18 variables, the task of interpreting all the intricate relationships can be quite complex.

Cronbach's Alpha : Scales and Internal Consistency of Scales

Cronbach's alpha (α) is designed as a measure of internal consistency; that is, to confirm whether all items within the instrument measure the same thing. Alpha is measured on the same scale as Pearson r (correlation coefficient) and typically varies between 0 and 1. A negative value is possible and indicates that an item measures the

Table 5.2.1 : Summary of Survey Data — HPs in HPTs (*N*=26)

Measurement Items	PRE* MEAN (SD)	POST* MEAN (SD)	MEAN DIFF	t-value	SIG (2-tailed)
1. I believe that some people have more ability than others and this means that there will always be differences between them.	3.31 (0.55)	3.08 (0.69)	0.23	1.81	0.08
2. I believe that I am good at problem solving and competent in programming.	2.50 (0.76)	3.00 (0.63)	-0.50	-5.00	0.00
3. I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.83 (0.61)	2.73 (0.67)	0.12	1.36	0.19
4. I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.81 (0.85)	2.73 (0.72)	0.08	0.49	0.63
5. I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.15 (0.83)	1.96 (0.60)	0.19	1.10	0.28
6. I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.50 (0.58)	2.96 (0.66)	-0.46	-3.64	0.00
7. To me, success means getting better grades than most students.	2.77 (0.65)	2.81 (0.69)	-0.04	-0.33	0.75
8. Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.23 (0.51)	3.35 (0.56)	-0.12	-1.14	0.27
9. My success in programming assignments in the past has largely been due to hard work.	2.88 (0.52)	3.15 (0.46)	-0.27	-3.04	0.01
10. My ability in programming has largely contributed to success in my assignments.	2.69 (0.55)	3.04 (0.45)	-0.35	-3.14	0.00
11. Luck has a lot to do with the success in my programming assignments.	2.46 (0.99)	2.31 (0.74)	0.15	0.78	0.44
12. I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.42 (0.86)	2.54 (0.86)	-0.12	-0.57	0.57
13. When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	2.85 (0.83)	3.00 (0.57)	-0.15	-1.07	0.29
14. When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.35 (0.69)	2.00 (0.57)	0.35	2.56	0.02
15. When I didn't do well in my programming assignment, it was because luck was not on my side.	2.12 (0.87)	2.12 (0.77)	0.00	0.00	1.00
16. When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.77 (0.71)	2.85 (0.54)	-0.08	-0.53	0.60
17. I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.77 (0.59)	2.92 (0.48)	-0.15	-1.07	0.29
18. I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.69 (0.79)	2.96 (0.66)	-0.27	-1.90	0.07

* Pre = Before Team Assignment; Post = After Team Assignment

Table 5.2.2 : Summary of Survey Data -- LPs in LPTs (*N*=34)

Measurement Items	PRE* MEAN (SD)	POST* MEAN (SD)	MEAN DIFF	t-value	SIG (2-tailed)
1. I believe that some people have more ability than others and this means that there will always be differences between them.	3.06 (0.55)	3.12 (0.73)	-0.06	-0.57	0.57
2. I believe that I am good at problem solving and competent in programming.	2.00 (0.60)	2.18 (0.46)	-0.18	-1.79	0.08
3. I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.24 (0.78)	2.59 (0.74)	-0.36	-3.19	0.00
4. I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.12 (0.64)	3.00 (0.74)	0.12	1.00	0.33
5. I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.38 (0.78)	2.44 (0.61)	-0.06	-0.40	0.69
6. I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.44 (0.75)	2.76 (0.74)	-0.32	-2.07	0.05
7. To me, success means getting better grades than most students.	2.53 (0.83)	2.56 (0.79)	-0.03	-0.22	0.83
8. Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.47 (0.51)	3.35 (0.54)	0.12	1.07	0.29
9. My success in programming assignments in the past has largely been due to hard work.	2.88 (0.64)	2.88 (0.41)	0.00	0.00	1.00
10. My ability in programming has largely contributed to success in my assignments.	2.71 (0.63)	2.74 (0.57)	-0.03	-0.30	0.77
11. Luck has a lot to do with the success in my programming assignments.	2.35 (0.77)	2.47 (0.79)	-0.12	-0.64	0.52
12. I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.47 (0.75)	2.59 (0.61)	-0.12	-0.94	0.35
13. When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.15 (0.70)	3.09 (0.62)	0.06	0.49	0.62
14. When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.32 (0.81)	2.26 (0.79)	0.06	0.35	0.73
15. When I didn't do well in my programming assignment, it was because luck was not on my side.	2.03 (0.67)	2.09 (0.71)	-0.06	-0.37	0.71
16. When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.65 (0.88)	2.62 (0.49)	0.03	0.18	0.86
17. I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.97 (0.58)	2.91 (0.62)	0.06	0.53	0.60
18. I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.88 (0.69)	2.82 (0.67)	0.06	0.44	0.66

* Pre = Before Team Assignment; Post = After Team Assignment

Table 5.2.3 : Summary of Survey Data -- HPs in MPTs (N=26)

	Measurement Items	PRE* MEAN (SD)	POST* MEAN (SD)	MEAN DIFF	t-value	SIG (2-tailed)
1.	I believe that some people have more ability than others and this means that there will always be differences between them.	3.12 (0.52)	3.12 (0.59)	0.00	0.00	1.00
2.	I believe that I am good at problem solving and competent in programming.	2.23 (0.86)	2.50 (0.71)	-0.27	-1.66	0.11
3.	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.77 (0.82)	2.65 (0.80)	0.12	0.68	0.50
4.	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.00 (0.63)	2.77 (0.65)	0.23	1.66	0.11
5.	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.27 (0.72)	2.23 (0.76)	0.04	0.23	0.82
6.	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.54 (0.65)	2.81 (0.69)	-0.27	-1.90	0.07
7.	To me, success means getting better grades than most students.	2.77 (0.76)	2.69 (0.84)	0.08	0.53	0.60
8.	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.58 (0.50)	3.27 (0.53)	0.31	2.54	0.02
9.	My success in programming assignments in the past has largely been due to hard work.	2.92 (0.63)	2.85 (0.54)	0.08	0.81	0.43
10.	My ability in programming has largely contributed to success in my assignments.	2.65 (0.63)	2.88 (0.52)	-0.23	-2.00	0.06
11.	Luck has a lot to do with the success in my programming assignments.	2.38 (0.90)	2.31 (0.68)	0.08	0.70	0.49
12.	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.23 (0.59)	2.38 (0.57)	-0.15	-1.16	0.26
13.	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.04 (0.60)	2.85 (0.54)	0.19	1.55	0.13
14.	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.31 (0.79)	2.31 (0.79)	0.00	0.00	1.00
15.	When I didn't do well in my programming assignment, it was because luck was not on my side.	1.81 (0.57)	1.845 (0.54)	-0.04	-0.30	0.77
16.	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.50 (0.65)	2.46 (0.76)	0.04	0.24	0.81
17.	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.73 (0.53)	2.62 (0.50)	0.12	0.83	0.42
18.	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.81 (0.57)	2.92 (0.84)	-0.12	-0.68	0.50

* Pre = Before Team Assignment; Post = After Team Assignment

Table 5.2.4 : Summary of Survey Data -- LPs in MPTs (*N*=26)

Measurement Items	PRE* MEAN (SD)	POST* MEAN (SD)	MEAN DIFF	t-value	SIG (2-tailed)
1. I believe that some people have more ability than others and this means that there will always be differences between them.	3.15 (0.61)	3.04 (0.72)	0.12	0.62	0.54
2. I believe that I am good at problem solving and competent in programming.	1.77 (0.51)	2.12 (0.52)	-0.35	-3.14	0.00
3. I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.27 (0.67)	2.42 (0.58)	-0.15	-1.16	0.26
4. I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.00 (0.63)	3.08 (0.56)	-0.08	-0.70	0.49
5. I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.35 (0.63)	2.42 (0.58)	-0.08	-0.70	0.49
6. I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.19 (0.63)	2.46 (0.51)	-0.27	-1.90	0.07
7. To me, success means getting better grades than most students.	2.35 (0.85)	2.38 (0.57)	-0.04	-0.27	0.79
8. Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.15) (0.46)	3.2692 (0.67)	-0.12	-0.83	0.42
9. My success in programming assignments in the past has largely been due to hard work.	2.58 (0.64)	2.85 (0.46)	-0.27	-2.27	0.03
10. My ability in programming has largely contributed to success in my assignments.	2.42 (0.64)	2.69 (0.47)	-0.27	-1.90	0.07
11. Luck has a lot to do with the success in my programming assignments.	2.65 (0.80)	2.69 (0.74)	-0.04	-0.23	0.82
12. I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.54 (0.65)	2.62 (0.64)	-0.08	-0.70	0.49
13. When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.00 (0.69)	3.00 (0.63)	0.00	0.00	1.00
14. When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.54 (0.81)	2.46 (0.76)	0.08	0.70	0.49
15. When I didn't do well in my programming assignment, it was because luck was not on my side.	2.27 (0.72)	2.19 (0.80)	0.08	0.46	0.65
16. When I was not successful in the past, it was because the programming assignment was too tough for many students.	3.04 (0.53)	2.54 (0.71)	0.50	3.61	0.00
17. I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.81 (0.63)	2.81 (0.70)	0.00	0.00	1.00
18. I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	3.19 (0.69)	2.92 (0.80)	0.27	1.49	0.15

* Pre = Before Team Assignment; Post = After Team Assignment

Table 5.3 : Correlation Matrix of the 18 Variables (N = 112)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1	-.110	.091	.121	.130	-.173	.243**	-.038	.053	-.148	-.052	.177	.107	.076	.116	.254**	.191*	.157
2	-.110	1	.517**	-.283**	-.461**	.416**	.331**	.195*	.285**	.416**	-.099	.061	-.212*	-.221*	-.203*	-.410**	-.207*	-.186*
3	.091	.517**	1	-.177	-.374**	.317**	.325**	.250**	.268**	.405**	-.190*	.018	-.066	-.202*	-.067	-.202*	-.027	-.065
4	.121	-.283**	-.177	1	.426**	-.207*	.060	.135	-.025	-.156	.189*	.062	.129	.344**	.167	.368**	.063	.184
5	.130	-.461**	-.374**	.426**	1	-.452**	.035	-.142	-.237*	-.346**	.296**	-.031	.195*	.308**	.209*	.459**	.137	.199*
6	-.173	.416**	.317**	-.207*	-.452**	1	.049	.255**	.468**	.474**	-.321**	-.183	-.225*	-.361**	-.239*	-.412**	-.140	-.153
7	.243**	.331**	.325**	.060	.035	.049	1	.274**	.073	.114	.033	.030	.061	.013	.120	-.079	-.012	.003
8	-.038	.195*	.250**	.135	-.142	.255**	.274**	1	.261**	.235*	-.215*	.140	.202*	-.098	-.347**	-.213*	.028	.034
9	.053	.285**	.268**	-.025	-.237*	.468**	.073	.261**	1	.579**	-.185	-.012	-.239*	-.273**	-.143	-.106	.115	-.044
10	-.148	.416**	.405**	-.156	-.346**	.474**	.114	.235*	.579**	1	-.015	-.069	-.272**	-.250**	.005	-.104	-.028	-.114
11	-.052	-.099	-.190*	.189*	.296**	-.321**	.033	-.215*	-.185	-.015	1	.140	.001	.338**	.493**	.409**	-.150	.141
12	.177	.061	.018	.062	-.031	-.183	.030	.140	-.012	-.069	.140	1	.303**	.250**	.009	-.024	.214*	.215*
13	.107	-.212*	-.066	.129	.195*	-.225*	.061	.202*	-.239*	-.272**	.001	.303**	1	.300**	.070	.027	.247**	.221*
14	.076	-.221*	-.202*	.344**	.308**	-.361**	.013	-.098	-.273**	-.250**	.338**	.250**	.300**	1	.243**	.226*	.062	.174
15	.116	-.203*	-.067	.167	.209*	-.239*	.120	-.347**	-.143	.005	.493**	.009	.070	.243**	1	.443**	-.021	.229*
16	.254**	-.410**	-.202*	.368**	.459**	-.412**	-.079	-.213*	-.106	-.104	.409**	-.024	.027	.226*	.443**	1	.124	.206*
17	.191*	-.207*	-.027	.063	.137	-.140	-.012	.028	.115	-.028	-.150	.214*	.247**	.062	-.021	.124	1	.175
18	.157	-.186*	-.065	.184	.199*	-.153	.003	.034	-.044	-.114	.141	.215*	.221*	.174	.229*	.206*	.175	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

opposite of what other items measure. The closer the alpha is to 1.00, the greater the internal consistency of items in the instrument being assessed. As to what is an acceptable alpha value, the rule of thumb (George & Mallery, 2001) that applies to most situations is: $\alpha > 0.9$ (excellent); $\alpha > 0.8$ (good); $\alpha > 0.7$ (acceptable); $\alpha > 0.6$ (questionable); $\alpha > 0.5$ (poor); $\alpha < 0.5$ (unacceptable).

Chronbach's Alpha was employed in the investigation to assess the internal consistency of the items in the instrument. Cronbach's alpha for all the 18 items was computed and was found to be low (0.48). The 18 variables were therefore probably not measuring the same underlying construct. It was likely that they were measuring more than one underlying construct. There were variables where the correlations between each of them and the sum of all other variables were quite low, sometimes even negative. Correspondingly, the Alpha value would increase if these items were deleted from the scale. After deleting these, further analyses were carried out and further deletions made until the Alpha value could not be increased anymore.

In our case, the initial 18 variables were reduced to a scale of 6 variables (variables 4, 5, 11, 14, 15 and 16), which had an Alpha value of 0.74. This means that the internal consistency of these six items was high and that they were likely to be measuring the same thing.

The discarded items were then analyzed separately and two additional scales were identified using the same procedure. The second scale had 5 variables (variable 2, 3, 6, 9 and 10) and a high Alpha value of 0.77. The third scale also had only 5 variables (variable 1, 12, 13, 17 and 18) but a lower Alpha value (0.56) compared to the first two scales. The generally agreed upon lower limit for Cronbach's (1951) alpha is 0.70

although this may be reduced to 0.6 in exploratory research (Robinson, Shaver and Wrightsman, 1991; Hair, et al., 1998). Variables 7 and 8 were unplaced in any of the three scales. Cronbach's Alpha analyses therefore identified three groups of related variables or scales, each one supposed to represent an underlying construct or rather an aspect of achievement motivation.

Factor Analysis with Orthogonal Rotation

Next, the 18 variables that measured the various dimensions of motivation (see **Table 5.1**) of the students in the survey were included in a factor analysis. The purpose was to validate the three scales (representing three underlying motivation constructs that would be uncovered) identified in the Cronbach's Alpha analyses carried out earlier, by demonstrating that their constituent items load on the same factors.

Using the Correlation Matrix

Generating a correlation matrix of variables is normally the starting point for all factor analyses. Factor analysis was based on the combinations of interrelations among the 18 descriptor variables (refer to **Table 5.3** for the 18 x 18 correlation matrix). With a large number of variables, it was very difficult to keep in mind or even contemplate all the intricacies of the various relationships. The quantity of information available made overall interpretation difficult. Factor Analysis would help to overcome the complexity of interpreting this large correlation matrix. It would provide a way of thinking about the interrelationships by positing the existence of underlying factors or factor constructs that account for the values appearing in the matrix of interrelations among the variables.

In essence this technique aims to take the matrix of correlations and extract (or generate) a much smaller set of "super-variables" which characterize the main trends in the correlation matrix. These "super-variables" or factors are generally much easier to understand than the matrix.

Factor Extraction

The Principal Components Method was used for factor extraction. Three factors were stipulated to be selected for rotation. The criteria for the number of factors to extract was an *a priori* one. Since the earlier Cronbach's alpha had produced three scales which were thought to represent three underlying factors, three factors were stipulated to be extracted. Varimax, an orthogonal method for rotation, was selected for use.

The factors were extracted in order of magnitude from the largest to the smallest in terms of the amount of variance explained by the component (factor). Since factors are essentially supervariables, they have a certain amount of variance associated with them. The amount of variance "explained" by a factor is related to the eigenvalue which is designed to show the proportion of variance accounted for by each factor. The eigenvalues for the three factors (components) extracted are all above 1.00 (see **Table 5.4**). It has to be noted that if a factor has an eigenvalue less than 1.0 it explains even less variance than an original variable and has to be rejected. Factors 1, 2 and 3 have eigenvalues of 4.32, 2.04 and 1.79 respectively. They accounted for slightly over 45% of the total variance. The percentages of the variance accounted for by the three factors (the eigenvalue divided by 18, the total number of variables) are also shown in **Table 5.4.**

Table 5.4 : Eigenvalues and Factor Loadings

Variable No.	Factor Reference	Measurement Items (Statements in Questionnaires)	Factor 1 Mastery Orientation	Factor 2 Learned Helplessness	Factor 3 Self-Worth Motivation
10	MO1	My ability in programming has largely contributed to success in my assignments.	**0.762**	0.023	-0.217
3	MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	**0.706**	-0.129	0.086
2	MO3	I believe that I am good at problem solving and competent in programming.	**0.692**	-0.241	-0.137
9	MO4	My success in programming assignments in the past has largely been due to hard work.	**0.653**	-0.095	-0.020
6	MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	**0.572**	-0.399	-0.258
7	MO6	To me, success means getting better grades than most students.	**0.496**	0.168	0.316
15	LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	0.016	**0.778**	-0.050
11	LH2	Luck has a lot to do with the success in my programming assignments.	-0.056	**0.746**	-0.091
16	LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	-0.196	**0.733**	0.082
5	LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	-0.446	**0.484**	0.244
4	LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	-0.121	**0.426**	0.351
14	LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	-0.285	**0.399**	0.362
13	SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	-0.253	-0.065	**0.672**
12	SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	0.038	0.007	**0.587**
17	SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	-0.079	-0.067	**0.515**
8	SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	0.397	-0.336	**0.450**
1	SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	0.086	0.220	**0.445**
18	SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	-0.048	0.283	**0.435**
		Initial Eigenvalues	4.32	2.04	1.79
		Percentage of Variance	24.00	11.34	9.95

Extraction Method : Principal Component Analysis.
Rotation Method : Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

Factor Loadings

Table 5.4 shows the factor loadings on each factor. Factor loadings vary between plus 1.0 and minus 1.0 and indicate the strength of relationship between a particular variable and a particular factor. They are therefore nothing other than correlation coefficients with a different name. A variable that has a substantial negative loading on the factor indicates that it is negatively correlated with the factor construct. The factor loadings were sorted in two ways : (a) the highest factor loadings for each factor are selected and listed in separate blocks (shaded in the table), and (b) within each block, the factor loadings are sorted from largest to smallest. If a data variable were to correlate perfectly with a factor, it would ordinarily be considered identical with the factor in what it measures.

A fairly commonly used cutoff level for orthogonal factor loadings is 0.40; that is no variable with a factor loading below 0.40 would be listed among those variables defining the factor. A squared value $(0.40)^2$ gives 0.16, which indicates that the data variable correlating with the factor at 0.40 has 16 percent of its variance in common with the factor. The other 84 percent lies elsewhere. **Table 5.5** gives a rough idea of the value of variable-factor correlations for factor interpretation purposes (Comrey and Lee, 1992). The loading must exceed 0.70 for the variable to account for 50 percent of its the variance to be in common with the factor.

Table 5.5 : Scale of Variable-Factor Correlations

Orthogonal Factor Loading	Percentage of Variance	Rating
0.71	50	Excellent
0.63	40	Very Good
0.55	30	Good
0.45	20	Fair
0.32	10	Poor

To be more stringent, the sample size has to be considered in order to determine whether the factor loading value is significant. For a sample size of about 120 respondents, factor loadings of 0.50 and above are significant (Hair et al., 1998). **Table 5.4** shows that the factor loadings on each of the three factor are generally fairly high (most of them above 0.5).

Variables 10, 3, 2, 9, 6 and 7 have loadings of 0.5 and higher on Factor 1. Variables 15, 11, 16, 5, 4 and 14 have loadings of 0.4 and higher on Factor 2. Variables 13, 12, 17, 8, 1 and 18 have loadings of 0.4 and higher on Factor 3. It can be seen that some variables loaded almost equally high on more than one factor; this implies that they are measuring aspects of more than one factor. Some of these variables which cross-load on more than one factor are variables 7, 4, 14 and 8 but the loadings are all below 0.5. Note that in an earlier Cronbach Reliability Analysis, it was found that Variables 7 and 8 were not placed in any of the three scales; these variables are normally ignored/dropped. All the other variables loaded relatively high on only one factor and low on the others.

Post Factor Analysis : Reliability Analysis Using Cronbach's Alpha

Factor analysis with 3 factors stipulated for rotation resulted in a rotated factor structure with three groups of variables, each group measuring some underlying construct of a factor. It was found that the variables under the three factors corresponded largely with those in the three scales generated earlier in the Cronbach's Alpha reliability analyses. While Variables 7 and 8 were unplaced in any of the three scales in the Cronbach's Alpha reliability analysis, Variable 7 was included in Factor 1 with the lowest factor loading (0.49), and Variable 8 appeared under Factor 3 with a factor loading of 0.45 (see **Table 5.4**).

Cronbach's alphas for each subset of variables (that is, items under each factor) were then computed. Summaries of the results of Cronbach's alpha reliability analyses are tabulated in **Table 5.6**. The Alpha value for the 6 variables under Factor 1 was 0.74 . This high Alpha value, despite the limited number of variables, indicated that there was internal consistency and that all the variables did measure the same thing. As for the 6 variables under the Factor 2, the Alpha value of 0.74 was also quite high indicating that there was high internal consistency of the items being assessed. The Alpha value for Factor 3 was 0.54 which was quite acceptable since only 6 items were assessed for internal consistency, and considering that the research is exploratory in nature.

Factors and Factor Loadings

In an ideal world, each of the original variables would load highly (e.g., > 0.5) on one of the factors and low (e.g., < 0.2) on all the others. In reality, this rarely happens.

Table 5.6 : Cronbach's Alpha Reliability Analysis

Scale 1 : Item-total Statistics

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
V10	12.4643	5.6924	.5784	.4472	.6840
V3	12.5804	5.2367	.5510	.3422	.6858
V2	12.9732	5.2335	.5990	.3912	.6715
V9	12.2679	5.9817	.4668	.3836	.7117
V6	12.6696	5.7728	.4869	.3421	.7056
V7	12.4911	6.1441	.2588	.1581	.7745

Alpha = 0.7435   Standardized item alpha = 0.7521

Scale 2 : Item-total Statistics

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
V15	12.8482	6.7605	.4643	.3189	.7132
V11	12.4464	6.0692	.5122	.3346	.7005
V16	12.1696	6.3223	.5708	.3818	.6836
V5	12.6071	6.5290	.4981	.3132	.7038
V4	11.9107	6.9289	.4305	.2641	.7219
V14	12.5268	6.6840	.4234	.2145	.7249

Alpha = 0.7446   Standardized item alpha = 0.7454

Scale 3 : Item-total Statistics

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
V13	14.6607	2.9829	.3943	.1711	.4414
V12	15.2589	2.9864	.3834	.1506	.4473
V17	14.8482	3.4452	.3088	.1111	.4905
V8	14.3125	3.9105	.1331	.0537	.5584
V1	14.5268	3.6930	.2108	.0708	.5312
V18	14.7857	3.2329	.2885	.0930	.4996

Alpha = 0.5444   Standardized item alpha = 0.5301

There will often be two or three irritating variables that end up loading on the "wrong" factor, and often a variable will load (equally high) onto two or three different factors. This therefore requires considerable understanding of the data collected, and it is rare for factor analysis to produce entirely clear results.

The factor loading matrix (**Table 5.4**) shows that although some measurement items loaded on more than one factor, in all cases the variables had the highest loadings (all above 0.4) on the factors they were expected to define and not elsewhere.

The first factor (Factor 1) composed primarily of variables that measure the mastery orientation of the respondents. We could confidently name this factor or supervariable Mastery Orientation. It was not difficult to see why these variables were loaded onto the same factor. The second factor (Factor 2) composed of the measures of self-helplessness and should be named as such: Self-helplessness. It was more difficult to give a name to the construct represented by Factor 3. While variables 12, 13, 17 and 18 are consistent with the Self Worth Motive formulation and were clearly measures of self-worth motivation, Variables 1 and 8 are not so obvious. It has to be noted that the students' interpretation of an item could be influenced both by cultural factors and by their motivational style.

Those students who have an entity view of ability (Variable 1) and believe that they don't have it could be learned helpless: "I know I can't do it because I haven't got the ability". However, in an Asian culture in which students normally attribute success and failure to effort, this entity view of ability is more likely to be seen as protection of self worth. Students who are protecting their self worth want others to believe that they are smart and that they have more ability than others. They will attribute their past failures

in programming to insufficient effort rather than a lack of ability. Moreover, they are not saying here that they are the ones who have less ability. They might have also interpreted this measurement item as indicating their lack of a particular kind of ability (i.e. ability in programming) but by implication have others that may be more important.

Variable 8 was expected have a higher loading on Factor 1 (Mastery Orientation) instead of Factor 3 (Self-worth Motivation). One would expect the mastery oriented students (rather than the self-worth motivated) to be more task-focused, defining success as having shown improvements in their work and having mastered their skills in programming. However, to the self-worth motivated, competition, including competition for high grades and striving to do better than other students in the class is something that they secretly want to avoid. They always have doubts about their own ability and failure to do better than others will certainly let others cast doubts on their ability. They therefore prefer success to be measured in terms of improvement made rather than in terms of high grades. According to Covington (1993) improvement-based reward criteria help reduce the potential threat to self-worth by deemphasizing ability.

A couple of other variables also appeared to have ended up loading on the "wrong" factor. For example, Variable 7 was supposed to measure performance goal orientation and was expected to have a major loading on Factor 3, Self-Worth Motivation. It has only a low loading of 0.316 on this factor (Self-Worth Motivation) while exhibiting a much higher loading (0.496) on Factor 1, Mastery Orientation.

The loading of variable 7 on the Mastery Orientation factor may be appropriate since this approach performance goal with a focus on good grades can be argued to be adaptive. Dweck (1986) found that students with performance goals and who are also confident in their present ability (i.e., high in self-efficacy) will demonstrate mastery behavioral patterns like seeking challenging tasks, using effective strategies and having high persistence. It was found that Variable 2 which measures self-efficacy and variable 10 which measures attribution of success to ability have very high loadings (0.76 and 0.69, respectively) on this Mastery Orientation factor.

Variable 6 which was meant to be a measure of overstriving (Atkinson, 1964), a maladaptive motivational response that is high in the motive to succeed and at the same time high in the motive to avoid failure, was expected to have a high loading on Factor 3, Self Worth Motivation. Instead, it had a negative loading of -0.258 on Factor 3 while exhibiting a high positive loading (0.572) on Factor 1 (Mastery Orientation). Looking closer, this measurement item actually emphasizes the importance of effort to ensure continuing successful outcome and is not an excuse or a rationalization for failure. In this sense, Variable 6 had therefore loaded correctly on the Mastery Orientation factor.

The Three Factors Explained

This section provides a brief description of each of the three factors : Mastery Orientation, Learned Helplessness and Self-Worth Motivation.

Factor 1 : Mastery Orientation

This factor has 6 variables and explains 17.4 % of the variance. It was named "Mastery Orientation" because most of the highly loaded items were related to a concern with achieving success, and mastery over the subject matter and programming skills. Students who are mastery oriented attribute their success to their ability as well as to the hard work they have put in. Since they have the desire to learn and to perfect their programming skills, they believe that easy assignments lack challenge and will not help them to improve. They are also confident and self-efficacious, believing that they are good at problem solving and are competent in programming. It appears that these students who are mastery oriented are also concerned with getting the best grades. They also measure their success in terms of grades and a sure sign that their ability and effort were paying off was that their grades were better than most students. These mastery oriented students had put in a lot of effort to learn their skills and wanted to continue to accept challenges and to prove to themselves that they have the ability to excel in programming. The six variables with loadings of 0.4 or more on this factor are shown in Table5.4.

Factor 2 : Learned Helplessness

This factor also has 6 variables and explains 15.5 % of the variance. It was named "Learned Helplessness" because the variables with high loadings on this factor were related to a maladaptive motivational style by the same name. Students who were learned helpless attributed their past failures to bad luck and to the toughness of the programming assignments. They also attributed their failures to their lack of ability and

saw the lack of ability as being beyond personal control. These students often worried that they might get poor grades and that they did not have the ability to do programming. If they could, they would choose a very easy assignment that they could cope with because this would certainly reduce or eliminate the risk of failure. They believed that it was no use for them to put in more effort since they kept on getting poor grades no matter how hard they had tried in the past. The variables with loadings of 0.4 or more on this factor are shown in **Table 5.4**.

Factor 3 : Self-Worth Motivation

This factor has 6 variables and explains 12.3 % of the variance. It was named "Self-worth Motivation" because the highly loaded items were related to another maladaptive motivational style identified by the same name (Covington, 1992). Students governed by the self-worth motive often use defensive strategies in order to protect their self-esteem against possible or anticipated effects of failure. Self-worth motivation resembles learned helplessness only inasmuch as students demonstrating these motivational styles share a concern with levels of ability. Individuals who were high on this factor attributed their past failures to lack of effort on their part, insufficient knowledge and choosing/using the wrong strategies or techniques. They also gave the excuse that too many assignment rules and regulations were being imposed and these could have hindered their performance. They attributed their previous successes to the fact that the assignments were too easy and could have been done by any student (even low performers) in the class. What these self-worth motivated students were saying was that the very easy assignments did not allow them to demonstrate that they were more able than other students. As a corollary, these self-worth motivated students were likely to blame their failures on the difficulty of their assignments.

These individuals had an entity view of ability, believing that some people had more ability than others and that there would always be differences between them. These students who were protecting their self-worth wanted others to believe that they were smarter than others even though deep down they had doubts on their own ability to succeed on the task at hand (Covington, 1984). Competition, including competition for high grades, was something that they wanted to avoid. The self-worth motivated students also preferred success to be measured in terms of improvement made rather than in terms of high grades. They had no confidence in getting good grades or better grades than most students, and failure to do so would certainly let others cast doubts on their ability. The variables with loadings of 0.4 or more on this factor are also shown in **Table 5.4.**

Mean Factor Scores

In order to compare the Mastery Orientation of two different groups of students, the mean factor scores (Comrey & Lee, 1992) for the two groups have to be computed. There is no need to compare the means of the various variables that come under this factor.

If there is a factor-pure variable that defines a factor then the score for that variable alone can be used as a factor score. This is also sometimes called a surrogate variable, one that is representative of a factor (Hair, et al., 1998). The factor matrix would be examined and the variable with the highest loading would be selected as a surrogate representative for that particular factor.

It is more usual, however, to have several variables that are related to the factor but none of which has anything approaching 80% of its variance concentrated in this one factor. In such cases factor scores are estimated using the scores of those variables related to the factor. A simple method recommended by Comrey and Lee (1992) is first to single out all those data variables that have factor loadings on the factor above a certain selected cutoff for example, 0.40. The raw scores for these data variables may be added up to provide a rough estimate of the factor score on this factor for a given individual. Some have called this a summated scale (Hair, et al., 1998), which is formed by combining several variables into a single composite measure. In simple terms, all of the variables loading highly on a factor are combined and the total, or more commonly the average score of the variables, is used. The scores for all the factors are calculated using this method.

Comparing the Mean Factor Scores of the Four Groups

A comparison of the mean factor scores between high performers and low performers before the team assignment can be seen in **Table 5.7.1**. High Performers have a significantly higher mean factor score for Factor 1, Mastery Orientation, than Low Performers (2.68 and 2.38; $p < 0.01$). The mean factor scores of the two groups for Factor 2 (Learned Helplessness) were not very different from each other (2.42 and 2.56 for high performers and low performers, respectively). Both groups had equally high mean factor scores for Factor 3 (Self-worth Motivation). The mean factor score for High Performers was only slightly lower than that for Low Performers (2.90 and 2.99).

Table 5.7.2 shows the differences in the mean factor scores of high performers and low performers after the team assignment. The mean factor scores of High and Low

Table 5.7.1 : Pre Assignment Factor Scores -- HPs and LPs Compared

Variables	Measurement Items	HPs N = 52 M, (SD)	LPs N = 60 M, (SD)	Mean Difference	t-value	SIG (2-tailed)
MO1	My ability in programming has largely contributed to success in my assignments.	2.67 (0.59)	2.58 (0.65)	0.09	0.77	0.44
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.81 (0.72)	2.25 (0.73)	0.56	4.08	0.00
MO3	I believe that I am good at problem solving and competent in programming.	2.37 (0.82)	1.90 (0.57)	0.47	3.44	0.00
MO4	My success in programming assignments in the past has largely been due to hard work.	2.90 (0.57)	2.75 (0.65)	0.15	1.33	0.19
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.52 (0.61)	2.33 (0.71)	0.19	1.48	0.14
MO6	To me, success means getting better grades than most students.	2.77 (0.70)	2.45 (0.83)	0.32	2.17	0.03
	Mean Factor Score (Mastery Orientation)	2.68 (0.47)	2.38 (0.42)	0.30	3.52	0.00
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	1.96 (0.71)	2.13 (0.70)	-0.17	-1.28	0.20
LH2	Luck has a lot to do with the success in my programming assignments.	2.42 (0.936)	2.48 (0.792)	-0.06	-0.37	0.71
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.63 (0.69)	2.82 (0.77)	-0.19	-1.32	0.19
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.21 (0.78)	2.37 (0.71)	-0.16	-1.10	0.27
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.90 (0.75)	3.07 (0.63)	-0.17	-1.25	0.22
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.33 (0.73)	2.42 (0.81)	-0.09	-0.61	0.54
	Mean Factor Score (Learned Helplessness)	2.42 (0.56)	2.56 (0.43)	-0.14	-1.46	0.15
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	2.94 (0.73)	3.08 (0.70)	-0.14	-1.05	0.30
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.33 (0.73)	2.50 (0.70)	-0.17	-1.28	0.21
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.75 (0.56)	2.90 (0.60)	-0.15	-1.36	0.18
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.40 (0.53)	3.33 (0.51)	0.07	0.71	0.48
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.21 (0.54)	3.10 (0.57)	0.11	1.06	0.29
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.75 (0.68)	3.02 (0.70)	-0.27	-2.03	0.04
	Mean Factor Score (Self Worth Motivation)	2.90 (0.34)	2.99 (0.36)	0.09	-1.38	0.17

Table 5.7.2 : Post Assignment Factor Scores -- HPs and LPs Compared

Variables	Measurement Items	HPs N = 52 M, (SD)	LPs N = 60 M, (SD)	Mean Difference	t-value	SIG (2-tailed)
MO1	My ability in programming has largely contributed to success in my assignments.	2.96 (0.48)	2.72 (0.52)	0.24	2.57	0.01
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.69 (0.73)	2.52 (0.68)	0.17	1.32	0.19
MO3	I believe that I am good at problem solving and competent in programming.	2.75 (0.71)	2.15 (0.48)	0.60	5.15	0.00
MO4	My success in programming assignments in the past has largely been due to hard work.	3.00 (0.52)	2.87 (0.43)	0.13	1.48	0.14
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.88 (0.68)	2.63 (0.66)	0.25	1.98	0.05
MO6	To me, success means getting better grades than most students.	2.75 (0.76)	2.48 (0.70)	0.27	0.90	0.06
	Mean Factor Score (Mastery Orientation)	2.85 (0.45)	2.57 (0.39)	0.28	3.53	0.00
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	1.98 (0.67)	2.13 (0.75)	-0.15	-1.13	0.26
LH2	Luck has a lot to do with the success in my programming assignments.	2.31 (0.70)	2.57 (0.77)	-0.26	-1.86	0.07
LH2	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.65 (0.68)	2.58 (0.59)	0.07	0.59	0.56
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.10 (0.69)	2.43 (0.59)	-0.33	-2.78	0.01
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.75 (0.68)	3.03 (0.66)	-0.28	-2.22	0.03
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.15 (0.70)	2.35 (0.78)	-0.20	-1.40	0.17
	Mean Factor Score (Learned Helplessness)	2.33 (0.45)	2.52 (0.41)	-0.19	-2.37	0.02
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	2.92 (0.56)	3.05 (0.62)	-0.13	-1.13	0.26
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.46 (0.73)	2.60 (0.62)	-0.14	-1.09	0.28
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.77 (0.51)	2.87 (0.65)	-0.10	-0.87	0.39
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.31 (0.54)	3.32 (0.60)	-0.01	0.69	0.93
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.10 (0.63)	3.08 (0.72)	0.02	0.10	0.92
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.94 (0.75)	2.87 (0.72)	0.07	0.54	0.59
	Mean Factor Score (Self Worth Motivation)	2.92 (0.31)	2.97 (0.35)	-0.05	-0.76	0.45

Performers for Factor 1 (Mastery orientation) moved up after they had completed their team assignment (to 2.85 and 2.57 respectively). The difference in the two groups' mean factor scores was still significant (p < 0.01). After the assignment, the High Performers' mean factor score for Factor 2 (Learned Helplessness) was lowered (from 2.42 to 2.33). Similarly, the mean factor score for Low Performers went down slightly from 2.56 to 2.52. There was a significant difference in the mean factor scores between the two groups (2.33 and 2.52; p= 0.02). After the team assignment, the mean factor scores for Factor 3 (Self-worth motivation) for the two groups remained high and there was no significant difference between the two groups (2.92 for high performers and 2.97 for low performers).

High performers were in HPTs as well as MPTs. There was a need to find out, using simple *t*-tests, whether there were significant differences in the pre assignment and post assignment factor scores of HPs both in HPTs and in MPTs. Similarly, low performers were in LPTs as well as MPTs. Again, there was a need to find out using *t*-tests whether there were any significant differences in the pre assignment and the post assignment factor scores of these two groups. Finally, using ANOVA, the factor scores for the four groups were compared to see whether there were any significant differences in the factor scores among these four groups. In order to find out which pair of means differed significantly, the Tukey HSD (Honestly Significant Difference) post hoc test was used.

Tables 5.7.3 to 5.7.6 show the motivational responses of the 4 groups (High Performers in HPT, Low Performers in LPT, High Performers in MPT and Low Performers in MPT) both before and after the team assignment, and the significance in the changes, if any. The mean factor scores for the four groups of students, both before

Table 5.7.3 : Pre and Post Assignment Factor Scores -- HPs in HPTs (N=26)

Variables	Measurement Items	PRE MEAN (SD)	POST MEAN (SD)	DIFF	t-value	SIG (2-tailed) (d)
MO1	My ability in programming has largely contributed to success in my assignments.	2.69 (0.55)	3.04 (0.45)	-0.35	-3.10	0.00
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.85 (0.61)	2.73 (0.67)	0.12	1.36	0.18
MO3	I believe that I am good at problem solving and competent in programming.	2.50 (0.76)	3.00 (0.63)	-0.50	-5.00	0.00
MO4	My success in programming assignments in the past has largely been due to hard work.	2.88 (0.52)	3.15 (0.46)	-0.27	-3.04	0.01
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.50 (0.58)	2.96 (0.66)	-0.46	-3.638	0.00
MO6	To me, success means getting better grades than most students.	2.77 (0.65)	2.81 (0.69)	-0.04	-0.33	0.75
	Mean Factor Score (Mastery Orientation)	2.70 (0.45)	2.96 (0.41)	-0.26	-4.32	0.00 (0.60)
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	2.12 (0.82)	2.12 (0.77)	0.00	0.000	1.00
LH2	Luck has a lot to do with the success in my programming assignments.	2.46 (0.99)	2.31 (0.74)	0.15	0.78	0.44
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.77 (0.71)	2.85 (0.54)	-0.08	-0.53	0.60
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.15 (0.83)	1.96 (0.60)	0.19	1.10	0.28
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.81 (0.85)	2.73 (0.72)	0.08	0.49	0.63
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.35 (0.69)	2.00 (0.57)	0.35	2.56	0.017
	Mean Factor Score (Learned Helplessness)	2.45 (0.62)	2.33 (0.45)	0.12	1.37	0.18 (0.22)
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	2.85 (0.84)	3.00 (0.57)	-0.15	-1.07	0.29
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.42 (0.86)	2.54 (0.86)	-0.12	-0.57	0.57
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.77 (0.59)	2.92 (0.48)	-0.15	-1.07	0.29
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.23 (0.51)	3.35 (0.56)	-0.12	-1.14	0.27
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.31 (0.55)	3.08 (0.69)	0.23	1.81	0.08
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.69 (0.79)	2.96 (0.66)	-0.27	-1.90	0.07
	Mean Factor Score (Self Worth Motivation)	2.88 (0.43)	2.98 (0.33)	-0.10	-1.75	0.09 (0.26)

Table 5.7.4 : Pre and Post Assignment Factor Scores — LPs in LPTs (*N*=34)

Variables	Measurement Items	PRE MEAN (SD)	POST MEAN (SD)	DIFF	t-value	SIG (2-tailed) (*d*)
MO1	My ability in programming has largely contributed to success in my assignments.	2.71 (0.63)	2.74 (0.57)	-0.03	-0.30	0.77
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.24 (0.78)	2.59 (0.74)	-0.35	-3.19	0.00
MO3	I believe that I am good at problem solving and competent in programming.	2.00 (0.60)	2.18 (0.46)	-0.18	-1.79	0.08
MO4	My success in programming assignments in the past has largely been due to hard work.	2.88 (0.64)	2.88 (0.41)	0.00	0.00	1.00
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.44 (0.75)	2.76 (0.74)	-0.32	-2.07	0.05
MO6	To me, success means getting better grades than most students.	2.53 (0.83)	2.56 (0.79)	-0.03	-0.22	0.83
	Mean Factor Score (Mastery Orientation)	**2.47 (0.42)**	**2.62 (0.46)**	**-0.15**	**-2.59**	**0.01 (0.34)**
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	2.03 (0.67)	2.09 (0.71)	-0.06	-0.37	0.71
LH2	Luck has a lot to do with the success in my programming assignments.	2.35 (0.77)	2.47 (0.79)	-0.12	-0.64	0.52
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.65 (0.88)	2.62 (0.49)	0.03	0.18	0.86
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.38 (0.78)	2.44 (0.61)	-0.06	-0.40	0.69
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.12 (0.64)	3.00 (0.74)	0.12	1.00	0.33
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.32 (0.81)	2.26 (0.79)	0.06	0.35	0.73
	Mean Factor Score (Learned Helplessness)	**2.48 (0.47)**	**2.49 (0.41)**	**-0.01**	**-0.05**	**0.96 (0.02)**
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.15 (0.70)	3.09 (0.62)	0.06	0.49	0.62
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.47 (0.75)	2.59 (0.61)	-0.12	-0.94	0.35
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.97 (0.58)	2.91 (0.62)	0.06	0.53	0.60
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.47 (0.51)	3.35 (0.54)	0.12	1.07	0.29
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.06 (0.55)	3.12 (0.73)	-0.06	-0.57	0.57
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.88 (0.69)	2.82 (0.67)	0.06	0.44	0.66
	Mean Factor Score (Self Worth Motivation)	**3.01 (0.36)**	**2.99 (0.28)**	**0.02**	**0.33**	**0.74 (0.06)**

Table 5.7.5 : Pre and Post Assignment Factor Scores -- HPs in MPTs (*N*=26)

Variables	Measurement Items	PRE MEAN (SD)	POST MEAN (SD)	DIFF	t-value	SIG (2-tailed) (*d*)
MO1	My ability in programming has largely contributed to success in my assignments.	2.65 (0.63)	2.89 (0.52)	-0.23	-2.00	0.06
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.77 (0.82)	2.65 (0.80)	0.12	0.68	0.50
MO3	I believe that I am good at problem solving and competent in programming.	2.23 (0.86)	2.50 (0.71)	-0.27	-1.66	0.11
MO4	My success in programming assignments in the past has largely been due to hard work.	2.92 (0.63)	2.85 (0.54)	0.07	0.81	0.43
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.54 (0.65)	2.81 (0.69)	-0.27	-1.90	0.07
MO6	To me, success means getting better grades than most students.	2.77 (0.76)	2.69 (0.84)	0.08	0.53	0.60
	Mean Factor Score (Mastery Orientation)	2.65 (0.49)	2.74 (0.47)	-0.09	-1.13	0.27 (0.19)
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	1.81 (0.57)	1.85 (0.54)	-0.04	-0.296	0.77
LH2	Luck has a lot to do with the success in my programming assignments.	2.38 (0.90)	2.31 (0.68)	0.07	0.700	0.49
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.50 (0.65)	2.46 (0.76)	0.04	0.24	0.81
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.27 (0.72)	2.23 (0.76)	0.04	0.23	0.82
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.00 (0.63)	2.77 (0.65)	0.23	1.66	0.11
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.31 (0.79)	2.31 (0.79)	0.00	0.00	1.00
	Mean Factor Score (Learned Helplessness)	2.38 (0.51)	2.33 (0.46)	0.05	0.71	0.49 (0.10)
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.04 (0.60)	2.85 (0.54)	0.19	1.55	0.13
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.23 (0.59)	2.38 (0.57)	-0.15	-1.16	0.256
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.73 (0.53)	2.62 (0.50)	0.11	0.827	0.416
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.58 (0.50)	3.27 (0.53)	0.31	2.54	0.02
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.12 (0.52)	3.12 (0.59)	0.00	0.00	1.00
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.81 (0.57)	2.92 (0.84)	-0.11	-0.68	0.50
	Mean Factor Score (Self Worth Motivation)	2.92 (0.23)	2.86 (0.27)	0.06	0.93	0.36 (0.24)

Table 5.7.6 : Pre and Post Assignment Factor Scores -- LPs in MPTs (*N*=26)

Variables	Measurement Items	PRE MEAN (SD)	POST MEAN (SD)	DIFF	t value	SIG (2-tailed) (d)
MO1	My ability in programming has largely contributed to success in my assignments.	2.42 (0.64)	2.69 (0.47)	-0.27	-1.89	0.07
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.27 (0.67)	2.42 (0.58)	-0.15	-1.16	0.26
MO3	I believe that I am good at problem solving and competent in programming.	1.77 (0.51)	2.12 (0.52)	-0.35	-3.14	0.00
MO4	My success in programming assignments in the past has largely been due to hard work.	2.58 (0.64)	2.85 (0.46)	-0.27	-2.27	0.03
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.19 (0.63)	2.46 (0.51)	-0.27	-1.90	0.07
MO6	To me, success means getting better grades than most students.	2.35 (0.85)	2.38 (0.57)	-0.03	-0.27	0.79
	Mean Factor Score (Mastery Orientation)	2.27 (0.40)	2.49 (0.28)	-0.22	-3.79	0.00 (0.65)
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	2.27 (0.72)	2.19 (0.80)	0.08	0.46	0.65
LH2	Luck has a lot to do with the success in my programming assignments.	2.65 (0.80)	2.69 (0.74)	-0.04	-0.23	0.82
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	3.04 (0.53)	2.54 (0.71)	0.50	3.61	0.00
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.35 (0.63)	2.42 (0.58)	-0.07	-0.70	0.49
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	3.00 (0.63)	3.08 (0.56)	-0.08	-0.70	0.49
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.54 (0.81)	2.46 (0.76)	0.08	0.70	0.49
	Mean Factor Score (Learned Helplessness)	2.65 (0.36)	2.57 (0.42)	0.08	1.13	0.27 (0.21)
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.00 (0.69)	3.00 (0.63)	0.00	0.00	1.00
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.54 (0.65)	2.62 (0.64)	-0.08	-0.70	0.49
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.81 (0.63)	2.81 (0.69)	0.00	0.00	1.00
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.15 (0.46)	3.27 (0.67)	-0.12	-0.83	0.42
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.15 (0.61)	3.04 (0.72)	0.11	0.62	0.54
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	3.19 (0.69)	2.92 (0.80)	0.27	1.49	0.15
	Mean Factor Score (Self Worth Motivation)	2.98 (0.36)	2.95 (0.43)	0.03	0.374	0.71 (0.08)

and after the team assignment, were calculated and are presented in the same four tables. The significance of the change in motivational responses are shown in the last column of each table. **Tables 5.8.1 and 5.8.2** summarize the results of the One-way ANOVA and the Tukey HSD test for the pre- and post-assignment survey data.

Measure of Effect Size

In evaluating a study there are two steps. First, whether the result is statistically significant is considered. If it is, this means that there is real effect. Whether the effect is large enough to make the result useful or interesting is then considered.

The level of significance does reveal something. It tells the researcher how confident he can be that he can reject the null hypothesis, that there is a nonzero effect. The lower the p level, the stronger the evidence for a nonzero effect. The p level indicates the strength of the evidence that there is a nonzero effect but does not show how big that nonzero effect is (Aron and Aron,1999).

Non-significant results are unthinkingly interpreted as showing there is in fact no effect. Significant result is interpreted as being an "important" result; that is significance is confused with a large effect size. If the sample size is large, a result with a tiny effect size could be statistically significant at $p < 0.01$. If the sample size was small enough, a result with a huge effect size could not be statistically significant at all. Therefore what is important is the effect size and not whether a result is non-zero.

Table 5.8.1 : Pre Assignment Survey -- Significance of Differences in Responses (ANOVA)

Variables	Measurement Items	Group 1 HP in HPT* N = 26 M, (SD)	Group 2 LP in LPT* N = 34 M, (SD)	Group 3 HP in MPT* N = 26 M, (SD)	Group 4 LP in MPT* N = 26 M, (SD)	Sum of Squares	df	F value	Sig	Pairwise Comparison of Groups Using Tukey HSD **
MO1	My ability in programming has largely contributed to success in my assignments.	2.69 (0.55)	2.71 (0.63)	2.65 (0.63)	2.42 (0.64)	1.42	3	1.25	0.29	
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.85 (0.61)	2.24 (0.78)	2.77 (0.82)	2.27 (0.67)	8.76	3	5.50	0.00	1>2, 4; 3>2
MO3	I believe that I am good at problem solving and competent in programming.	2.50 (0.76)	2.00 (0.60)	2.23 (0.86)	1.77 (0.51)	7.76	3	5.40	0.00	1>2, 4
MO4	My success in programming assignments in the past has largely been due to hard work.	2.88 (0.52)	2.88 (0.64)	2.92 (0.63)	2.58 (0.64)	2.05	3	1.83	0.15	
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.50 (0.58)	2.44 (0.75)	2.54 (0.65)	2.19 (0.63)	1.89	3	1.44	0.24	
MO6	To me, success means getting better grades than most students.	2.77 (0.65)	2.53 (0.83)	2.77 (0.76)	2.35 (0.85)	3.33	3	1.83	0.15	
	Mean Factor Score (Mastery Orientation)	2.70 (0.45)	2.47 (0.42)	2.65 (0.49)	2.27 (0.40)	3.08	3	5.29	0.00	1>4 3>4
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	2.12 (0.82)	2.03 (0.67)	1.81 (0.57)	2.27 (0.72)	2.90	3	1.98	0.12	
LH2	Luck has a lot to do with the success in my programming assignments.	2.46 (0.99)	2.35 (0.77)	2.38 (0.90)	2.65 (0.80)	1.51	3	0.68	0.57	
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.77 (0.71)	2.65 (0.88)	2.50 (0.65)	3.04 (0.53)	4.12	3	2.66	0.05	4>3

Table 5.8.1 (Continued)

Code	Statement									
LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	2.15 (0.83)	2.38 (0.78)	2.27 (0.72)	2.35 (0.63)	0.86	3	0.51	0.67	
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.81 (0.85)	3.12 (0.64)	3.00 (0.63)	3.00 (0.63)	1.42	3	0.99	0.40	
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.35 (0.69)	2.32 (0.81)	2.31 (0.79)	2.54 (0.81)	0.92	3	0.51	0.68	
	Mean Factor Score (Learned Helplessness)	2.45 (0.62)	2.48 (0.47)	2.38 (0.51)	2.65 (0.36)	0.98	3	1.32	0.27	
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	2.85 (0.84)	3.15 (0.70)	3.04 (0.60)	3.00 (0.69)	1.35	3	0.89	0.49	
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.42 (0.86)	2.47 (0.75)	2.23 (0.59)	2.54 (0.65)	1.38	3	0.89	0.45	
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.77 (0.59)	2.97 (0.58)	2.73 (0.53)	2.81 (0.63)	1.04	3	1.02	0.39	
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.23 (0.51)	3.47 (0.51)	3.58 (0.50)	3.15 (0.46)	3.17	3	4.26	0.01	3>4
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.31 (0.55)	3.06 (0.55)	3.12 (0.52)	3.15 (0.61)	0.96	3	1.03	0.38	
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.69 (0.79)	2.88 (0.69)	2.81 (0.57)	3.19 (0.69)	3.57	3	2.51	0.06	4>1
	Mean Factor Score (Self Worth Motivation)	2.88 (0.43)	3.01 (0.36)	2.92 (0.23)	2.98 (0.36)	0.26	3	0.70	0.55	

* HP : High Performers; LP : Low Performers; HPT : High Performers Teams; LPT : Low Performers Teams; MPT : Mixed Performers Teams

** Significant differences between groups at 0.05 level.

Table 5.8.2 : Post Assignment Survey : Significance of Differences in Responses (ANOVA)

Variables	Measurement Items	Group 1 HP in HPT* N = 26 M, (SD)	Group 2 LP in LPT* N = 34 M, (SD)	Group 3 HP in MPT* N = 26 M, (SD)	Group 4 LP in MPT* N = 26 M, (SD)	Sum of Squares	df	F value	Sig	Pairwise Comparison of Groups Using Tukey HSD **
MO1	My ability in programming has largely contributed to success in my assignments.	3.04 (0.45)	2.74 (0.57)	2.89 (0.52)	2.69 (0.47)	2.01	3	2.60	0.06	
MO2	I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	2.73 (0.67)	2.59 (0.74)	2.65 (0.80)	2.42 (0.58)	1.34	3	0.90	0.44	
MO3	I believe that I am good at problem solving and competent in programming.	3.00 (0.63)	2.18 (0.46)	2.50 (0.71)	2.12 (0.52)	13.33	3	13.30	0.00	1>2, 3, 4
MO4	My success in programming assignments in the past has largely been due to hard work.	3.15 (0.46)	2.88 (0.41)	2.85 (0.54)	2.85 (0.46)	1.75	3	2.65	0.05	
MO5	I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	2.96 (0.66)	2.76 (0.74)	2.81 (0.69)	2.46 (0.51)	3.42	3	2.59	0.05	1>4
MO6	To me, success means getting better grades than most students.	2.81 (0.69)	2.56 (0.79)	2.69 (0.84)	2.38 (0.57)	2.60	3	1.61	0.19	
	Mean Factor Score (Mastery Orientation)	2.95 (0.41)	2.62 (0.46)	2.74 (0.47)	2.49 (0.28)	3.04	3	5.98	0.00	1>2,4
LH1	When I didn't do well in my programming assignment, it was because luck was not on my side.	2.12 (0.77)	2.09 (0.71)	1.85 (0.54)	2.19 (0.80)	1.75	3	1.15	0.33	
LH2	Luck has a lot to do with the success in my programming assignments.	2.31 (0.74)	2.47 (0.79)	2.31 (0.68)	2.69 (0.74)	2.59	3	1.58	0.20	
LH3	When I was not successful in the past, it was because the programming assignment was too tough for many students.	2.85 (0.54)	2.62 (0.49)	2.46 (0.76)	2.54 (0.71)	2.15	3	1.83	0.15	

Table 5.8.2 (Continued)

LH4	I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	1.96 (0.60)	2.44 (0.61)	2.23 (0.76)	2.42 (0.58)	4.11	3	3.34	0.02	2>1 4>1
LH5	I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	2.73 (0.72)	3.00 (0.74)	2.77 (0.65)	3.08 (0.56)	2.34	3	1.70	0.17	
LH6	When I did not perform well in my programming assignments in the past, it was because I am not very smart.	2.00 (0.57)	2.26 (0.79)	2.31 (0.79)	2.46 (0.76)	2.87	3	1.77	0.16	
	Mean Factor Score (Learned Helplessness)	2.33 (0.45)	2.49 (0.41)	2.33 (0.46)	2.57 (0.42)	1.15	3	2.04	0.11	
SWM1	When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	3.00 (0.57)	3.09 (0.62)	2.85 (0.54)	3.00 (0.63)	0.87	3	0.82	0.48	
SWM2	I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	2.54 (0.86)	2.59 (0.61)	2.38 (0.57)	2.62 (0.64)	0.85	3	0.63	0.60	
SWM3	I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	2.92 (0.48)	2.91 (0.62)	2.62 (0.50)	2.81 (0.69)	1.66	3	1.62	0.19	
SWM4	Success means that I have shown improvement in my work and that I have mastered my programming skills.	3.35 (0.56)	3.35 (0.54)	3.27 (0.53)	3.27 (0.67)	0.18	3	0.18	0.91	
SWM5	I believe that some people have more ability than others and this means that there will always be differences between them.	3.08 (0.69)	3.12 (0.73)	3.12 (0.59)	3.04 (0.72)	0.12	3	0.08	0.97	
SWM6	I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	2.96 (0.66)	2.82 (0.67)	2.92 (0.84)	2.92 (0.80)	0.33	3	0.20	0.90	
	Mean Factor Score (Self Worth Motivation)	2.98 (0.33)	2.99 (0.28)	2.86 (0.27)	2.95 (0.43)	0.26	3	0.78	0.51	

* HP : High Performers; LP : Low Performers; HPT : High Performers Teams; LPT : Low Performers Teams; MPT : Mixed Performers Teams

** Significant differences between groups at 0.05 level.

Effect size is simply a way of quantifying the effectiveness of a particular intervention (for example, the cooperative team assignment in this study). There is a need in this investigation to use effect size to show how big the difference is between the pre and post assignment factor means, since the 4-point scale used for measurement is not one whose interpretation will be familiar to most people. Cohen's (1988) d was used to calculate the effect size. It was computed simply by dividing the difference in the pre and post factor means by the pooled standard deviation.

Specifically what has to be known is the size of the effect of the intervention and not just the statistical significance of the differences in the pre assignment factors scores and the post assignment factor means. To say that the difference in the pre assignment and post assignment score of a derived factor is 0.80 is not particularly informative. It is not known whether this is a big difference or a small difference because the units of measure are not something that most people have an intuitive feel for. The effect size will indicate whether the difference is large enough to make the result useful, meaningful or interesting. The larger the difference between the pre and post assignment factor means and the smaller their standard deviations, the larger the effect size.

Cohen (1988) laid out some very general guidelines for what he considered to be small, medium and large effect sizes. He characterized $d = 0.20$ as an effect that is small, but probably meaningful, an effect size, $d = 0.50$ as a medium effect that most people would be able to notice (such as half a standard deviation difference in IQ), and an effect size of 0.80 as large. These defined levels are helpful as a rough guide. The APA Task Force on Statistical Inference's advice is: "Always provide some effect-size

estimate when reporting a *p* value." (Wilkinson & The APA task Force on Statistical Inference, 1999 : 599).

For High Performers in High Performers Teams (see **Table 5.7.3**) their highest factor score (2.88) before the team assignment was for Self Worth Motivation. The post assignment score for this factor went up to 2.98 but the increase was not statistically significant. The effect size of 0.26 is considered small but is probably meaningful.

There was a slight drop in the factor score for Learned Helplessness (from 2.45 to 2.33) after the assignment. The effect of the cooperative team assignment (effect size of 0.22) on this motivational style of high performers in HPTs is also considered small. The increase in the Mastery Orientation factor score (from 2.70 to 2.96) after the assignment was statistically significant (p < 0.01). The effect size of 0.60 is considered a medium effect and is both meaningful and interesting.

As for the high performers in Mixed Performers Teams (see **Table 5.7.5**), their Self Worth Motivation factor score was also the highest of their three factor scores both before and after the cooperative assignment. This factor score went down from 2.92 to 2.86. The change was not statistically significant and the size of the effect (0.20) was small but probably meaningful. There was also a slight (not statistically significant) increase in the Mastery Orientation factor score, from 2.65 to 2.74 after the assignment. The size of the effect (0.19) was also small. The score for the Learned Helplessness factor went down slightly from 2.38 to 2.33. The effect size of 0.10 was also considered small.

Low Performers in Low Performers Teams also had a high factor score (highest compared to the other two factor scores) for Self Worth Motivation both before and after the team assignment (3.01 and 2.99 respectively) (see **Table 5.7.4**). There was only a small (not statistically significant) drop in the factor score after the assignment. The effect size of 0.06 was too small to be meaningful. There was only a small and insignificant change in the score for the Learned Helplessness factor after the assignment (from 2.48 to 2.49) and the effect size of 0.02 was also too small to be meaningful. The Mastery Orientation factor score went up from 2.47 to 2.62 after the team assignment. The change was statistically significant at 0.05 level. The effect size of 0.34 is considered small but interesting.

The Self Worth Motivation factor score was also the highest of the three factor scores for Low Performers in Mixed Performers Teams, both before and after the cooperative team assignment (see **Table 5.7.6**). The Self Worth Motivation score went down only slightly from 2.98 to 2.95 after the assignment. The effect size of 0.08 was considered small. The Learned Helplessness factor score also went down from 2.65 to 2.57. The change was not statistically significant. However, the size of the effect for Learned Helplessness (0.21) was small but meaningful. The factor score for Mastery Orientation went up from 2.27 to 2.49. The change was statistically significant at 0.01 level. The size of the effect was 0.65. This is a medium effect, an effect that is anticipated in the present investigation of the benefits of cooperative teamwork as an intervention especially for Low Performers.

Tables 5.8.1 and 5.8.2 compare the motivational styles of the four groups before and after the assignment, respectively. A one-way analysis of variance was carried out for the means of the 18 variables and the scores of the three factors for four independent

groups (HPs in HPTs, LPs in LPTs, HPs in MPTs and LPs in MPTs). In addition to determining whether significant differences existed among the means and factor scores, there was also a need to know which pair of means differed significantly. The Tukey HSD (Honestly Significant Difference) post hoc test was used to do this. **Tables 5.8.1 and 5.8.2** summarize the results of the One-way ANOVA and the Tukey HSD test for the pre- and post-assignment survey data.

Of the three factors, the factor score for the Self-worth Motivation Factor was the highest for all the four groups, both before and after the team assignment. **Table 5.8.1** shows that the Self-Worth Motivational style had high scores in all the four groups and the one-way analysis of variance confirmed that the means did not differ significantly from each other. This maladaptive motivational style continued to have the highest factor scores among the four groups even after the team assignment. The post-assignment factor scores for the four groups also did not differ significantly from each other (see **Table 5.8.2**).

Table 5.8.1 shows that before the team assignment, the scores for the Mastery Orientation factor were not as high as the scores for Self-worth Motivation factor for all the four groups. There was a significant difference in the factor scores of the four groups. The Mastery Orientation factor scores for the two groups of high performers (mean factor score of 2.70 for those in HPT, and 2.65 for those in MPT) were the highest. The LPs in MPTs had the lowest Mastery Orientation factor score (2.27) followed by LPs in LPTs (2.47). **Table 5.8.2** shows that the Mastery Orientation factor scores for all groups have moved up after the team assignment but the mean factor scores for the high performers in both High Performance Teams and Mixed Performance Teams (2.95 and 2.74 respectively) continued to be the highest. Before the

assignment, the Mastery Orientation factor scores for low performers in Mixed Performance Teams (2.27) and Low Performance Teams (2.47) were the lowest of the four group. After the assignment, the Mastery Orientation scores for low performers in MPTs and LPTs were still the lowest of the four groups and were significantly lower ($p < 0.05$) than the high performers in High Performers Teams (see **Table 5.8.2**).

There were no statistically significant differences between the mean factor scores for Learned-helplessness for the four groups both before and after the team assignment (see **Tables 5.8.1 and 5.8.2**). However, before the team assignment, the group with the highest factor score for learned helplessness (at 2.65) was the LPs in MPTs and the group with the lowest factor score (2.38) was the HPs in MPTs. After the assignment, the LPs in MPTs continue to have the highest factor score (2.57) for learned helplessness among the four groups.

Summary of Findings

Principal Components Analysis helped to identify three factors which were found to correspond to Mastery Orientation (an adaptive motivational style) and two maladaptive motivational styles, namely Self-Worth Motivation and Learned Helplessness. Each of these were represented by six variables, each one with a measurement item in the survey questionnaire used.

In most cases, the variables had major loadings on the factors they were expected to define and not elsewhere. However, a few variables had unexpectedly and interestingly ended up loading on the "wrong" factors. Some of the questionnaire items did not appear to measure what they were designed to measure. Students' interpretation of a

measurement item could be influenced both by cultural factors and by their motivational style.

For example, Variable 8 which was supposed to measure mastery goal ("Success means that I have shown improvement in my work and that I have mastered my programming skills.") had a higher loading on Factor 3 (Self-worth Motivation) instead of Factor 1 (Mastery Orientation). It can also be argued that students who were protecting their self-worth preferred success to be measured in terms of improvement made rather than in terms of high grades. Improvement-based reward criteria can help reduce the potential threat to self-worth by deemphasizing ability (Covington,1993).

Another variable which surprisingly ended up loading on a "wrong" factor was Variable 7. This variable was designed to measure performance goal orientation and was expected to have a major loading on Factor 3, Self-Worth Motivation but instead had a much higher loading on Factor 1, Mastery Orientation. Dweck (1986) found that students with performance goals and who are also confident in their present ability (i.e., students with high self-efficacy) will demonstrate mastery behavioral patterns like seeking challenging tasks, using effective strategies and having high persistence. It was found that Variable 2 which measures self-efficacy and variable 10 which measures attribution of success to ability had very high loadings (0.76 and 0.69, respectively) on this Mastery Orientation factor.

Goals may be adaptive or maladaptive depending on what outcome is being considered. Mastery goals might lead to more interest and intrinsic motivation, but approach performance goals might lead to better performance (Harackiewicz et al., 1998). It has been argued that approach performance goals with a focus on good grades are adaptive

(Elliot, 1997; Harackiewicz et al., 1998; Pintrich, 2000c). Perhaps it may be appropriate to give this factor a more generic name like Adaptive or Achievement Motivation instead of Mastery Orientation since out of the three factors, this is the only factor that represents an adaptive motivational style.

Students who have an entity view of ability (Variable 1) and believe that they don't have it could be learned helpless: "I know I can't do it because I haven't got the ability". However, in an Asian culture in which students normally attribute success and failure to effort, this entity view of ability is more likely to be seen as protection of self worth. Students who are protecting their self worth want others to believe that they are smart and that they have more ability than others.

Students' mastery orientation, self-worth motivation and self-helplessness were measured and compared using computed mean factor scores. When the mean factor scores of the four groups were compared, it was found that factor scores for Self-worth motivation were the highest for all the four groups both before and after the team assignment. There was no significant differences in the Self-Worth motivation factor scores of the four groups. The pre-assignment Mastery Orientation factor scores for the high performers in both HPTs and MPTs were the highest of the four groups. The low performers in MPTs had the lowest Mastery Orientation factor scores. After the assignment, the Mastery Orientation factor scores of the high performers in HPTs and MPTs were still the highest of the four groups. The Mastery Orientation score of the low performers in MPTs remained the lowest. It is interesting to note that the Mastery Orientation factor score of low performers in LPTs was higher than their counterparts' in MPTs both before and after the team assignment although the difference was not significant. The Learned Helpless factor score for the low

performers in MPTs was the highest of the four groups both before and after the team assignment although there were no significant differences in the Learned Helplessness factor scores among the four groups.

In order to investigate the effects of the intervention (using the team assignment) on the motivational orientations of the four groups of students, an effect size measure was used. The effect size indicate whether the differences in the pre- and post assignment scores for Mastery Orientation, Self-worth Motivation and Learned Helplessness were large enough to be considered useful, meaningful or interesting.

The Mastery Orientation factor scores for HPs in HPTs, LPs in LPTs and LPs in MPTs went up significantly after the team assignment. The effects of the team assignment on the mastery orientation of HPs in HPTs and LPs in MPTs (d = 0.60 and 0.65 respectively) were quite substantial and this is an interesting finding. The effect of the change in mastery orientation for LPs in LPTs was small but meaningful in this learning context. Another interesting finding is that the change in the Mastery Orientation for HPs in MPTs was not significant and the effect size (d = 0.19) was rather small.

There were no statistically significant changes in the Self-worth Motivation factor scores for the four groups. The factor score for HPs in HPTs went up slightly. The effect size was small (d = 0.26) but perhaps worth noting. The factor scores for all the other three groups went down slightly. The effect size of the intervention on the Self-worth Motivation of HPs in MPTs was small (d = 0.24) but perhaps also worth noting. The effect size of the changes in Self-worth Motivation scores for the LPs in LPTs and MPTs were too small to be meaningful.

Similarly, there were no statistically significant changes in the factor scores for Learned Helplessness for all the four groups after the team assignment. The factor scores for learned helplessness fell for HPs in HPTs, HPs in MPTs and LPs in MPTs while the factor score for LPs in LPs remained constant. The sizes of the effect were small for HPs in HPTs and LPs in MPTs ($d = 0.22$ and 0.21 respectively) but probably worth noting.

The next chapter looks at the effects of outcomes on the self-worth motivation of high and low performers in HPTs, LPTs and MPTs. This is done through another questionnaire survey which required the students to rate themselves first and then their team-mates in terms of ability, deservingness of rewards and level of pride (for successful teams) or shame (for failing teams).

Chapter 6

Self-Worth Related Consequences of Success and Failure

Introduction

A third questionnaire survey was administered to the same group of 120 students immediately after they were informed of their team grades. They were also reminded of their team goals and were informed whether their teams had been successful or unsuccessful in achieving their grade goals, that is getting the team grades that they wanted. A questionnaire was used and the students were asked to rate their ability, indicate what rewards they felt they deserved, and also the level of pride (if successful) or shame (if unsuccessful) they felt. They were also asked to rate their teammate's ability, indicate the amount of rewards their teammate deserved, and the level of shame or pride they thought their teammate was experiencing. These ratings were intended to measure the self-worth related effects of the collaborative assignment (Harris and Covington, 1993).

Groups with students of different (mixed) performance levels have often been used by researchers in their investigations. In the laboratory experiments conducted by Ames (1985) and Harris & Covington (1993), Individual Performance Level was experimentally manipulated; high and low performers were in fact artificially created. In the first part of this investigation, data from Mixed Performance Teams (MPTs) were analyzed separately to see whether the results of investigations carried out in the

past by other researchers could be replicated. Each of the Mixed Performance Teams had two students, a high performer and a low performer. Students who did well in their first semester were classified as high performers and those who performed poorly were classified as low performers. Students did not know they were classified as such but they were aware of who in the class was doing well in programming and who was not. There were two outcomes for each team : Success and Failure to achieve the team's grade goal. Data from four groups were analyzed. The four groups were: (1) Successful High Performers in Mixed Performers Teams, (2) Successful Low Performers in Mixed Performers Teams, (3) Unsuccessful High Performers in Mixed Performers Teams, and (4) Unsuccessful Low Performers in Mixed Performers Teams.

Unlike other studies which involved only Mixed Performers Teams, the present investigation looked into two other team types : High Performers Teams and Low Performers Teams. Each High Performance Team had two students who were both high performers, and each Low Performance Team had two students who were both low performers. The second part of the investigation attempts to establish the self-worth related effects of success and failures on students in High Performance Teams and Low Performance Teams and whether these effects were different from those of their counterparts in the Mixed Performance Teams. Again there were two outcomes: success and failure (to achieve their teams' grade goals). Altogether eight different groups of students were studied. They were (1) Successful High Performers in High Performers Teams, (2) Successful Low Performers in Low Performers Teams, (2) Successful High Performers in Mixed Performers Teams, (4) Successful Low Performers in Mixed Performers Teams, (5) Unsuccessful High Performers in High Performers Teams, (6) Unsuccessful Low Performers in Low Performers Teams, (7)

Unsuccessful High Performers in Mixed Performers Teams, and (8) Unsuccessful Low Performers in Mixed Performers Teams.

Analysis of Ratings : HPs and LPs in MPTs

The purpose of the investigation was to establish the self-worth related effects of success and failure on high performers and low performers in Mixed Performers Teams. Each student had to rate his own ability, deservingness of reward and his level of pride (if the team was successful) and his level of shame (if the team was unsuccessful). Each student also had to rate his teammate's ability, deservingness of reward and level of pride or shame. Means and standard deviations of the dependent measures for the four groups of students are summarized in **Table 6.1**. The table also shows the differences in the ratings on ability, deservingness of rewards and level of pride/shame that high performers and low performers gave themselves and their team-mates, and the statistical significance (at 0.05 or 0.01 level) of these differences.

Intergroup Comparisons

The four groups' self-other ratings on ability, deservingness of rewards and level of pride/shame appear to be very different from each other's. The differences in the ratings they gave themselves, in terms of ability, deservingness of rewards and levels of pride/shame vary from group to group, as do the differences in the ratings they gave their team-mates. The differences in self-other ratings also vary. For each measure, it had to be established whether there was a significant difference in the mean ratings of the four groups. The significance of difference in ratings for pride and shame for the two successful and two unsuccessful groups respectively had to be established.

Table 6.1 : Self-Other Ratings of HPs and LPs in Successful and Unsuccessful MPTs [+]

	Ability			Reward			Pride/Shame		
	Self	Other	Diff	Self	Other	Diff	Self	Other	Diff
Successful MP Teams									
High Performers (N=11)									
Mean	5.09	5.54	-0.45	5.63	6.18	-0.55	5.90	6.27	-0.36
SD	1.64	1.43		1.12	1.16		1.97	1.73	
Low Performers (N=11)									
Mean	4.18	6.45	-2.27**	5.27	6.45	-1.18*	6.09	6.09	0.00
SD	1.07	1.21		1.27	1.21		1.92	1.57	
Unsuccessful MP Teams									
High Performers (N=15)									
Mean	5.33	5.20	0.13	5.53	5.66	-0.13	4.53	4.80	-0.27
SD	1.49	0.86		1.45	0.97		1.18	1.42	
Low Performers (N=15)									
Mean	4.00	7.20	-3.20**	5.60	7.46	-1.86**	5.60	5.00	0.60
SD	1.81	1.37		1.68	1.24		2.06	1.85	

[+]   MPT (Mixed Performers Teams)
*   Mean difference is significant at 0.05 level.
**   Mean difference is significant at 0.01 level.

A one-way Analysis of Variance (ANOVA) was carried out for each of the dependent variables (measurement items) in the investigation : self-ability rating, other-ability rating, difference between self- and other-ability ratings, self-reward rating, other-reward rating, self- and other-reward ratings difference.

For each dependent variable, the one-way ANOVA would tell if there were significant differences in the ratings of the four groups in the investigation. Table 6.2 shows the significance of the differences (at 0.05 level) in the means of the four groups for each of the dependent variables. It was found that significant differences exist in the comparisons of ratings among the four groups for each the following variables : other-ability rating, self-other ability ratings difference, other-reward rating, and self-other reward ratings difference. For self-ability ratings, there was only a marginally significant (p = 0.07) difference in the means of the four groups.

The significance values, however, did not indicate where the differences were. A post-hoc test, Tukey (HSD – Honestly Significant Difference) test was carried out to help identify which two groups' means differed significantly from each other. For each dependent variable, the results of pairwise comparisons of the mean ratings of the four groups are shown in the last column of Table 6.2.

The high performers and low performers in the MPTs were asked to indicate the amount of pride they and their team-mates were experiencing when their teams were successful in meeting their grade goals. When their teams were unsuccessful, they were asked to indicate how much shame they felt and how much shame they thought their team-mates felt. The differences in the pride/shame ratings they gave themselves

Table 6. 2 : Significance of Differences in Ratings of Ability and Deservingness of Rewards in MPTs (ANOVA)

Measurement Items	Successful Teams		Unsuccessful Teams		Sum of Squares	df	F value	Sig.	Pairwise Comparisons using Tukey HSD **
	Group 1 High Performers *N*=11 Mean	Group 2 Low Performers *N*=11 Mean	Group 3 High Performers *N*=15 Mean	Group 4 Low Performers *N*=15 Mean					
Ability (Self)	5.09	4.18	5.33	4.00	17.890	3	2.470	0.07	
Ability (Other)	5.54	6.45	5.20	7.20	35.053	3	7.762	0.00	4 > 1, 3
Ability (Self-Other Difference)	-0.45	-2.27	0.13	-3.20	101.881	3	9.420	0.00	4 > 1, 3 2 > 3
Reward (Self)	5.63	5.27	5.53	5.60	0.920	3	0.150	0.92	
Reward (Other)	6.18	6.45	5.66	7.46	25.493	3	6.430	0.00	4 > 1,3
Reward (Self-Other Difference)	-0.55	-1.18	-0.13	-1.86	24.997	3	2.669	0.05	4 > 3

** Significant differences between groups at 0.05 level

and their team-mates were also computed and intergroup comparisons were made. Differences in Pride (or Shame) ratings were analyzed using simple t-tests. Results of the two t-tests are summarized in **Tables 6.3 and 6.4.** There were no significant differences between the groups in any of these measures.

Ability Ratings

In MPTs, high performers' self-ability ratings were higher than low performers' self-ability ratings, regardless of outcome. It was found that unsuccessful high performers gave themselves higher ability ratings than successful high performers (means = 5.33 and 5.09).

When the teams were successful, the high performers rated their team mates' ability a little higher than the rating they gave themselves (means were 5.09 and 5.54; mean difference was -0.45) but the difference was not significant. When the teams were not successful, the high performers rated their teammate's ability as slightly lower than what they gave themselves (means were 5.33 and 5.20 ; mean difference was 0.13). The difference was also not significant.

When the MPTs were unsuccessful, the Low Performers gave themselves a lower ability rating than when they were successful (means were 4.00 and 4.18; mean difference = -0.18) although the difference was not significant.

Low performers gave themselves low ability ratings (regardless of outcome) compared to the ratings they gave to high performers. They (low performers) perceived themselves as having lower ability compared to their team-mates. When the MPT

Table 6.3 : Ratings of Pride in Successful MPTs : Significance of Differences in Responses (t-test)

Measurement Items	Successful MPTs		t-test * for Equality of Means			
	High Performers N=11 Mean	Low Performers N=11 Mean	t	df	Sig.(2-tailed)	Mean Difference
Pride — Self	5.90	6.09	-0.219	20	0.829	-0.1818
Pride — Other	6.27	6.09	0.257	20	0.800	0.1818
Pride (Self-Other Difference)	-0.36	0.00	-1.174	20	0.254	-0.3636

* Equal-Variance *t* test was used since Levene's test did not show significant difference.

Table 6.4 : Ratings of Shame in Unsuccessful MPTs : Significance Of Differences in Responses (t-test)

Measurement Items	Unsuccessful MPTs		t-test for Equality of Means			
	High Performers N=15 Mean	Low Performers N=15 Mean	t	df	Sig.(2-tailed)	Mean Difference
Shame -- Self	4.53	5.60	-1.735*	22	0.960	-1.0667
Shame -- Other	4.80	5.00	-0.332	28	0.743	-0.2000
Shame (Self-Other Diff)	-0.27	0.60	-1.017	28	0.318	-0.8667

* Unequal-Variance t test used here since Levene's test showed significant difference.

were successful, low performers rated their team-mates' ability as higher than theirs (means = 6.45 and 4.18 ; mean difference = 2.27; p = 0.01). When the teams were unsuccessful, low performers also rated their team-mates' ability as higher than theirs (means = 7.20 and 4.00 ; difference = 3.20; p = 0.01). Low performers gave an even higher ability rating to their team-mate when their teams were unsuccessful.

Reward Ratings

When the teams were successful, the self-reward ratings of high performers were higher than the self-reward ratings of low performers (means = 5.63 and 5.27). When the teams were unsuccessful, the self-reward ratings of low performers were higher, but not significantly, than the self-reward ratings of high performers (means = 5.53 and 5.60).

While high performers who were unsuccessful gave themselves slightly fewer rewards than when they were successful (means = 5.53 and 5.63; mean difference = -0.10), unsuccessful low performers gave themselves more rewards than when they were successful (means were 5.60 and 5.27) although the differences were not significant in either case.

Successful high performers gave their team-mates more rewards (means of 5.63 and 6.18; mean difference = -0.55) than they gave to themselves. They felt that their low-performing team mates deserved more rewards than they did. The high performers felt the same way even when their teams were unsuccessful. They thought that their team mates should get more rewards than they (means of 5.53 and 5.66; mean difference = -0.13) even though just slightly more. The differences, however, were not significant.

In both successful and unsuccessful condition, the low performers gave significantly higher reward ratings (mean differences = 1.18 and 1.86, significant at 0.05 and 0.01 level, respectively) to their high performing team-mates than they gave themselves. The ratings low performers gave to their high performing team-mates were higher when the teams were unsuccessful than when the teams were successful (means of 7.46 and 6.45; mean difference = -1.01; p = 0.37) although the difference was not significant.

Differences in Self-Other Ability and Rewards Ratings

Low performers in mixed performers teams rated their partners as smarter regardless of outcome. When successful, they rated their team mate's ability higher than the rating they gave themselves (means were 4.18 and 6.45, mean difference was -2.27). The mean difference was significant at 0.01 level. The ability rating unsuccessful low performers gave their team mates was also significantly higher than the rating they gave themselves (means were 4.00 and 7.20; mean difference was -3.20; p = 0.01).

Low performers gave high performers significantly more rewards than they gave themselves regardless of outcome. The mean differences in self-other rewards ratings of low performers under success and unsuccessful conditions were -1.18 and -1.86 respectively. The differences were significant at 0.05 and 0.01 level respectively. The mean differences in self-other rewards ratings of high performers under success and unsuccessful conditions were -0.55 and -0.13 respectively.

Ratings of Pride and Shame

When the teams were successful, there was no statistically significant difference in the ratings for pride that HP and LP gave themselves. Neither was there any significant difference in level of pride these two groups gave to their team-mates. The differences in ratings they gave themselves and to their team-mates were also compared. There was no significant difference between the two groups.

When the MPTs were unsuccessful, the LP gave themselves a higher shame rating than they gave to their team-mates (means = 5.60 and 5.00) although the difference was not statistically significant. High Performers gave themselves lower shame ratings compared to what they gave their team-mates (means = 4.53 and 4.80). However, the self-other shame rating differences for the two groups (mean differences = -0.27 and 0.60) were not significant.

Analysis of Ratings : HPs and LPs in HPTs, LPTs and MPTs

The aim of the second part of this investigation was to compare the self-worth related effects of success and failure on high performers and low performers in the three team types : HPTs, LPTs and MPTs. A comparison of the effects of success and failure on high and low performers in MPTs was made separately and the findings were reported earlier in this chapter. This section reports the effects of outcome on high and low performers in HPTs and LPTs and compares them with the effects on students in MPTs.

Means and standard deviations for the ratings of successful and unsuccessful high and low performers in HPTs, LPTs, and MPTs are shown in **Table 6.5**. The table also shows the differences in the ratings on ability, deservingness of rewards and level of pride/shame that high performers and low performers gave themselves and to their team-mates, and the statistical significance (at 0.05 or 0.01 level) of these differences.

Intergroup Comparisons

The eight groups' self ratings and ratings of the other member in the team on ability and deservingness of rewards appear to be very different from each other. For each measure, it had to be established whether the 8 different groups' ratings differed significantly from each other. The significance in difference in ratings for pride and shame for the four successful and four unsuccessful groups respectively also had to be confirmed.

A one-way Analysis of Variance was carried out for each of the dependent variables in the investigation : self-ability rating, other-ability rating, self-other ability ratings difference, self-reward rating, other-reward rating, self-other reward ratings difference. Results of the one-way ANOVA (see **Table 6.6**) showed whether there were significant differences between the eight groups for each variable but did not indicate where those differences were. A post hoc procedure, Tukey (HSD), was used to determine between which two groups significant differences occurred. While the overall ANOVA compares all values simultaneously, the Tukey (HSD) procedure makes the pairwise comparisons of mean ratings, one pair at a time. Results of the pairwise comparisons for each of the dependent variables are shown in the last column of **Table 6.6**. The

Table 6.5 : Self-Other Ratings of HPs and LPs in Successful And Unsuccessful HPTs, LPTs and MPTs [+]

<u>HIGH PERFORMERS (HPs)</u>

	<u>Ability</u>			<u>Reward</u>			<u>Pride/Shame</u>		
	<u>Self</u>	<u>Other</u>	<u>Diff</u>	<u>Self</u>	<u>Other</u>	<u>Diff</u>	<u>Self</u>	<u>Other</u>	<u>Diff</u>
<u>Successful HPs</u>									
H P Teams (N=6)									
Mean	6.83	7.50	-0.67	7.16	7.33	-0.17	7.33	7.33	0.00
SD	1.83	1.37		1.72	1.36		1.86	1.21	
M P Teams (N=11)									
Mean	5.09	5.54	-0.45	5.63	6.18	-0.55	5.90	6.27	-0.36
SD	1.64	1.43		1.12	1.16		1.97	1.73	
<u>Unsuccessful HPs</u>									
H P Teams (N=20)									
Mean	5.35	6.20	-0.85*	6.40	6.65	-0.25	5.10	4.90	0.20
SD	1.34	1.28		1.23	1.04		2.49	2.02	
M P Teams (N=15)									
Mean	5.33	5.20	0.13	5.53	5.66	-0.13	4.53	4.80	-0.27
SD	1.49	0.86		1.45	0.97		1.18	1.42	

[+]   HPTs, LPTs, MPTs (High Performers, Low Performers and Mixed Performers Teams respectively)
*   Mean difference is significant at 0.05 level.
**   Mean difference is significant at 0.01 level.

Table 6.5 (Continued)

	Ability				Reward				Pride/Shame		
	Self	Other	Diff		Self	Other	Diff		Self	Other	Diff
Successful LPs											
L P Teams (N=16)											
Mean	5.18	6.00	-0.81*		5.50	6.81	-1.31**		5.37	5.50	-0.13
SD	1.68	1.46			1.46	1.37			1.40	1.36	
M P Teams (N=11)											
Mean	4.18	6.45	-2.27**		5.27	6.45	-1.18*		6.09	6.09	0.00
SD	1.07	1.21			1.27	1.21			1.92	1.57	
Unsuccessful LPs											
L P Teams (N=18)											
Mean	3.66	5.22	-1.56**		4.88	5.66	-0.78**		5.72	5.50	0.22
SD	1.08	1.00			0.90	1.08			1.99	1.58	
M P Teams (N=15)											
Mean	4.00	7.20	-3.20**		5.60	7.46	-1.86**		5.60	5.00	0.60
SD	1.81	1.37			1.68	1.24			2.06	1.85	

+   HPTs, LPTs, MPTs (High Performers, Low Performers and Mixed Performers Teams respectively)

*   Mean difference is significant at 0.05 level.

**   Mean difference is significant at 0.01 level.

Table 6.6 : Ratings of Ability and Deservingness of Rewards -- Significance of Differences in Responses (ANOVA)

Measurement Items	Successful Teams				Unsuccessful Teams				Sum of Squares	df	F value	Sig.	Pairwise Comparisons using Tukey HSD **
	HPT*	LPT	MPT		HPT	LPT	MPT						
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8					
	HP* N=6 Mean	LP N=16 Mean	HP N=11 Mean	LP N=11 Mean	HP N=20 Mean	LP N=18 Mean	HP N=15 Mean	LP N=15 Mean					
Ability (Self)	6.83	5.18	5.09	4.18	5.35	3.66	5.33	4.00	75.363	7	4.875	0.00	1 > 4, 6, 8 5 > 6 7 > 6
Ability (Other)	7.50	6.00	5.54	6.45	6.20	5.22	5.20	7.20	60.711	7	5.566	0.00	1 > 6, 7 8 > 3, 6, 7
Ability (Self-Other Difference)	-0.67	-0.81	-0.45	-2.27	-0.85	-1.56	0.13	-3.20	114.15	7	5.283	0.00	4 > 7 8 > 2, 3, 5, 7
Reward (Self)	7.16	5.50	5.63	5.27	6.40	4.88	5.53	5.60	37.635	7	2.983	0.01	1 > 6 5 > 6
Reward (Other)	7.33	6.81	6.18	6.45	6.65	5.66	5.66	7.46	44.106	7	4.623	0.00	8 > 6, 7
Reward (Self-Other Difference)	-0.17	-1.31	-0.55	-1.18	-0.25	-0.78	-0.13	-1.86	36.716	7	2.469	0.02	8 > 5, 7

* HPT, LPT, MPT (High, Low and Mixed Performance Teams respectively); LP, HP (High and Low Performers respectively)
** Significant differences between groups at 0.05 level

results of a one-way ANOVA for pride ratings and the results of a one-way ANOVA for shame ratings are shown in **Tables 6.7 and 6.8,** respectively.

Ability Ratings

The ability ratings that the high performers in HPTs gave themselves were the highest compared to all the other groups. This was true regardless of whether they were successful or not. However, the self-ability ratings were lower when they were unsuccessful (means = 6.83 and 5.35; mean difference = 1.48). When they were successful, the abilty ratings HP gave themselves in MPTs were lower than those that HP gave themselves in HPTs but the difference was not significant (means = 6.83 and 5.09; difference = 1.74). When the teams were unsuccessful, HPs' self ratings of ability in HPTs and MPTs were lower (means = 5.35 and 5.33 respectively).

In HPTs, HPs rated their team-mates' ability as much higher than theirs (mean differences were -0.67 for successful and -0.85 for unsuccessful teams). The mean difference for unsuccessful teams was significant at 0.05 level.

In successful Low Performers Teams, the low performers rated their ability as significantly lower than the rating they gave to their team mates (means = 5.18 and 6.00, mean difference = -0.81, p = 0.05).

The self-ability ratings of the successful low performers in LPTs were even higher than the ability ratings successful low performers in MPT gave themselves (means = 5.18 and 4.18, mean difference = 1.00) although the difference was not significant. When they were unsuccessful, low performers in LPTs rated themselves very low in ability

Table 6.7 : Ratings of Pride in Successful Teams -- Significance Of Differences in Responses (t-test)

Measurement Items	Successful Teams				Sum of Squares	df	F value	Sig.
	HPT	LPT	MPT					
	Group 1 HP N=6	Group 2 LP N=16	Group 3 HP N=11	Group 4 LP N=11				
	Mean	Mean	Mean	Mean				
Pride -- Self	7.33	5.37	5.90	6.09	17.008	3	1.845	0.155
Pride -- Other	7.33	5.50	6.27	6.09	15.212	3	2.243	0.098
Pride (Self-Other Diff)	0.00	-0.13	-0.36	0.00	0.886	3	0.390	0.761

* HPT, LPT, MPT (High, Low and Mixed Performance Teams respectively); LP, HP (High and Low Performers respectively)

Table 6. 8 : Ratings of Shame in Unsuccessful Teams -- Significance of Differences in Responses (ANOVA)

Measurement Items	Unsuccessful Teams				Sum of Squares	df	F value	Sig.
	HPT	LPT	MPT					
	Group 5 HP N=20 Mean	Group 6 LP N=18 Mean	Group 7 HP N=15 Mean	Group 8 LP N=15 Mean				
Shame -- Self	5.10	5.72	4.53	5.60	14.006	3	1.129	0.344
Shame -- Other	4.90	5.50	4.80	5.00	5.065	3	5.549	0.650
Shame (Self-Other Diff)	0.20	0.22	-0.27	0.60	5.670	3	0.397	0.756

* HPT, LPT, MPT (High, Low and Mixed Performance Teams respectively); LP, HP (High and Low Performers respectively)

(mean = 3.66), the lowest ratings given by any one group of students. They rated their team mates' ability as significantly higher (means were 3.66 and 5.22, mean difference = -1.56, p = 0.01).

Rewards Ratings

High performance team (HPT) members gave themselves and their team mates very high reward ratings when their teams were successful (means = 7.16 and 7.33). These reward ratings were the highest among the eight groups. They gave themselves and their team-mates lower reward ratings when they did not succeed (means = 6.40 and 6.65). High performance team members gave higher reward ratings to their team-mates, more than they gave to themselves regardless of outcome. The rewards that HP in HPT gave themselves were higher than HP in MPT gave themselves regardless of the outcome but the differences were not significant.

The rewards that LPT members gave themselves (mean = 4.88) when they were unsuccessful were the lowest any one group gave itself. They also felt that they were less deserving of rewards than their team-mates. They gave themselves a higher reward when their teams were successful (means = 5.50).

Low performance team (LPT) members felt that their team-mates deserved more rewards than they did and gave significantly higher reward ratings to their team-mates regardless of the outcome (mean differences were -1.31 for successful outcome and - 0.78 for unsuccessful, p = 0.01 in both cases).

Differences in Self-Other Ability and Rewards Ratings

All students had given higher ability ratings to their team-mates regardless of outcome with only one exception : the High Performers in MPTs gave a slightly lower ability rating to their team-mates compared to what they gave themselves (mean difference = 0.13), when their teams were unsuccessful. The self-other ability difference (means = -0.85; $p = 0.05$) was significant in unsuccessful HPTs.

The self-other ability rating differences of HPs were greater in HPTs (means = -0.67 for successful teams and -0.85 for unsuccessful teams) compared to the differences of HPs in MPTs (means = -0.45 for successful teams and 0.13 for unsuccessful teams).

LP gave their LPT team-mates higher ability ratings when the teams were successful. The self-other ability difference was -0.81 ($p = 0.05$). When LPTs were unsuccessful, this self-other ability rating difference widened to -1.56 ($p = 0.01$).

The self-other ability rating differences for Low Performers in successful and unsuccessful LPT were lower than those for Low performers in successful and unsuccessful MPTs. When compared with their team-mates, low performers in LPTs surprisingly perceived significant ability difference. Low performers, as expected, perceived an even greater ability difference when they compared themselves with their team-mates (the high performers) in MPTs. The self-other ability differences of LP in successful and unsuccessful MPTs were higher than all the other groups.

As for self-other differences in reward ratings, the differences were only marginal for HPs in both successful and unsuccessful HPTs (means = -0.17 and -0.25 respectively).

The self-other differences in reward ratings were also low for HPs in both successful and unsuccessful MPTs (means = -0.55 and -0.13 respectively). These differences were not significant.

LPs gave their team-mates (whether they were HPs in MPT or LPs in LPT) substantially higher rewards than they gave themselves, regardless of outcome. The differences were all statistically significant. The self-other difference in reward ratings was the highest for LP in unsuccessful MPT teams.

Ratings of Pride and Shame

Students from successful teams experienced pride and those from unsuccessful teams experienced shame. Students were asked to indicate how much pride (or shame) they felt and also indicate how much pride (or shame) they thought their team-mates were experiencing. The levels of pride indicated by the successful groups were compared to see whether there were any significant differences. The levels of shame reported by students from the unsuccessful groups were also compared. **Table 6.7** shows the results of the analysis of group variances for shame and **Table 6.8** shows the results of the analysis of group variances for shame.

Successful High performance team (HPT) members reported their level of pride was similar to their team-mates' (both means were 7.33). Successful Low performance team (LPT) members reported their level of pride was slightly lower than that enjoyed by their team-mates (means were 5.37 and 5.50; mean difference = -0.13). The level of pride of low performers in successful LPTs was lower than that of their counterparts' in successful MPTs (means = 5.37 and 6.09) although the difference was

not significant. There was also no statistically significant difference in the level of pride enjoyed by high performers in the HPTs compared to that of their counterparts in successful MPTs.

Members of unsuccessful high performance teams (HPTs) believed that their team-mates experienced less shame than they did (means = 5.10 and 4.90; mean difference = 0.20). Members of unsuccessful low performance teams (LPTs) experienced the highest level of shame (mean = 5.72) compared to all the other unsuccessful groups in the investigation and believed that their team-mates felt less shame (mean = 5.50). The level of shame experienced by high performers in HPTs was slightly higher than that of high performers in unsuccessful MPTs (means = 5.10 and 4.53).

Summary of Findings

High performers in successful MPTs gave higher ability ratings to their team-mates (low performers) compared to what they gave themselves although the difference was not statistically significant. They, however, gave their team-mates lower (but not significantly) ability ratings when the teams were unsuccessful. While success raised the high performers' perceptions of the other students' abilities, team failure quickly led them to put the blame on their team-mates.

Successful high performers in MPTs gave their team-mates more rewards than they gave to themselves. They felt that their low-performing team mates deserved more rewards than they did. The high performers felt the same way even when their teams were unsuccessful. They thought that their team mates should get more rewards than they even though only slightly more. The differences, however, were not significant.

The ability ratings that the high performers in HPTs gave themselves were the highest of all the groups. This was true regardless of whether they were successful or not. However, the self-ability ratings were higher when they were successful than when they were unsuccessful. High performers' perception of their own ability appeared to be higher when they were in HPTs. The lower perception of their team efficacy in MPTs could have affected the perception of their own ability.

HPs in HPTs rated their team-mates' ability as much higher than theirs regardless of the outcome. The mean difference for unsuccessful teams was, however, significant. There were self-other ability rating differences for high performers in HPTs. This finding was unexpected because one would expect the self-other ability rating differences to be lower in HPT since team members knew that both members in the team were high performers and were equally capable.

High performance team (HPT) members gave themselves very high reward ratings regardless of outcome. The reward ratings they gave themselves were the highest among the eight groups. The rewards that HPs in HPTs gave themselves were higher than what HPs in MPTs gave themselves regardless of the outcome but the differences were not significant. Again, it could be that their self-efficacy was somewhat affected when they were in MPTs.

Members of unsuccessful HPTs believed that their team-mates experienced less shame than they did. Everyone believed that the students in HPTs were the strongest in programming and would achieve their grade goals. In MPTs, the HPs could blame

their team-mates for the unsuccessful outcome of their teams but in HPTs there was nobody to blame but themselves.

Low performers in MPTs gave themselves low ability ratings (regardless of outcome) compared to the ratings they gave to high performers. They (low performers) perceived themselves as having lower ability compared to their team-mates. Low performers gave an even higher ability rating to their team-mate when their teams were unsuccessful.

In MPTs, the difference between the self-other ability ratings of low performers was higher than the difference between the self-other ability ratings of high performers. This is true regardless of outcome but the difference was statistically significant when the teams were unsuccessful. Being a low performer in MPTs did magnify the perception of ability differences and especially so when the team failed.

In both successful and unsuccessful conditions, the low performers in MPTs gave significantly higher reward ratings to their high performing team-mates than they gave themselves. Surprisingly, the ratings low performers gave to their high performing team-mates were higher when the teams were unsuccessful than when the teams were successful although the difference was not significant.

As far as reward ratings are concerned, the difference in the self-other reward ratings of low performers was higher than the difference in the self-other reward ratings of high performers. This is true in both successful and unsuccessful MPTs but the difference was significant only when the outcome was unsuccessful. Again, being a low performer in a mixed team dramatically magnified perceptions of self-other differences and especially so when the team failed.

When the MPTs were unsuccessful, the low performers gave themselves a higher shame rating than they gave to their team-mates although the difference was not significant. High Performers gave themselves lower shame ratings compared to what they gave their team-mates. However, the self-other shame rating differences for the two groups were not significant. It appeared that there was only a slight hint of double jeopardy (individual shame and team blame) for low performers in unsuccessful teams in this study.

In LPTs, low performers' ratings of their own ability were high when their teams were successful. The ratings were even higher than their counterparts' in successful MPTs. There is certainly less ambiguity here that the low performers had contributed directly to the success of their teams without the help of high performers.

However, when they were unsuccessful, low performers in LPTs rated themselves very low in ability, the lowest rating of themselves given by any one group of students. On the other hand, they rated their team mate's ability as significantly higher. Failure to them was a sure indication and confirmation that they were indeed low performers and they lacked the ability to program.

When compared with their team-mates, low performers in LPTs surprisingly perceived a significant ability difference. Low performers perceived a even greater ability difference when they compared themselves with their team-mates (the high performers) in MPTs although this is not surprising. In fact the self-other ability rating differences of low performers in successful and unsuccessful MPTs were the highest compared to all the other groups.

The relatively high reward ratings that successful LPs in LPTs gave themselves were comparable to the self-reward ratings of their counterparts in successful MPTs. However, the rewards that LPT members gave themselves when they were unsuccessful were the lowest any one group had given itself. This is consistent with the very low ability ratings they gave themselves when they were unsuccessful.

LPs gave their team-mates (whether they were high performers in MPT or low performers in LPT) substantially higher rewards than they gave themselves, regardless of outcome. The differences were all statistically significant. The self-other difference in reward ratings was the highest for low performers in unsuccessful MPT teams. Low performers felt that their team-mates deserved more rewards than they did regardless of their team-mates' performance level or outcome. It could be that the low performers did not have high regards of their own ability and contributions, and felt that they deserved less even when the teams were successful.

This investigation revealed that members of LPTs experienced the highest level of shame compared to all the other unsuccessful groups under investigation and believed that their team-mates felt less shame. The level of shame experienced by low performers in LPTs was not very different from that experienced by low performers in unsuccessful MPTs. For those in LPTs, failure was a confirmation that they did not have the ability and they felt ashamed. Perhaps they were also guilty because they were unable to help their team to succeed. As highlighted earlier, there was also a slight hint that low performers in MPTs not only experienced shame but were also blamed for their teams' failure.

Chapter 7

Students' Perspectives on Teamwork

Introduction

In Chapter 5, the students' motivational responses to programming both before and after the team assignment were analyzed and the findings reported. In Chapter 6, we looked at how success and failure affected the self-worth motivation of high and low performers who worked in MPTs, HPTs and LPTs.

This chapter reports the findings of another part of the research project which focused on the problems in the team-working process and the motivational responses (the feelings, thoughts and behaviours) of high performers and low performers to various aspects of team-working. One major drawback of using survey questionnaires to elicit such information is that respondents are not able to fully express their views and opinions. In order to obtain the students' responses to team processes and tasks in which motivation was important, semi-structured interviews with students were carried out by the researcher. The advantages of using interviews are many. These include the ability to seek clarifications, explanations and elaborations from the students at any point during the interviews; and the ability to find out exactly what the students were thinking, their values and preferences, and their attitudes and beliefs.

Research focusing on processes rather than outcome has reported potentially serious problems, and factors that influence their occurrence. The main aims of the interviews

were to investigate how the students coped with teamwork and their responses to various aspects of team-working at different stages of the team assignment; the problems and difficulties faced and how they resolved them; their motivational responses; and their thoughts about the collaborative assignment in general.

Face-to-face interviews with the students were conducted immediately after the students had submitted their completed team assignments but just before the team grades were announced. These students either attended the interviews together with their teammates or came alone. An interview schedule was prepared to help with the interviewing (see Appendix E). It comprised of a list of questions that could be referred to by the interviewer (researcher) during the very informal interviews with the students.

Before the interviews began, the students were informed that the session would be tape-recorded. The explanation given to the students was that this would allow the interviewer to concentrate on the conversation without having to take down too much notes. The interviewees were assured that nothing they said would be divulged and they were encouraged to speak up freely on any issues or topics being discussed. The students being interviewed were encouraged to express their thoughts and feelings about the team assignment and about working together with another student in a team. The tape-recordings were transcribed into text before analysis work was carried out.

The tools and techniques employed in the analysis of interview data in the research were those adapted from grounded theory methodology (Glaser and Strauss, 1967; Strauss & Corbin, 1998). These were useful for analysis of the interview data even though the objective was not for theory generation but more to look for evidence to

verify and validate current motivational and learning theories and the hypotheses discussed in the literature survey chapters.

Organizing, Indexing and Analyzing Qualitative Data

The huge volume of text-based data necessitated some form of organizing and ordering. A system was needed for indexing various parts of the interview transcripts. The central idea of indexing (categorizing or coding) was to apply a uniform set of indexing categories systematically and consistently to the whole data set. The system should allow the researcher to locate and retrieve relevant portions of text for the purposes of answering the research questions; addressing theoretical concerns; and helping in the illustration, explanation, and presentation of evidence.

The categories for indexing purposes were generated with the research questions in mind. We wanted to find out the students' perceptions of the team assignment, and also the problems in team-working and the factors that influenced their occurrence. Since the purpose was not to generate a new theory, the concepts and terminologies discussed in the current literature on achievement motivation theories and cooperative learning were used for coding purposes. Very broad and general indexing categories (or theoretical concepts) were identified before coding began. More specific categories (or subcategories) were created during the coding process to make the slices of data more focused around core issues.

Each interview script was first read and sections of the scripts (quotations) were coded according to which categories of information they were providing. Since the interviews

were unstructured and informal, many parts of the interview scripts had very little relation to the research questions and could not be coded. Going through the scripts the second time, the categories were reviewed one by one and the quotations were coded again but this time using codes (names of categories and concepts) that were narrower and more specialized. The amount of text indexed each time could be a little over-inclusive. Sometimes the questions asked by the researcher during the interviews were also included as part of the texts indexed. This was done because longer slices of retrieved data (longer quotations) would make more sense when viewed out of the context of the whole interview than would shorter ones.

Sometimes, the same slice of text was indexed by more than one category (code), for example, a general category and a more specific one. However, these categories for the same slice of text could be unrelated if different ideas or concepts were represented by the same slice of data. It was also necessary to go through the scripts another time when it was discovered that some important categories were entirely overlooked and data slices (e.g. quotations) were needed for these. All these meant more time and effort but they helped in the process of building explanations and arguments.

The relationships between the codes (categories) were also identified and these relationships could be illustrated using diagrams or charts. These are useful analytical tools that helped the researcher in his analytical thinking. The concepts (categories) that were linked using relationships represented aspects of the problem domain under investigation. The relations used to link these domain concepts were also used to analyze the phenomena.

Appendices F and G illustrate the coding of two of the interview scripts. The sections of the script that were coded are indicated by the braces on the right hand side. The categories used for coding are shown at the top of the braces. The relationships between the categories used for cross-indexing of the interview scripts are illustrated in the network diagram in Appendix H.

A slice or segment of data that had been coded could be integral to, or constitutive of, our explanation or could provide an illustration of it. The slice of data was constitutive of our explanation if it was used to develop our explanation, that is it had added something to our explanation. On the other hand, it could have provided help to illustrate a key point in our explanation. Indeed segments of data or quotations were cited when establishing and presenting our explanations in our findings. This was to ensure that our explanations, and the analysis on which they were based, were sound, well-founded and convincing.

In this research project, the tasks for organizing, indexing and retrieval of qualitative data were facilitated by the use of a computer software ATLAS.ti (Muhr, T., 1997) which was specially developed for researchers using qualitative methodology such as grounded theory. It was a convenient tool for storing, analyzing and retrieving information and was certainly helpful in the analysis of more than 150 pages of the transcribed interviews. It facilitated the activities involved in qualitative analysis, particularly selecting, coding, annotating and comparing noteworthy segments of texts. The coding functions allowed quotations (words, phrases or sentences) to be linked to codes. Notes (explanations, clarifications and additional information) were made for both the quotations and the codes (Appendix H shows the notes and comments given to the categories or codes). This "memo" facility allowed the researcher to

clarify the meaning of a code or to explain how it was used for coding. There was no restriction on the number of codes assigned to a quotation and a code could be used to refer to any arbitrary number of quotations. It has to be noted that the software cannot create the categories for the user, or decide which chunks of text they apply. It provides the researcher with the capability of graphically representing relationships in the data (see Appendix H). A text search facility is provided for searching for occurrence of specific text strings, and a query tool is available for the retrieval of coded text. How helpful the software could be for analysis depends almost entirely on the sophistication of the coding system built by the researcher.

The findings of this qualitative analysis are reported in this chapter. Comments taken from the interview transcripts are used to illustrate the students' experiences of positive and negative aspects of working in teams, including their motivational responses. The problems faced by the students while working together in software development teams and the factors that influenced their occurrences are highlighted and discussed.

The Collaborative Assignment

The assignment presented a problem that resembled a small but typical software project. The application that the students had to develop was authentic since the functions of a fare-card vending machine were familiar to the students and in fact most, if not all, students had seen and used fare-card vending machines. Since the range of software development tools and techniques available for use by the students were the similar to those used in industry for developing software, the software development environment was therefore a real one.

An error-free software product had to be developed by each programming team. The various components of the software had to be well-integrated, tested and then run as a working system. The two members in each team were free to allocate tasks between themselves, and to use whatever resources were available to them. Each team was also asked to come up with a team goal, that is a grade that the team could work towards achieving. A team grade was awarded to the team.

The concern of motivation theorists is that if group rewards are given based on a single group product, there is little incentive for group members to explain concepts to one another, and one or two members may do all the work (see Slavin, 1995). However, in this investigation, individual accountability was built into the assessment of the team assignment. Every student had to identify the components that s(he) had a hand in programming and the tasks s(he) was assigned by the team to do. There was a test (viva) at the end of the assignment when each team member was called upon to explain the work he claimed that he had done, and to present and demonstrate the software that the team had created.

The teams were given two weeks to complete the assignment. As it was term-time, lectures, tutorials and practicals were still going on during that period. In fact for some students, there was also a concurrent piece of assignment (for an elective that they were taking) that had to be completed and handed in first.

Although the tutors felt that two weeks were sufficient for even a weak team to complete the assignment, there were complaints from some students that the time allotted to complete the assignment was inadequate:

> "We had only one week left to complete this assignment and it was a busy week in church [Good Friday and Easter Monday]. Our time was taken up by compulsory church activities. We had no time to meet and discuss our work."

The tight deadline was the excuse that some students gave for not completing the assignment and/or for their lack-luster performance:

> "We were given a lot freedom. We can change or add to the program specifications ... so my point is that the assignment is quite flexible but we were not given enough time."

Some students even blamed it on their bad luck for having a concurrent assignment for another module to tackle:

> "I think the time allocated is not enough ...some of us had to complete an assignment for an elective. We had to juggle with this two assignments. It is very difficult ... both required our attention. The other assignment had to be handed in earlier ... so we had to focus on it first."

Team Size and Composition

Students were asked to form their own teams, with two members in each team. Since the small teams were made up of students from the same class and students were allowed to choose their team-mates, it was believed that a much simpler social process was involved and team members should not need too much time to develop ways of

working well together. Communication and co-ordination work would also be less complex than those required in bigger teams.

The students were given the freedom to choose their own team mates. The only condition was that they had to pair up with another person in the same class. Those who got an A or B grade in their introductory programming module in the first semester were considered high performers and those who had a grade C or lower were considered low performers. The students were not told whether they were categorized as high performers or low performers. However, the students knew very well who amongst them in their class was doing well in programming, and who was not.

There were three team types : the high performers teams with two high performers in each; low performers teams with two low performers in each; and mixed performers team with one high performer and one low performer in each. Students did not know and did not need to know the team types they belonged to.

Choice of Team-mates

Although students were free to choose whoever they wanted to be in their teams, some found this arrangement unfair since a high performer could team up with another high performer:

> "I don't quite like the good students teaming up together because that's not fair. The good ones should help the not so good. At the same time the good should teach the lousy ones how to do it. What's the use of two good ones sticking together? In the end they don't learn anything."

"If we group the strong ones together, definitely the weaker students will not be able to compete with them."

Low performers preferred to work with high performers either because they could depend on high performers, or more positively, they could learn something from the high performers. However there were low performers who could not find high performers willing to be their teammates. They felt rejected and became even more conscious of their low ability in programming. They had no choice but to team up with other low performers in the class. Some students in low performers teams felt that they were very much disadvantaged and did voice their unhappiness at the interview. They had very low team efficacy and this could have affected their performance.

Some high performers who could not find high performers in the class to team up with and had to pair up with a low performer, were also unhappy. They blamed it on bad luck for getting a low performer to work with:

"In every course ... there are always students who are not willing to work. You are really unlucky to get paired up with one of them ... then you have to do the work for them."

"If he [the low performer in the team] gets 20 marks and I get 70 marks ... average is a fail grade ... that is not fair."

It is not difficult to imagine who would be blamed if the team failed to achieve its grade goal. There was also a suggestion that the tutor should do the pairing since he/she would certainly not put two poor performers together and let the team suffer:

"The tutor should not have allowed two weak students to be paired up. There should be a good programmer in each team."

"That is what the tutors should do ... put the good ones and the weak ones together."

Choice of Tasks

In low performers teams and mixed performers teams, the easier tasks were allocated to the member who was perceived to be less able in programming. In mixed performers teams, the easier tasks were done by the low performers and the more challenging tasks by the high performers. This was done without disagreement as the students made a quick initial assessment of their own ability and their team-mates' and then decide who was more skillful and knowledgeable in programming. The better student also assumed the role of the team leader:

"Yes ... I felt it was reasonable [for him to take on the more complex component] because he is better than me in OOP [the programming module]...mine [the component given to me] was much easier to do."

"I am supposed to be the most skillful in the team ... skillful in Programming ... did the most work, tackled the toughest part of the assignment."

There was also consideration of each other's special situation and circumstances:

"Initially I was thinking that the vending machine [component] could be more tedious ... and because he had another assignment to complete, I was thinking if I give him the easier part, then he can spend more time on his other assignment."

A high performer actually completed all the work even before meeting up with his team-mate who was a low performer and dictated what he (the low performer) had to do :

"When I met my team-mate, I just took out part of the program for him to do."

He actually decided what to assign to his teammate after he had completed the whole assignment on his own.

Sometimes, allocation of tasks was also based on knowing each other's talents, strengths and weaknesses:

> "Since he is stronger in design and graphics... I passed it [the user interface component] to him ... I did the other one."

A high performance student in a mixed performers team commented that he dared not take the risk of being creative in the assignment and suggested that it was because there was a low performer in the team:

> "The other teams took on the challenge to redesign the system and to change the programming specifications because they have two high performers in the team. I don't want to confuse my team mate by doing that ... I am happy just to stick to the basic requirements."

Team Efficacy and Team Grade Goals

Students were asked to indicate their team grade goals. Their grade goals could be low but it should be something that they thought they could achieve. This was to ensure that even low performers in LPTs would have the chance to enjoy success.

The team goal should reflect the perceived collective efficacy of the team (Bandura, 1997). In appraising their personal efficacies, individuals inevitably consider group processes that enhance or hinder their effort. Conversely, in judging the efficacy of the

team as a whole, members certainly consider how well their team-mates can execute their roles. In tasks involving high system interdependence, members must work well together to achieve group results. The aggregate of personal efficacies would over-predict the level of team performance if members do not how to or cannot work well in a team. When there is a highly efficacious individual in the team, the other member will have a higher opinion of their team's capability than his own individual capability. Beliefs of collective efficacy predict level of group performance. Bandura (1997) is of the view that the stronger the beliefs these people hold about their collective capabilities, the more they can achieve.

High performers teams were expected to have a high sense of team efficacy since there were two high performers in each team. Their high expectation in terms of high team grades was a reflection of the perceived high collective efficacy of their teams. The grade goals of high performance teams were mainly As and Bs.

Mixed performers teams also had very high grade goals (mainly grade Bs and Cs). The presence of an efficacious high performer in the mixed performers team could have raised the perceived collective efficacy of the team:

> "I wanted get at least an 'A' for the team ... last semester I got 80. But this is based on what I can do."

This high team grade was based on this student's record of past successes and what she herself could achieve. The ability of the other member of the team was not taken into consideration when she came up with the team goal. This accounts for some very high, and perhaps unrealistic, grade goals set by MPTs.

Team efficacy in LPTs was expected to be low and yet many LPTs had very ambitious team grade goals. These high achievement standards were not realistic compared with their actual records of past performances. It could be an indication that they were willing to try hard (something that the tutors would see as a positive sign) but these unrealistic aspirations saw many LPTs teams failing to achieve the team grade goals in the end. Having unrealistic team goals was not uncommon in the other team types but they had very different reasons for being optimistic.

While the grade goals of low performance teams were mainly Cs or Ds, some grade goals for low performance teams were as high as a B grade. Those who thought they could do well believed in what joint effort (increase in effort) could achieve. Perhaps as a student in a low performers team put it,

> "Two brains working together was better. We have more ideas and because there were two of us, we could complete this assignment sooner. As a team, we could focus on the assignment more as compared to doing it individually."

From a self-worth protection perspective, setting one's achievement goal so high that failure is virtually assured is a self-handicapping strategy. Failure at an exceedingly difficult task reveals very little about one's ability since success is beyond the reach of all but the most capable or energetic students. If virtually everyone else in the class fails too, then the problem resides not in them but rather in the goals they have set (Covington, 1998).

Other Problems With Teamworking

Motivation theorists believe that for cooperative learning to be successful, only group goals and individual accountability of work done are necessary. In most classrooms, students are used to working individually, being rewarded for individual excellence in performance, and competing with each other for high grades. Placing them in groups does not mean they will actually/ automatically cooperate. There is considerable and disturbing evidence that students often do not behave prosocially when working in groups. Managing interpersonal relations often detracts from learning. The problems faced by the students are discussed next.

Cheating

However, according to the students interviewed, cheating was going on especially among some of the weak teams (those comprising low performers) and they suggested that the tutors should and could have prevented it.

"Perhaps they cannot do it themselves. Some students simply do not like programming. They really don't know how to do it. They do not want to get a zero. So they copy just to pass."

"Cheating was going on but we can't stop it. It is unfair to other students especially when grades are involved."

"There should be a good programmer in the team. This will help to stamp out cheating."

"Instead of asking all the teams to develop the same application, there should be given a variety of different applications to choose from. This also prevents copying and cheating."

Some students felt that they were not cheating if they were looking at other people's program to see how they could improve theirs. It was one way to master and to perfect their skills. Copying would not help them to learn the skills and to understand their work. They would not be able to perform when they go out to work.

> "Looking at other people's program to learn and to improve is different from taking the program wholesale from people from other classes."

> "If I do not know how to do the assignment, I will first try my best. Even if I cannot complete it in time, I will hand it in. I don't want to cheat. When I go out to work after I graduate, I want to be able to write programs. I won't be able to copy [then]. I must therefore learn how to do programming. It is useless to copy. It will help you to get the marks but you really don't know how to do it."

There were clearly signs of stress among the low performers in the weaker teams who could not cope. From a self-worth perspective, cheating is a way to avoid failure by appearing to have succeeded in completing the programming assignment (Covington, 1998). Team members were not able to help each other and when submission date drew near, they had to resort to copying other people's programs.

Demonstration of Ability

HPT members were all skillful in programming and had done well in the previous semester, scoring grade A or B for their introductory programming module in their first semester examinations. There should have been no problems with the assignment if they had worked closely with their team mates. In fact, the assignment was easy enough and could have been completed by a high performer single-handedly in less than two weeks, without any help from his teammate. The challenge in the assignment for high performers was in fact the ability to work in a team, with another person (a

low performer in a MPT or a high performers in a HPT) to complete the assignment. The assignment did not require technical prowess. They had to demonstrate their team working skills. Like students in the other team types, their ability to cooperate, communicate and coordinate were put to the test:

> "Nobody knows everything. When we come together to plan and schedule our work, agree on the design of our software, check each other's code, and integrate the modules, we found out that we have a lot to learn from each other. We also learned that if team members do not and cannot communicate well with each other, the team will not succeed even though the team has two students who are very strong in programming."

For most teams, there were exchange of ideas, sharing of knowledge and planning as expected. They wanted their teams to succeed and were committed to achieve their team goals.

Some high performers in HPTs were, however, all out to demonstrate their competence and ability. They wanted to show their team mates that they were better in programming:

> "There is one particular team ... the best in OOP in the class ... one student is better than the other. They will discuss [what each should do] ... then the next day when they came back to school ... the better one said he has already done everything ...."

There was also another high performance team where a student did everything "... without asking his partner ... he never asked his partner for his opinion."

Those who did not work closely with their team mates suffered the same fate as the uncooperative students in mixed performers and low performers teams. They found difficulties at the stage when they tried to integrate their software components and

would have to look at each other's codes and make the necessary changes quickly before submission.

There was also a clamor for what were perceived as the most difficult parts of the assignment. They wanted challenges and at the same time also wanted to demonstrate their ability to their team-mates and tutors.

In MPTs the high performers felt that they had heavier responsibility to ensure the success of their teams. They believed that the success of their teams depended entirely on them. Some took control of the team by being its de facto leader. They allocated the tasks; the easier ones were assigned to their team mates. They did the final integration of the various components. They tested and corrected or modified their team-mates' programs without giving any reasons or explanations. Sometimes they did not inform their team-mates of what they had done. Low performers relied heavily on the high performers to make the decisions in almost every aspect and at every stage of the assignment.

One high performer explained why his team-mate was not able to explain the functions and logic of her program to the tutor during the test/viva :

> "She did not recognize her own program. In order to integrate the various components I had to make changes to her codes. She didn't know that I have modified it and was unable to explain to the tutor during the viva."

The better student in the team had felt responsible for the successful completion of the assignment and had taken the liberty to modify his team-mate's program without her

knowledge. His team-mate was therefore not able to explain the logic of her program when she was questioned by her tutor during the test.

Some high performers in the MPTs did not want others to think that they were responsible for, what they thought, the likely failure of their teams. One even completed the assignment single-handedly within a couple of days and showed the completed work to his tutor :

> "When I got the assignment handout, I went home straight away to do the assignment. I completed the program within 2 nights. I emailed it to Allan [his tutor]. [When] I got a team mate [a low performer] ... I just selected a few parts of the program for [him] to do."

He did this to tell his tutor indirectly that if the team were to obtain a lower grade than what it aimed for, he was definitely not the one responsible for the failure. Therefore he should not be blamed. His low performing team-mate would be responsible for failure to achieve the team's grade goal. Perhaps they also wanted to get praise and recognition for working hard and completing the assignment without any help from their team-mates.

Help Giving

In a competitive situation where students have to work on their individual assignments, seeking help can sometimes be quite difficult. Every student looks after himself first and would be unwilling to share:

> "There are two types of good students .... those who can help and are willing to do so ... the other type are those who can help but are selfish ... for them to teach you is like you have to beg them."

In a team assignment where only one grade is awarded for team performance, the stronger team member is more willing to offer help because it is to his advantage to teach his team mate to ensure team success. Therefore help seeking and helping giving are behaviours that are central to learning in groups.

High performers who have an incremental view of ability believed that their team mates could develop their ability if guidance and help were given. Some were also more ready to offer help to their team mates, even unsolicited help. Their team mates, however, must put in the effort to improve their skills and knowledge.

> "It is not because they are stupid. Once they have understood the concepts and how to apply them, they will find the whole thing very easy."

> "... you just have to keep learning and applying what you have learned ... that is the only way to improve."

> "He is very hard working ... very keen learner ... that's why he can do it [the assignment]."

Those strong in the subject were confident that they had ability not only in programming but the ability to teach as well. In fact one student claimed that he had been doing (peer) tutoring.

> "I consider myself experienced to teach Programming ... because I am one of the better ones in OOP [name of the module] ... sometimes I teach my classmates."

In high performers teams, team members realized the benefits and importance of team work :

"Since it is teamwork,.it doesn't matter who puts in more effort...just to complete the assignment. We have to learn from each other. Definitely there are things I know that Lewis does not know and vice versa. What he does not know, he can ask me. If I don't understand [any thing] I will ask him."

It has been reported that in collaborative learning, the high achievers should be the ones who benefit most (Slavin, 1991; Webb, 1992). In MPTs, high performers did not mind having to help low performers in their teams and believed that by doing so, they would become even better in what they were doing. Help-giving can benefit even high performers and they admit it:

"... when I teach them ... and encounter something I don't know ... I have to make sure I know it before I teach somebody ... so I have to learn first. I get better by helping others."

"... we learn from their mistakes ... so that we don't make the same mistakes ourselves."

Being able to help, that is knowing that one can provide help and the act of helping also provided a lot of satisfaction to the high performer and helped them gain self-esteem through the process. This had nothing to do with wanting to get a high grade. Using their skills and knowledge to help others made these students feel good about themselves and they become even more confident.

Students must also be responsible for knowing how and when to help. According to one student interviewed, somebody published " a skeleton of the codes on the web". Some students saw it as an act to show off his/her ability. It was also considered an irresponsible act :

"Helping by broadcasting the code will do more harm than good. The students will just copy without really understanding the code. He will not be able to answer questions posed by the tutors later."

Sometimes students may not know how to provide help effectively and may require special training to learn how to explain and elaborate. To be able to provide help effectively, students should be helped to craft good explanations. These include giving examples, creating analogies, using metaphors and multiple representations. These require students to make visible their thinking process and skills (Resnick, 1987; Resnick & Klopfer, 1987; Newton, 2000; Sternberg, 1985; Swartz et al., 1998; Swartz & Parks, 1994). They need to be effective thinkers in the first place before helping others to understand. Some high performers had difficulties trying to make their low performing team-mates understand what they were doing:

"He went through my program and then pointed out where the errors were located and what how I should modify it. He tried to explain to me why the code has to be changed but I didn't understand him at all."

Seeking Help

In this investigation, low performers in LPTs who believed that their programming skills could be improved through practice and hard work were willing to put in effort to successfully complete their assignment:

"[I] seldom doubt my ability. If you put in hard work you have this ability. It is just whether you want to put in the effort."

They would turn to their classmates, friends from other classes, their tutors, published materials and even the internet for help instead of to their team mates. This was because sometimes their team mates found the assignment difficult too and needed

help themselves; they were not in the position to offer any help. The act of looking for help from all sources, when needed, showed that those students were actively looking for answers and wanting to learn. They approached these people and then came back to explain what they had learnt to their team-mates. They looked at other people's work to see how they could improve theirs.

They were willing to put in a lot of time and effort to help each other in order to complete their assignment. Working with another student in a team allowed the students to develop a greater sense of responsibility to get work done. In the end, they realized that to succeed, they just had to put in more time and effort to learn and develop their skills in programming. They soon realized that ability in programming could be developed over time. Students who were focused on learning would not see help-seeking as reflecting negatively on their ability (Butler, 1995). They saw help-seeking as a strategy to help themselves learn.

The reason why some students did not approach their tutors for help was that they had difficulty communicating with their tutors. It was not a relationship problem but a communication problem; they could not understand their tutors' explanations. Somehow they found that their classmates were able to explain difficult concepts and principles in a way that they could understand. Perhaps with their classmates, they were more persistent in asking questions until their doubts were cleared. However, help might not be forthcoming for various reasons:

> "In team work they will feel free to ask for the help they want for sure because they are all working in one team. However, the help they get depends on who they are paired up with. Some are not very good in explaining, some are not very patient ... just like our tutors."

Some students may not even be aware that they need help nor seek it when needed. They may not know how to ask questions that identify their problems, or they may be unable to make use of help they receive.

Some low performers in MPTs were reluctant and afraid to seek help because they did not want to take up the precious time of their teammate or classmates. Some also did not want to appear stupid by asking too many questions. More troubling though are students who remained silent or withdrawn because they believed that needing help indicated incompetence (Nelson-LeGall, 1985; Fosterling, 2001) as can be seen in the following description of a student in a helpless state:

> "I don't know ... he didn't ask questions. I asked him twice ... what he thought about this assignment ... what problems he was facing. He just said he didn't understand it at all. Maybe he thought he could not provide any help and that I could complete the assignment without him. He didn't do anything. He should feel very shameful but I think he has no shame."

Team-Working Skills

There was no way the students in the team were able to produce a piece of integrated software if they just simply divided the tasks between them and went separate ways to do their work. Some planning and scheduling, however simple, was required right from the start. Although it was not stipulated, team members were expected to work closely together to design the system and the various components; allocate the various tasks; test and then integrate the various software components. They were also expected to review each other's work, and ask for explanations and clarifications as and when necessary. At the end of the assignment both members of the team should

be very familiar with the overall system design and how each component functioned. Close communication and co-ordination were required so that the assignment could be completed successfully.

Some students did not know how to work together with another person in a team to develop a software product. Admittedly the students had no previous experience working in teams to develop software. In the past, they had been used to working alone on their programming assignments and exercises. There was evidence that the students were having difficulties working together in teams to develop software. The problems faced by some teams are summarized in the following comments by the students of their team working experience during the interview sessions:

"... when we tried to integrate our programs into one, we found that it didn't work. There were lots of errors. I have an understanding of a concept and she has her own interpretation. I don't understand her code at all. I admit that we did not know how to work together to produce a working product."

"... there was a lot of work to be done to correct each other's mistakes due to lack of understanding ... in the end it is really a waste of time to work in a team. I think it should be an individual assignment."

"... in programming it's better to work independently ... because when two persons work together they may have different understanding of the various concepts ... and when there are clashes [differences in interpretation or understanding of concepts], then there'll be a lot of work involved to change the code. In an individual [rather than team] assignment ... we can still seek help from or offer help to our friends. We can still discuss and share our knowledge. Its just that in the end you can go home and work alone."

"Honestly, I don't know how I should communicate with my team mates, to exchange ideas, to solve problems together. I have tried my best. I still think I need to learn how to do better in this area. But how? "

" ... but it is difficult [to work in a team] ... firstly the team is small ... nothing much to plan ... assignment is pretty small scale ... it's very messy and unnecessary work in a team."

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"When we tried to put our program together, we found a lot of errors. I don't understand her code at all ... maybe only 30%. I couldn't even help her to debug. There was also no time left."

"If I had to work on it (the assignment) alone, I would not have any problems. His understanding of the various concepts was different from mine. A lot of work has to be done to iron out our differences."

"I thought how she program didn't matter to me. I was only responsible for my own components. But I was shocked when the time came to combine the various modules. I didn't understand what she was trying to do."

The tutors felt that the assignment was small enough to be handled by two students working in a team. At that stage the students had no experience in software project planning and control. This, the teaching team felt, was not really necessary as the assignment was not a complex software project undertaken either individually or by a large programming team. Some simple planning and target setting would suffice. They felt no need to have team-building activities before the assignment since the teams were small. Also, the team members were from the same class and they were no strangers.

Tools and techniques to help students in their cooperative tasks had been introduced to the students in the lectures and tutorials and they were expected to adapt and to use these in their team activities so that they could produce a working product.

When a small program is being written by a single experienced programmer, the development process is very simple. After reading the requirements specification, the structures of the program and the data are very clear in his mind while he is writing the code. If the program has to be modified, he understands the program so well that he knows exactly where to make necessary changes. With large software, however, and if

more than one person is involved in the development, it is usually necessary to introduce more structure and formality into the process.

The programmers can no longer write code based on the specification alone. First, they have to produce a model (a structure chart or diagram) showing how the overall functionality of the program is split into a number of subprograms, and illustrating their relationships. Models are certainly much easier to understand than the code of the system and are often used to illustrate aspects of a system's overall structure or architecture. They provide a valuable means of communication both between different members of the development team, and also between the team and the client or user. UML (Priestley, 2000), a tool for designing object-oriented software was introduced to the students but most students normally skip this design step. They jumped straight into coding without coming up with a design, a structure or a model first.

In class, students very often ask their classmates and even tutors to help them check their programs after they have done the checking themselves and still cannot find the errors or "bugs". This is a tedious job which nobody likes to do for another person. However, in teamwork a thorough check of a team-mates' program will benefit the team as a whole. This is also a good mentoring method since such reviews provide a coaching opportunity to pass along tips for better ways to do things the next time. However it was evident from the interviews that such mentoring was not carried out all the time. Sometimes low performing students did not even know that their programs had been modified by their team-mates. The most common excuse was that there was no time to explain where and why the changes were made.

Understanding source codes written by another programmer is an essential skill, critical when software components have to be integrated to form a functioning system and important when programmers have to maintain software written by others. In MPTs and LPTs, many low performers would not have the ability to look for defects (syntax, logical and run-time errors) in their own programs let alone comprehending programs coded by someone else. One would expect the knowledgeable and skillful high performers to take on all these tasks.

Summary of Findings

Studies on cooperative learning and team-working have emphasized the positive motivational effects and successful outcomes, and researchers are optimistic of their potential as an effective intervention strategy especially for low performers.

Cooperative goals and reward structures aim to ensure that team members experience support for contributing to group effort and they therefore have greater opportunities for success than in a traditional competitive situation (Covington, 1993). Cooperative teams will be successful because low performers in the teams will be more motivated to learn; high performers will ensure that their low performing team-mates will learn from them; and cooperative learning strategies will be used with reward criteria that deemphasize ability differences.

Even though there are group incentives and individual accountability (held by motivation researchers to be essential for effective cooperative teamwork), just putting two students together in a team to develop a software product does not necessarily

mean that they will automatically be able to work together to learn, to complete the assignment and to achieve their grade goal.

The present study has shown that cooperative teams were not always successful, regardless of whether the teams comprised mixed performance students or only high performance students. On the other hand, there were successful low performance teams, that is teams comprising only low performance students. The feedback of students during the interviews, was useful in identifying the sources of problems in team work which had led to failures of the teams.

Even though the students were given the freedom to form their own teams, there was dissatisfaction that some teams comprised only high performers. High performers were unhappy that they had to team up with low performers and low performers complained that they had no choice but to team up with other low performers. Having three types of teams had in fact resulted in accentuated perceptions of individual differences among low performers in both LPTs and MPTs. It was also difficult to develop group cohesion (an important factor for effective team-working) when the students (especially HPs in MPTs) showed such discriminatory behaviour right from the start.

All teams were allowed to come up with their team grade goals. The teams were considered successful if they were able to achieve their goals. Students in HPTs were expected to aim for higher team grade goals and to be able to achieve them. High performers and especially the low performers in the MPTs were also expected to benefit from the team assignment. Students in LPTs were expected to have problems achieving their grade goals, if the goals were unrealistic. It was found that some

teams, especially the mixed performers teams and low performers teams, had unrealistically high grade goals. With very high grade goals, the chance of failing would be higher. Failure to reach one's goal and be rewarded implied low ability and would threaten self-worth. Setting unattainable grade goals, however, could also be seen as a way to protect self-worth.

Students developing software must not only be familiar with the software development environment and competent in using software development tools and techniques. They must also know how development teams are organized and coordinated. They have to know how development teams ensure that they are producing quality products that users need and that the products are delivered on time. All software development teams require a set of procedures for working effectively in project teams. These include procedures for software design and coding and procedures for product review, walkthrough, testing and integration. Students should be taught how to use such strategies, tools and techniques, and they should apply these in their team assignments.

In MPTs, high performers were expected to offer help to their team-mates but some might not be able to do that due to lack of skills. Students who could gain the most from cooperative activities are those who provide elaborated explanations to others (Webb, 1989, 1992). One of the most effective means of elaboration is explaining the material to someone else. Skills are needed for students to be able to explain concepts clearly so that they could be understood by their team-mates.

In HPTs, there were many opportunities for the high performers to discuss, to argue, and to present and hear one another's viewpoints. Again, the software development

team's working strategies and techniques (all requiring interactions among team members) should provide a useful platform for: feedback, debate and the search for better solutions; the mastering of social processes, such as participation and argumentation, and cognitive processes, such as verification and criticism; and encouraging discovery learning, creative thinking and ideas generation. Through a team project, all students and not only high performers, should have the opportunity to learn to apply the team working skills that they would not need when they work alone. They have to know that software developed by professionals in industry is usually very large and could require the effort of many teams of software developers to complete and that successful software products depends not only on technical excellence but on how members of the software development team work together with suitable design and development strategies and methodologies. They should also be given the opportunity to apply these design and development strategies in their team assignment.

Without high performers in their teams, the LPT members felt that the arrangements were unfair and that they were cheated of a chance to learn from and to work with those better in programming. Having two low performers in the same team heightened the ability difference, lowered team morale and contributed generally to low team efficacy. The time given to complete the assignment was also an added constraint to the low performers and could resulted in team members being helpless, not knowing what to do or how to proceed with the assignment. The high and unrealistic goals they set for themselves were also indications of the need to protect their self-worth. The timing of the team assignment was also not right for some since they had to complete a concurrent assignment for an elective module. This of course provided them with an excuse for not doing well in the team assignment.

Chapter 8

Discussion of Findings

Introduction

The literature on learning and on motivation has suggested how team-working can motivate students to learn and promote mastery orientation. Not all teams can be successful and team-working is not without its problems. The potentially negative effects of cooperative failure are believed to be offset by the increased likelihood of success afforded by the use of cooperative learning and reward strategies (Covington, 1993). To make cooperative learning more effective as an intervention especially for low performers, the problems and difficulties experienced by students working in cooperative learning environments have to be identified (see Chapter 7) and then alleviated or eliminated so that the likelihood of success can be increased.

In this final chapter, the findings from chapters 5, 6 and 7 are reviewed and discussed. Reference is made to the literature reviewed in chapters 2 and 3. The research questions identified in chapter 4 are used as a basis for discussion in this chapter. Suggestions of areas for further research are made at the end of the chapter.

Research Question 1 : What were the students' motivational responses to Programming both before and after they completed the team assignment?

In Chapter 5, the use of Factor Analysis helped identify three factors which represent three motivational styles of the polytechnic IT students surveyed. These are mastery orientation, learned helplessness and self-worth motivation. While these motivational styles, which are based largely on the research of Ames, Dweck and Covington, should not be seen as all-inclusive, they do provide a useful framework to study the adaptive and maladaptive motivational responses of first year IT students to a two-week team assignment.

Students' mastery orientation, self-worth motivation and self-helplessness were measured and compared using computed mean factor scores. When the mean factor scores of the four groups of students (HPs in HPTs, LPs in LPTs, HPs in MPTs and LPs in MPTs) were compared, it was found that factor scores for Self-Worth Motivation were the highest for all the four groups both before and after the team assignment. There were also no significant differences in the Self-Worth Motivation factor scores of the four groups.

The pre-assignment Mastery Orientation factor scores for the high performers in both HPTs and MPTs were the highest of the four groups. The low performers in MPTs had the lowest Mastery Orientation factor score. After the assignment, the Mastery Orientation factor scores of the high performers in HPTs and MPTs continued to be the highest of the four groups. The Mastery Orientation score of the low performers in MPTs remained the lowest. It was found that the Mastery Orientation factor score of low performers in LPTs was higher than their counterparts' in MPTs both before and after the team assignment although the difference was not significant.

The Learned Helpless factor score for the low performers in MPTs was the highest of the four groups both before and after the team assignment although there were no significant differences in the Learned Helplessness factor scores among the four groups.

In order to understand the effects of the intervention (using the team assignment) on the motivational orientations of the four groups of students, an effect size measure (Cohen, 1988) was used. The effect size (d) indicates whether the differences in the pre- and post assignment scores for Mastery Orientation, Self-worth Motivation and Learned Helplessness were large enough to be considered useful, meaningful or interesting.

The two-week cooperative team assignment had positive effects on all four groups. The effects on Mastery Orientation on all the four groups were positive. The Mastery Orientation factor scores for HPs in HPTs, LPs in LPTs and LPs in MPTs went up significantly after the team assignment. The effects of the team assignment on the mastery orientation of HPs in HPTs and LPs in MPTs (d = 0.60 and 0.65 respectively) were quite substantial. The effect on the mastery orientation for LPs in LPTs was small (d = 0.34) but meaningful in this learning context. Another interesting finding is that the change in the mastery orientation for HPs in MPTs was not statistically significant and the effect size (0.19) was not large enough to be meaningful. The effect size of 0.65 for LPs in MPTs was an important finding because it indicates that cooperative team assignments do have the potential as an intervention for use with low performers, at least in mixed performance teams.

The findings indicated that the two-week team assignment had an influence on the students' motivational responses to programming. The positive effect of team-working on the students' mastery orientation style were apparent in all the four groups although the effect on HPs in MPTs was not large enough to be meaningful. This means that team-work can be used as a strategy to improve students' level of mastery orientation towards a difficult core subject in the IT curriculum. Evidence of the students' increased mastery orientation is discussed later in this chapter.

Surprisingly, it was found that the cooperative assignment did not result in any statistically significant changes in the self-worth motivation factor scores for the four groups of students. It is interesting to note that the self-worth motivation factor score continued to be the highest of the three factor scores for all the four groups after the cooperative team assignment. The factor score for HPs in HPTs even went up slightly. The effect size was small ($d = 0.26$) but still worth noting. The self-worth motivation factor scores for all the other three groups went down only very slightly and the changes were not significant. The effect sizes were too small to be meaningful. The self-worth motivation factor scores were still high after the team assignment. It would be interesting to know why and how these students were protecting their self-worth. The factors that affect self-worth are considered in next section of this chapter where the second research question is discussed. Interviews with the students also produced interesting discovery on the reasons why these students were protecting their self-worth, and evidence of the ways they do it. These are discussed in a later section in this concluding chapter where the third research question is considered.

There were no significant differences in the learned helplessness factor scores of the four groups of students being studied. There were no statistically significant changes in

the factor scores for Learned Helplessness for all the four groups after the team assignment. The factor scores for Learned Helplessness fell only slightly for HPs in HPTs, HPs in MPTs and LPs in MPTs while the factor score for LPs in LPTs remained the same. The effect sizes were too small to be considered meaningful. Evidence of self-helplessness among some students will be discussed later in this chapter.

Research Question 2 : How did success and failure in the team assignment affect the self-worth motivation of low performers and high performers?

The interdependence associated with cooperative goals or rewards provides an incentive for students to put in their best effort, share ideas, and achieve (Ames & Ames, 1981, 1984). A team relationship has always been assumed to enhance self-worth by deemphasizing ability differences and fostering a sense of unity and common purpose (Ames & Ames, 1984; Johnson & Johnson, 1985, 1989, 1994). Students who have experienced repeated failures in a competitive classroom should benefit from cooperative goals or reward structures because they will experience support for contributing to the group effort and they will be more motivated. Cooperative learning has potential as an intervention for use with low performers (Covington, 1993). But findings in this study indicate that self-worth protection was still high after the team assignment even though there were positive effects on the students' mastery orientation.

Cooperative reward structures are frequently combined with a reward standard that deemphasizes the role of ability in the allocation of rewards. For example, some

methods emphasize self-improvement (Madden & Slavin, 1983; Slavin, 1980) or performance relative to that of students with similar past achievement (DeVries & Edwards, 1974). When these criteria are used, there is no direct relationship between team members' absolute level of performance and their individual contribution to team success. In this investigation, polytechnic IT students were asked to define their own team grade goals and to work together to achieve those team goals. This alternative reward structure was introduced to increase the team's likelihood of success only if realistic goals were set.

Harris and Covington (1993) found in their study that even the experimentally manipulated individual performance level dramatically influenced the ratings of high and low performers with regard to self- and other-ability, deservingness of reward, and feelings of shame or pride. Their findings illustrate how threatening to self-worth explicit performance differences can be. It is not difficult to imagine the devastating impact in a typical classroom of open comparisons of individual performance indicators in terms of grades or marks.

In previous studies (Ames, 1981; Harris & Covington, 1993), outcome (success or failure) also appeared to be a critical factor in reducing or magnifying the impact of individual performance level differences. Harris and Covington (1993) found that when members of the teams were successful, they gave themselves and their team-mates more reward than when they failed. Success reduced the discrepancy between the reward given to self and the reward given to the team-mate, particularly for the high performers. Success also raised students' perceptions of the other students' abilities and even low performers benefited from success. On the other hand, failure was associated with indicators of a threat to self-worth for both high and low

performers (i.e., less deserving of reward and lowered perceptions of ability by the other student in the team).

The findings of this study of polytechnic first year IT students similarly indicate that both individual performance level and outcome to some extent influence the ratings of high and low performers in mixed performers teams with regard to self- and other-ability, deservingness of reward, and feelings of shame or pride.

High performers in successful MPTs viewed their own and their partners' ability and deservingness of reward as very similar. Successful cooperation had therefore fostered a sense of perceived similarity and shared responsibility. However when the teams were unsuccessful, high performers gave slightly lower ability ratings to their team-mates than they gave themselves. While success raised the high performers' perceptions of the other students' abilities, team failure made them quickly put the blame on their team-mates.

Their low performing team-mates were not as able as they were and were responsible for their teams' failure. Some dissatisfaction with their team-mates' (low performers) performance was indicated. High performers were really protecting their self-worth when they gave themselves higher ratings when their teams were unsuccessful than when their teams were successful. What they were saying was that their teams' failure was not their fault.

However, they gave their low performing team-mates slightly more rewards than they gave themselves. Although their team-mates were not as smart as they were, they had nevertheless put in their best effort and were probably given the rewards as a form of

encouragement. However, it is also true that they wanted to protect their team-mates and at the same time to ensure that their team grades would not suffer.

In both successful and unsuccessful conditions, the low performers in MPTs gave significantly higher ability and reward ratings to their high performing team-mates than they gave themselves. Surprisingly, the ratings low performers gave to their high performing team-mates were higher when the teams were unsuccessful than when the teams were successful although the difference was not significant. It could be that the low performers felt responsible for their teams' failure and were indirectly saying that their high performing team-mates deserved (or should be compensated by getting) more rewards. Guilt came with shame to the low performers, and they believed that they were responsible for the failure of the their teams. By giving a high ability rating to their teammate, they might be saying that their team-mates were not to be blamed or to be held responsible for their teams' failure. It was also a simple form of compensation.

The amount of difference between high performers' self-ratings of ability and their ratings of the other students in their teams (i.e., the low performers) was significantly less than the comparable difference between the low performers' self- and other-ability ratings. This was true regardless of outcome but the difference was statistically significant when the teams were unsuccessful. Being a low performer in MPTs significantly magnified perceptions of ability differences.

Individual performance level also influenced the self-other difference in ratings of deservingness of reward in MPTs. The amount of difference in the self-other ratings of high performers was less than the amount of difference in the self-other ratings of low

performers regardless of outcome. Again, being a low performer significantly magnified perceptions of self-other difference and especially so when the teams were unsuccessful.

This study also found that when the MPTs were unsuccessful, the LPs gave themselves a higher shame rating than they gave to their team-mates although the difference was not significant. High Performers gave themselves lower shame ratings compared to those they gave their team-mates. The self-other shame rating differences for the two groups, however, were not significantly different.

One would expect that when failure occurs in a mixed ability team, the low performer in a cooperative reward condition will be perceived by self (and team-mate) as incompetent. On the other hand, the high performer will be insulated from the implications of failure, because the low performer can always be blamed. There was only a very slight hint of double jeopardy (both individual shame and team blame) for low performers in unsuccessful MPTs in this study. The result of this study is therefore not entirely consistent with past research (Ames, 1981; Harris & Covington, 1993).

A difference between the present investigation and previous studies was how success and failure were determined. In previous studies, the teams were successful only when they achieved scores determined by the researchers. In this study the teams were asked to set their own grade goals. This could have diluted the impact of failure in a cooperative reward structure.

While previous studies on the self-worth related effects of success and failure on cooperative learning (Ames, 1981; Harris & Covington, 1993) focused only on mixed

performance teams, this investigation also looked at the effects of success and failure on the self-worth motivation of students with similar performance levels working together. In this study, low performers worked in pairs in LPTs and high performers worked in pairs in HPTs.

If individual performance level can dramatically influence the ratings of high and low performers with regard to self- and other-ability, deservingness of reward, and feelings of shame or pride, then one can expect low performers in LPTs to give very low ability and reward ratings to themselves and to their team-mates. One can also expect high performers in HPTs to give very high ability and reward ratings to themselves and to their team-mates.

It was found in this study that the ability ratings that the high performers in HPTs gave themselves were the highest compared to all the other groups. This is true regardless of whether they were successful or not. However, the self-ability ratings were higher when they were successful than when they were unsuccessful although the difference was not significant. HPs' perception of their own ability appeared to be higher when they were in HPTs. The lower perception of their team efficacy in MPTs could have affected perception of their own ability.

In HPTs, HPs rated their team-mates' ability as much higher than theirs regardless of the outcome. This finding was unexpected since no ability differences were expected between the members in the HPTs; team-mates were equally competent. The self-other ability rating difference of unsuccessful HPs in HPT was in fact statistically significant. This could be another way to say that they were responsible for their teams' failure since they were not as able as their team-mates. Using ability rather than

effort attribution for failure would lessen the blame and condemnation from their team-mates and could gain some sympathy from their tutors (see Grant and Dweck, 2001).

In LPTs, low performers' ratings of their own ability were high when their teams were successful. These ratings were even higher than the self ratings of their counterparts in successful MPTs. When they were successful in LPTs there was less ambiguity as to who contributed to the teams' success. In MPTs, credit was always given to the most able member, the high performer, for the teams' success. However, when they were unsuccessful, low performers in LPTs rated themselves very low in ability, the lowest self rating given by any one group of students. On the other hand, they rated their team mates' ability as significantly higher. Failure to achieve their team grade goals was like a confirmation that they were indeed low performers and they lacked the ability to program. This was likely to be accompanied by a feeling of shame. They felt responsible for their teams' failure to achieve their goals. Giving a higher ability rating to their team-mate was like trying to compensate their team-mate for the team's failure.

High performance team members gave themselves very high reward ratings regardless of outcome. The reward ratings they gave themselves were among the highest of the eight groups. This was consistent with the high ability ratings they gave themselves.

The relatively high reward ratings that successful LPs in LPTs gave themselves were comparable to the self-reward ratings of their counterparts in successful MPTs. However, the amount of rewards that LPT members gave themselves when they were unsuccessful was the lowest any one group had given itself. This is consistent with

their very low self-ability ratings. They felt that they were responsible for the failure of their teams and were less deserving of rewards.

The self-other ability differences for low performers in successful and unsuccessful LPTs were lower than those of low performers in successful and unsuccessful MPTs. When comparing themselves with their team-mates, low performers in LPTs surprisingly perceived a significant ability difference. Although low performers perceived an even greater ability difference when they compared themselves with their team-mates (the high performers) in MPTs, this finding is not surprising. The self-other ability differences of LPs in successful and unsuccessful MPTs were the highest compared to all the other groups. Regardless of the ability-level of their team-mates and regardless of outcome, being a low performer has accentuated the perception of ability difference.

LPs gave their team-mates (whether they were HPs in MPT or LPs in LPT) substantially higher rewards than they gave themselves, regardless of outcome. The differences were all statistically significant. The self-other difference in reward ratings was the highest for LP in unsuccessful MPT teams. Low performers felt that their team-mates deserved more rewards than they did regardless of their team-mates' performance level or outcome of the assignment. It could be that the low performers did not have high regards for their own ability and contributions, and felt that they deserved less when the teams were successful. Instead, credit was given to their team-mates. When their teams were unsuccessful they felt that they and not their team-mates were responsible for the outcome. Perhaps they felt that team-mates should be compensated with and deserved more rewards.

This study of polytechnic IT students revealed that members of LPTs experienced the highest level of shame compared to all the other unsuccessful groups under investigation and believed that their team-mates felt less shame. The level of shame experienced by low performers in LPTs was slightly higher than that experienced by low performers in unsuccessful MPTs. For those in LPTs, failure was a confirmation that they did not have the ability and they felt shameful. Perhaps they were also guilty because they were unable to help their team to succeed.

Everyone believed that students in the HPTs were the strongest in programming and would most likely achieve their grade goals. In MPTs, the HPs could blame their low performing team-mates for the unsuccessful outcome of their teams but in HPTs there was nobody to blame but themselves. Members of unsuccessful HPTs believed that their team-mates experienced as much shame as they did.

This study has therefore shown that the Individual Performance Level, Outcome, and even Team Type have their influences on students' self-worth motivational responses.

Harris and Covington (1993) have raised the question of whether past findings on the positive effects of using a cooperative reward structure were a consequence of the reward structure per se or of the higher probability of success for low performers typically associated with these techniques. Harris and Covington's study in fact suggests that a critical issue is success or failure rather than whether one uses a cooperative or competitive reward structure. According to these researchers, the potentially negative effects of cooperative failure may be offset by the increased likelihood of success afforded by the use of cooperative learning strategies. Also, without the use of alternative reward structures or criteria, low performers, especially

those working with other students of the same performance level, stand little chance of being successful. The chances of success for low performers are greatly increased if their success is based on improvement (or a self-defined goal) or they are put together with high performers.

There is an assumption that the students will be able to work together in a cohesive manner and that they are equipped with the skills to use the special tools and techniques in a software development team. In Chapter 7, other problems of students working in teams were identified; these problems would often lead to team failures. Restructuring of the team assignments would be needed to avoid the problems identified and to enable the students to enjoy their experience, including success, working in teams.

Research Question 3 : What were the students' perceptions of the team assignment? Were there problems working in teams and what influenced their occurrence?

Studies on cooperative learning and team-working have emphasized their positive motivational effects and successful outcomes, and researchers are optimistic of their potential as an effective intervention strategy, especially for low performers. However, problems with team-working and the contributory reasons were identified during the interviews with twenty students. Some of the problems with team-working were found to be related to the maladaptive motivational style of the students. It was reported in chapter 5 that the factor scores for self-worth motivation (a maladaptive motivational style) were the highest for all the four groups, both before and after the team assignment. The interviews with the students produced the evidence of contextual

influences on this maladaptive motivational style. The interviews also provided information about the students' actual motivational responses, that is their thoughts, feelings and behaviours when faced with specific tasks and decisions during their team assignment. Information obtained from the survey questionnaires alone would not be adequate to help explain the motivational styles of the students and to provide evidences of students' motivational responses.

Cooperative goals and reward structures aim to ensure that team members experience support for contributing to group effort and they therefore have greater opportunities for succeeding than in traditional competitive situations (Covington, 1993). Cooperative teams will be successful because low performers in the teams will be more motivated to learn; high performers will ensure that their low performing team-mates will learn from them; and cooperative learning strategies will be used with reward criteria that deemphasize ability differences.

Even though there are group incentives and individual accountability (held by motivation researchers to be essential for effective cooperative teamwork) just putting two students together in a team to develop a software product does not necessarily mean that they will automatically be able to work together to learn, to complete the assignment and to achieve their grade goal.

This study looked at students working in pairs in homogeneous and heterogeneous teams in terms of the students' performance levels. The study found that individual performance levels, the types of teams they were in, and outcome have their effects on the motivational responses of students. The feedback of students during the interviews have been useful in identifying the sources of problems in team work

which could explain the maladaptive motivational responses and team failure. If problems with team-working could be identified, it would be possible to suggest how to alleviate these problems and difficulties faced by the students and at the same time enhance the students' mastery orientation.

Meaningfulness of the Team Assignment

In Chapter 3, it was noted that the salience of specific goals in classroom structures can orient students toward qualitatively different patterns and that the goal orientation experienced by students in the classroom can be shaped by specific structures or dimensions. Also, the factors that can contribute to building effective teams were also highlighted in Chapter 3. Problems and difficulties faced by the students are discussed in the light of these structures and factors.

While authenticity of the assignment would normally refer to how real or authentic the task is in order that it can be meaningful, it can also, in the context of the team assignment, refer to how the complexity of the project and the time allowed for the completion of the project make cooperation necessary. To the high performers, the assignment could be completed by one person in less than two weeks. They felt that there was no need for teamwork. In fact they found that it was more difficult to work in a team in which they had to spend time and effort to communicate and to coordinate. For high performers in MPTs, having a low performer as a team-mate was an additional burden since low performer had to be supported. The tasks also did not allow the low performers to demonstrate their other skills and talents, so that they could be seen to be contributing in other ways to their teams. High performers in HPTs found that the assignment was small enough to be tackled by one person and that

a team with two high performers was just unnecessary. Many were able to complete the assignment single-handedly within a matter of days and showed their finished product to their tutors. The assignment was evidently not challenging enough for the high performers.

An assignment is also considered meaningful if it is useful and of value to the students. It should help the students apply what he or she has learned in order to create something usable and useful. It should help the students prepare for jobs in industry. The assignment should be interesting and should appeal to the students. Some students felt that the assignment was artificial in the sense that the software could only simulate the working of a fare-card vending machine. They wanted to develop software that could be used by people. They wanted to solve real problems in real domains. There was only one project (fare-card vending machine system) available and all teams had to work on it. A better design would have had more projects available for the teams to choose. This could also have helped to reduce the problem of copying of work done by other teams, and curbed the problem of inter-group comparison and competition to a certain extent.

While the assignment was too easy for high performers, low performers who lacked the skills and knowledge found it difficult. The problem was compounded by the fact that some students had another assignment to complete within the same two weeks. This created a state of panic for these students. Some resorted to copying blindly the work of classmates in other teams while others became quite helpless. Their team-mates who were in the same predicament were also not able to help them. Adequate time should be allocated to give students a chance to complete their assignments.

Realistic Goal Setting

In order to increase the chances of success, teams were allowed to set their own goals. The intention was to allow students some freedom to decide for themselves the grade goals they wanted to achieve for their teams. The responses to the pre-assignment survey showed that some teams (those that failed to achieve their grade goals in the end) were not able to set realistic goals.

Table 8.1 : Team Grade Goals and Actual Team Grades

Groups	Team Grade Goals (Mean)	Actual Team Grade (Mean)
Successful		
HPT [1]	4.33 [2]	4.33
LPT	2.94	3.38
MPT (HP)	3.18	3.55
MPT (LP)	3.27	3.55
Unsuccessful		
HPT	4.75	3.20
LPT	4.00	1.78
MPT (HP)	4.60	2.93
MPT (LP)	4.47	2.93

(1) HPT = High Performers Teams; LPT = Low Performers Teams; MPT(HP)=High Performers in Mixed Performers Teams; MPT(LP)= Low Performers in Mixed Performers Teams.
(2) Grade A = 5, B = 4, C =3 , D = 2 and F = 1

Table 8.1 shows the grade goals of the various groups and their actual achievements. It can be seen that some LPTs had set unrealistically high goals for themselves -- unrealistic when compared with their records of past accomplishments. It could be that these low performers did not want to create the impression that they were lowering their aspirations and backing away from a challenge. By having these unrealistic

aspirations, they were perhaps trying to give the impression that they were willing to try hard. Also, a statement of a worthy goal, unattainable as it may be, can actually become a source of personal gratification (Covington, 1998).

The findings of the study on the effects of failure on the self-worth motivation of LPs (as reported in Chapter 6) confirmed this. When LPTs failed to achieve these unrealistic goals, low performers were devastated because failure confirmed that they really lacked the necessary ability. Their aspirations remained unfulfilled and frustration would likely to lead to deteriorating performance and even helplessness (Seligman, 1975). In MPTs, LPs felt responsible for their teams' failure to achieve their grade goals. There were slight hints that they experienced both shame and guilt at the same time.

Anxiety can also bring into play defensive mechanisms like aiming too low. If high performers in HPTs have unrealistically low grade goals, this could also be a self-worth protection motive (Galloway et al., 1998). This type of behaviour can be considered maladaptive since it was not aimed at improving performance.

A team's grade goal may also reflect the team's efficacy. In a MPT, the presence of a high performer could have raised the team's efficacy level which was reflected in the setting of a high team grade goal. There is a perception that the HP would be able to help the team to do well; the efficacy of the team is based on the ability of the high performer in the team.

According to Covington (1998), success and failure are psychological concepts; judgments of success and failure depend less on the individuals' actual levels of

attainment than on whether they achieved their goals. Many of the behaviours associated with the need to achieve, including realistic goal setting, can be enhanced/encouraged through systematic classroom instruction. If students are allowed to decide on their own level of achievement, then good self-judgment becomes the main reason for success, and failure occurs only because of unrealistic aspirations, a cause of failure within the power of students to correct. Then learning need no longer be so aversive, nor effort feared.

Team Cohesiveness

It was noted in Chapter 7 that some students were unhappy that they were unable to team up with the classmates whom they wanted. Performance oriented and grade conscious high performers were reluctant to team up with low performers and low performers were disappointed when they could not find high performers to team up with them. Low performers felt rejected when high performers wanted to have nothing to do with them but instead quickly teamed up with other performance oriented high performers. In the end, low performers had no choice but to pair up with other low performers in the class. High performers who could not find other high performers to form teams had to reluctantly team up with low performers. Ability differences were magnified when students were given the freedom to choose their own team members. Some teams therefore had very low cohesion right from the start and this had an adverse effect on the teams' performance and outcome.

Having three types of teams had in fact resulted in accentuated perceptions of individual differences among low performers in both LPTs and MPTs. It was also difficult to develop group cohesion (an important factor for effective team-working)

when the students (especially HPs in MPTs) had such discriminatory behaviour right from the start. Without high performers in their teams, the LPT members felt that the arrangements were unfair and that they were cheated of a chance to learn from and to work with those better in programming. Having two low performers in the same team heightened ability difference, lowered team morale and contributed generally to low team efficacy.

Choice of Tasks and Demonstration of Ability

It was found that the easier tasks were allocated to the less able members in the teams. In MPTs, the seemingly easier tasks were given to the low performers and the more difficult tasks taken over by the high performers. The high performers became the team leaders by default. HPs in MPTs were not willing to take on more challenges or risks because of their lack of faith in the ability of the low performers in their teams. Knowing their own limited capacity, low performers in LPTs tackled only the basic requirements of the assignments.

In the team assignment, the challenge for high performers was not the difficulty of the programs to be written but for them to work with another student either with a low performer in a MPT or with another high performer in a HPT. Some high performers in HPTs were all out to demonstrate their ability. They also clamored for what they perceived as the most difficult components to program. They wanted to show their team-mates that they were better in programming. Those who did not, and did not know how to work in a cooperative manner, had difficulties trying to integrate the various components to make the software work. Some high performers in MPTs did not want their classmates or tutors to think that they were responsible for their teams'

failure. They completed the whole assignment within a few days and showed the completed work to their tutors. If their teams were to fail, the low performers in their teams should be the ones to be blamed. Perhaps they also wanted to make sure that their teams had something to submit when the due date arrived.

Giving and Seeking Help

Help seeking and helping giving are behaviours that are central to learning in groups. The stronger team members were more willing to offer help because it was to their advantage to teach their team mates so that their teams could succeed. High performers did not mind having to help low performers in their teams and believed that by doing so, they would become even better in what they were doing. Help-giving was therefore beneficial to high performers. They learnt more when they provided explanations and elaborations. Helping others also provided them with a lot of satisfaction and help raise their efficacy level and self esteem.

However, it appears that some students who wanted to help did not know how to do so. Some high performers were found to have difficulties trying to make their team-mates understand what they were doing in terms of programming. They lacked the skill to provide explanations that required clarity and organization in thinking. They were unable to provide clear explanations including giving examples, creating analogies, using metaphors and multiple representations. These required the students to make visible their thinking process and skills, and evidence suggests that training in peer tutoring is necessary.

Students who were focused on learning would not see help-seeking as reflecting negatively on their ability (Ryan et al., 2001). However some students were reluctant to seek help from their team-mates since they might appear to be stupid and slow by asking too many questions. Instead, they turned to other classmates or friends from other classes. There were those who remained silent or withdrawn because they believed that needing help indicated incompetence. Some simply gave up since the assignment was just too difficult for them to cope with.

Software Development and Team Working Skills

Group goals and individual accountability are not adequate to ensure team success. Appropriate methods for cognitive development and cognitive elaboration should be introduced to the students working in pairs to develop software instead of letting the teams grope without any guidance on the use of team-working strategies.

In this investigation, the IT students had not yet developed the critical knowledge and skills necessary to facilitate the systematic development of software. Most first year IT students would approach the program development task as solving a given problem by sitting in front of the computer and coding by trial and error. The tasks, methodology (which include tools and techniques) and skills must be taught early in any IT course which focuses on software development. In fact it is critical for instructors to stress the teaching of these tasks, methods and required skills in an introductory course so that students will begin to develop them as early as possible. While bricolage as a learning style (Turkle and Papert, 1990) may be helpful, if not essential for beginners, software engineering must be learned and practiced by those aiming to be software developers.

If instructors do not succeed immediately in teaching the required fundamental skills, many first year students will get discouraged as problems get harder to solve. It may lead them away from the programming aspect of IT, and perhaps from this field altogether. When students first learn to program, most do not have enough knowledge of computer structure and organization to understand how or why their programs really work. IT students have to quickly learn a fairly large set of skills which include: using a programming methodology; using the tools and techniques that support the methodology; problem solving (which includes problem understanding and analysis; solution planning; and solution designing); writing programs using a programming language; program comprehension; debugging; designing a human-computer interface; testing; and software integration.

When students are assigned to write programs, they frequently generate the source without any organized thought process. Many students begin writing their programs almost as soon as they have read the assignment handouts that contain the problem statement. Students who work alone on small programs will skip many of the required steps. They will have problems writing larger, more complex programs and working with others in software development teams if they do not practise and develop these critical software development skills.

Working with others in a team requires additional software development strategies and techniques. Peer review strategies (IEEE, 1999; Weigers, 2002), like software design and code "walkthroughs" (Yourdon, 1989), and a suitable software development strategy like pair programming (Beck, 2000), had not been introduced to the students at that stage of their Diploma course.

A walkthrough is an informal review in which the author of a product (a design or a piece of code) describes the product to a group of peers and solicits comments. In a typical code walkthrough, the author presents a code module to his project teammates, describing what it does, how it is structured and how it performs its tasks, the logic flow, and its inputs and outputs. Design walkthroughs provide a way to assess whether the proposed design is sufficiently robust and appropriate to solve the problem. Arguing the correctness and soundness of a proposed design leads to improvement as well as to detection of defects.

In pair programming, two developers work on the same program simultaneously at a single workstation. This approach facilitates communication and permits continuous, incremental, and informal review of each person's ideas. Culturally, pair programming promotes collaboration, an attitude of collective ownership of the team's products, and a shared commitment to the quality of each software component (Williams & Kessler, 2000). The pair can quickly make corrections because of real-time review by the partner. The result is robust designs and programs.

These approaches are consistent with the constructivist approach because when students evaluate/review their peers' work, they improve their own performance. Students in this investigation had not been exposed to such group processes and software development strategies.

Students developing software must also know how development teams are organized and coordinated; how development teams ensure that they are producing quality products that users want and deliver them on time. All software development teams

require a set of procedures for working effectively in project teams. These include procedures for software design and coding and procedures for product review, walkthrough, testing and integration. Students in this investigation had not yet been taught how to use these tools, techniques and strategies required for effective working in a team.

Possible Areas for Future Research

In laboratory-based experiments, participants have normally been asked to solve puzzles or to react to described scenarios. Performance is experimentally manipulated to produce high and low performers in each pair, and successful and unsuccessful pairs. This is not to deny that laboratory studies necessarily possess ecological validity but in this study and future field studies of polytechnic students, such experimental manipulations in a natural or real classroom setting could not be used.

As an extension of the current research, the following studies could be carried out in the future:

a) A comparative study of students working alone and students working in mixed ability teams but using the same reward criterion. A 2 x 2 x 2 (Reward Structure x Outcome x Individual Performance Level) factorial ANOVA could be carried out to establish whether there are significant main effects for each of these factors on the ratings for self-ability, other-ability, self-reward and other-reward. Pride and shame data could be analyzed using 2-way

factorial ANOVA procedures. The total variance explained by each independent factor and the interactions of the factors could be determined by using these procedures.

b) A comparison of the self-worth motivation effects of cooperative reward structures combined with a reward standard that alters the criteria used to evaluate individual performance and deemphasizes the role of ability, and a reward standard based on achievement and grades. A reward standard that uses team-defined goals as a criteria to evaluate performance is not realistic to most students, because grades indicate their level of competency, achievement and success.

c) A study of the effects of inter-group competition on cooperation and students' self-worth motivation. In inter-group competition, there is only one winning team in the end.

d) A strength of the research reported here was its ecological validity. However, that inevitably meant that the results could have been compromised by other variables both within the students' course at the polytechnic and external to the polytechnic. An experimental approach would enable the researcher to investigate the influence of specific variables. For example, it would be possible to examine the effect of prior experience on team work, or the effectiveness of teams of students selected by the tutors compared with teams formed by the students themselves.

IT course enrolment figures showed that technical and technology courses were not attractive to female applicants. Many joined the IT course only because they were not given the courses they preferred. Many female students believed that they were not suited for the course because they believed that they did not have the aptitude (or intelligence) or that they would not be able to cope with the heavy mathematics contents of the course. It would therefore be interesting to introduce another factor (i.e., gender) into the study.

In order for the tutors to be able to form effective teams, it would be useful for them to know how students would be motivated when working together in same-gender and mixed-gender teams. In a mixed-gender team, the female students could be high or low performers. Her team-mate (a male student) could be a high performer or a low performer. In a same-gender team, the female students could be of the same performance or different performance levels. How would these variations in team mix affect the motivation responses of students in the teams? The self-worth-related consequences of success and failures on these mixed-gender and mixed-ability teams could also be studied.

Conclusion

This study found that the team assignment had a positive effect on the Mastery Orientation of both high and low performers and especially so for high performers working in high performers teams and low performers in mixed performance teams. These high performers had the highest Mastery Orientation scores before the assignment. The assignment allowed them to learn what they did not already know from other high performers. They were able to compare notes, share their views and

ideas, develop a deeper understanding of subject matters, and were able to develop their technical skills to a higher level. Successful completion of their teams' assignments also raised their individual efficacy levels. They were more confident and expected to be able to take up tougher projects in the future. The team assignment also helped to improve the mastery orientation of low performers in mixed performers teams. They asked more questions and received more help from their team-mates who wanted their teams to succeed. The low performers also benefited by observing the process by which high performers go about learning and doing their programming work. They felt more motivated to try because their team-mates wanted them to succeed. Although this might serve as an argument for heterogeneous groupings as the main mode of grouping, it was found in this study that homogeneous teams of high performers also benefited from the cooperative experience.

While the mastery orientation scores of the four groups improved after the team assignment, the self-worth motivation scores for all the groups continued to be the highest, indicating this maladaptive motivation style was still quite strong. The students continued to remain focused on ability. Ability differences were accentuated when students were allowed to form teams comprising of only low performers. Even mixed ability teams accentuated perceptions of ability differences. In High performers teams, high performers were found to be trying to demonstrate their ability to show that they were better than their teammates. Team failures also resulted in accentuation of low ability, ability differences when comparing themselves to others, and the feelings of shame and guilt, especially among the low performers.

From a motivation perspective, it is quite adequate to have only team goals, group rewards and individual accountability. Team members will cooperate and all members

will learn and benefit through working together. While success is not guaranteed in team-working, it is believed that the potentially negative effects of cooperative failure may be offset by the increased likelihood of success afforded by the use of cooperative learning strategies which include the use of alternative reward criteria (Harris & Covington, 1995). The use of such alternative reward criteria in cooperative learning strategies would help to increase the likelihood of success for the teams. Without these, low performers have very little chance of being among the successful students in traditional classrooms. However, it is naive to believe that an alternative reward criterion is sufficient to ensure successful outcomes.

The problems with team-working identified in Chapter 7 make it obvious that adding team work to classroom instruction is not something simple. The teachers involved in designing and introducing the collaborative software development assignment need to be aware of some of the many limitations and considerations to successful use. For team work to be effective, the teachers should address these potential problems of process and the factors that influenced their occurrences. Here is where constructivist theories of learning and instruction can provide useful input to motivation theory.

It is clear that for the software development team assignment to be more effective, the teachers should consider the following:

(a) promoting positive norms, to include training for cooperation, including listening and resolving conflicts, teaching students to appreciate the skills and abilities of others. An emphasis on team-building activities would result in higher group cohesion (Blumenfeld, 1996; Cohen, 1986; Johnson & Johnson, 1989, 1999).

(b) making the assignment interesting, authentic, challenging and meaningful to all students after having considered their individual performance level (Ames, 1992).

(c) promoting interdependency by making the tasks sufficiently heavy, challenging and interdependent so that no student can possibly complete the assignment on his own without collaborating with his team-mate.

(d) giving the teams enough time to complete the assignment. This requires the teachers to know the students' other course commitments, like concurrent assignments.

(e) assessing the performance levels of the students and the other skills and talents they possess before helping them to form teams of the right size and with the right mix of background.

(f) exposing students to the tools and techniques used by software development teams in industry including software design methodology, peer reviews and pair programming.

(g) preparing students to be peer tutors; this involves giving elaborated explanations that require clarified and organized thinking, similar to those normally required by teachers in the classroom.

(h) teaching students how to set realistic goals for themselves and their teams.

The cognitive processes described by the constructivists (see Chapter 3) are important mediating variables that could help explain the positive mastery oriented outcomes (achievement, affective and non-achievement) of effective cooperative learning methods. The constructivists, as pointed out in Chapter 3, do not believe that group goals and individual accountability are necessary in cooperative learning. They also do not emphasize the building of group cohesiveness.

Team-working is not a panacea for developing mastery orientation and preventing maladaptive motivational styles in the learning of programming. However, if teamwork is properly structured, using ideas from research on constructivist perspectives on learning and instruction, it should maximize the benefits for both high and low performers. Creating successful group work is not simply a matter of putting students together. Building truly constructivist, mastery oriented classrooms is certainly not easy and there are dilemmas and difficulties that are likely to impede the teachers' attempts (Blumenfeld, 1992; Chan, 2002b).

The findings from this research on the motivation and learning of polytechnic students working in teams to develop software add to the pool of knowledge regarding the use of cooperative learning strategies for learning and instruction, and motivation. Several aspects of the research are new. This research investigated the motivation styles of high and low performers working together in mixed performance teams, high performance teams or low performance teams to complete a team assignment requiring them to develop a piece of software. It is hoped that the findings will be useful to motivation researchers as well as teachers involved in the teaching of software development.

Appendix A : Assignment Handout

THE CENTRE FOR COMPUTER STUDIES
DIPLOMA IN IT(CS)

OBJECT ORIENTED PROGRAMMING
2001 — Semester 2

<u>Assignment</u>

Duration :	2nd April to 14th April, 2001

Duration :   2nd April to 14th April, 2001

Weightage :   60% of total coursework

Nature :   50% individual
50% team

Deadline :   12 noon on 14th April 2001

Penalty for late submission :   10 marks per day or part thereof.
No submission will be accepted after 5 pm, 17th April 2001.

There are **6** pages (excluding this cover page) in this handout. Read the problem specification, instructions and requirements carefully, before you to begin.

SIMULATION OF FARECARD VENDING MACHINE

OBJECTIVE

This assignment assesses your understanding and mastery of the topics taught in the Object-Oriented Programming module. You are expected to demonstrate competency in problem solving, devising appropriate objects, algorithm planning, program design and implementation in Java. As you are required to work in teams of two, you will also learn about teamwork.

Problem Definition:

In this assignment, you are to write a Java application to simulate a Farecard Vending Machine and also perform the journey using the farecard.

When the Vending Machine is invoked it should display the possible operations namely:

1. Farecard purchase
2. Farecard Top up
3. Travel
4. View balance amount.

1. On selection of Farecard purchase, two pieces of information are to be obtained from the user namely **Category** and **Amount** :

<u>Category</u>	<u>Amount</u>
Children	$50
Adults	$25
Senior Citizens	$10

2. On selection of **Top up** the **amount** is to be obtained and accumulated to the current balance in the card. The current balance in the Farecard should be displayed.

3. On selecting **Travel**,

    a. the Vending machine should display the different stages and obtain destination stage. The options for **stage** could be as follows for the adult and senior citizen card:

Stage	Fare
1.	60 cents
2.	80 cents
3.	$1.00
4.	$1.20
5.	$1.40

  b. When the stage is obtained, the Vending machine should deduct the fare from the current balance as follows:

Children : For a child card it should display only a stage with **45 Cents** label and deduct only 45 cents for the journey performed.

Adults : Deduct amount corresponding to the stage.

Senior Citizens: Deduct 50% of the amount prescribed for the stage.

 4. On selecting **view balance** the current balance amount in the card should be displayed.

Suggested user interface

Standard Requirements

Team work (30%):

 (Refer Appendix for details)

- Designing the base class for a person and its derived classes. General design of user interface.
- Integration of the individual modules and writing the Test driver.

Individual contribution (50%):

Member 1 :

- Implementation of Person class and the derived classes. Implementation of UI (stands for user interface) Class

Member 2 :

- Implementation of VendingMc class

Both team members :

- List the classes and methods implemented by you and your team-mate separately.

Additional Requirements

Team work (20%) :

- Introducing Payment by nets
- Handling all exceptional conditions in the transactions.
- Total amount collected in this vending machine through purchase and top up transactions.

Deliverables

You are to submit to the Admin. counter at Level 8, Block 31, the following in an envelope topped with the CCS assignment cover sheet:

- Hard copy of your program listings (properly organized) for your **.java** files

- A diskette labelled with your name, ID, team name, tutorial group. The diskette should contain all the necessary files (**.java** and **.class**) to run your application. [one floppy per team]

- A write-up which should include:

  - Your name, ID, team name, tutorial group.
  - Contribution List prepared by the individual.
  - Assumptions (if any) or deviations from the specified requirements.
  - Any other thing(s) that you would like to highlight.

You should also be prepared to be interviewed and/or to give a demo of your program upon request.

APPENDIX

Outline of the various classes

[This is just a skeletal code that outlines the basic classes needed. You may need to add more attributes and methods to these classes and also add extra classes to your application. You may also need to add return values for methods when necessary.]

Class Person {

  protected double balance;

  public topup(double val);
  abstract public deduct(double val);
  showbalance();

}

Classes Adult, SeniorCitizen and Children all derived from Person.

Class Integrate {

  // construct VendingMc class here

}

Class VendingMc {
static int count;
Person [] allFareCards;
UI uInterface;
JComboBox category, amount, stage;
double [] fareForStages = { 60,80,100,120,140};

Public VendingMc() {
 uInterface = new UI();
//   Initialises all the required components in this class through appropriate methods in UI
//   class

// This class also defines the functionality for each of the components

}

```
purchase_card(int category, double amount)  {
// this method creats a new object according to the category and adds it to allFareCards[]
//Also updates count


}


topup_card(double amount)  {
//this method selects randomly a person from allFareCards and calls the topup method of
the object
}


perform_travel(double amount)
{
//this method select a person from allFareCards and call the deduct method of the object
}




Class UI {

// Contains the components indicated the Screenshot

//The constructor lays out all the components
//All components initially remain disabled
//Contains methods for returning reference to all components
}
```

Appendix B : Pre-Assignment Motivational Style Questionnaire

PRE-ASSIGNMENT QUESTIONNAIRE

Name of Student : _____

Student Number : _____

Team-mate's Name : _____

SECTION A

1. I am aiming for _____ marks for the individual component of this assignment.

2. We are aiming for _____ marks for the team component of this assignment.

SECTION B

Instruction : For each statement in this section, indicate whether you strongly disagree (1), disagree (2), agree (3) or strongly agree (4) by circling your response.

	Strongly Disagree	Disagree	Agree	Strongly Agree
3. I am looking forward to work with another person in a team to do this assignment.	1	2	3	4
4. Team-mates should support and help each other to successfully complete the assignment.	1	2	3	4
5. I think my team-mate's programming skills are better than mine.	1	2	3	4
6. I believe that some people have more ability than others and this means that there will always be differences between them.	1	2	3	4
7. I believe that I am good at problem solving and competent in programming.	1	2	3	4
8. I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	1	2	3	4
9. I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	1	2	3	4
10. I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	1	2	3	4

	Strongly Disagree	Disagree	Agree	Strongly Agree
11. I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	1	2	3	4
12. To me, success means getting grades better than most students.	1	2	3	4
13. Success means that I have shown improvement in my work and that I have mastered my programming skills.	1	2	3	4
14. My success in programming assignments in the past has largely been due to hard work.	1	2	3	4
15. My ability in programming has largely contributed to success in my assignments.	1	2	3	4
16. Luck has a lot to do with the success in my programming assignments.	1	2	3	4
17. I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	1	2	3	4
18. When I was not successful in my programming assignment, it was because I did not put in enough effort or have sufficient knowledge.	1	2	3	4
19. When I did not perform well in my programming assignments in the past, it was because I am not very smart.	1	2	3	4
20. When I didn't do well in my programming assignment, it was because luck was not on my side.	1	2	3	4
21. When I was not successful in the past, it was because the programming assignment was too tough for many students.	1	2	3	4
22. I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	1	2	3	4
23. I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	1	2	3	4

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Appendix C : Post-Assignment Motivational Style Questionnaire

POST-ASSIGNMENT QUESTIONNAIRE

Name of Student : _____
Student Number : _____
Team-mate's Name : _____

SECTION A

1. I deserve _____ marks for the individual component of this assignment.

2. My team-mate deserves _____ marks for the individual component of this assignment.

3. Both my team-mate and I deserve _____ marks for the team component of this assignment.

SECTION B

Instruction : For each statement in this section, indicate whether you strongly disagree (1), disagree (2), agree (3) or strongly agree (4) by circling your response.

	Strongly Disagree	Disagree	Agree	Strongly Agree
4. It is fair that both my team-mate and I get the same marks for the team component.	1	2	3	4
5. My team-mate has other talents and abilities besides ability in programming.	1	2	3	4
6. We worked well as a team and were able to make all important decisions together.	1	2	3	4
7. I believe that some people have more ability than others and this means that there will always be differences between them.	1	2	3	4
8. I believe that I am good at problem solving and competent in programming.	1	2	3	4
9. I often have this desire to learn and to perfect my programming skills. An easy programming assignment will not help me to improve my skills.	1	2	3	4
10. I often worry that I might get poor grades and that I do not have the ability in programming. I will choose an assignment that I can cope with easily because this reduces the risk of failure.	1	2	3	4
11. I seem to be getting poor grades in programming no matter how much I have tried. It is no use putting in more effort.	1	2	3	4

	Strongly Disagree	Disagree	Agree	Strongly Agree
12. I have done well in my programming assignments by working extremely hard. I have to continue to prove to myself that I have the ability to program.	1	2	3	4
13. To me, success means getting better grades than most students.	1	2	3	4
14. Success means that I have shown improvement in my work and that I have mastered my programming skills.	1	2	3	4
15. My success in programming assignments in the past has largely been due to hard work.	1	2	3	4
16. My ability in programming has largely contributed to success in my assignments.	1	2	3	4
17. Luck has a lot to do with my success in my programming assignments.	1	2	3	4
18. I have been successful in the past because the programming assignments were easy and could have been done by any student in the class.	1	2	3	4
19. When I was not successful in my programming assignments in the past, it was because I did not put in enough effort or have sufficient knowledge.	1	2	3	4
20. When I did not perform well in my programming assignments in the past, it was because I am not very smart.	1	2	3	4
21. When I didn't do well in my programming assignment, it was because luck was not on my side.	1	2	3	4
22. When I was not successful in my programming assignment, it was because the assignment was too tough for many students.	1	2	3	4
23. I was unsuccessful in my programming assignments in the past because although I worked hard, I did not employ the right strategies or use suitable techniques.	1	2	3	4
24. I feel that there were too many rules, deadlines, instructions, specifications, and limits/constraints imposed on the assignments.	1	2	3	4

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Appendix D : Evaluation of Self and Team-mate Questionnaire

EVALUATION OF SELF AND TEAM-MATE

Name of Student   : _____

Student Number   : _____

Team-mate's Name : _____

Instruction :   **For each of the following questions, please circle your response.**

SECTION A

1. Was your team **successful** in getting the marks you expected ?   **Yes / No**

2. How capable do you think you are in programming ?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at								very
all capable								capable

3. How much reward do you think you deserve for how you have performed ?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
no								maximum
reward								reward

Answer either Question 4 or Question 5

4. If your team **was successful** in this assignment, how proud are you with your performance ?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at				some				very
all proud				pride				proud

5. If your team **was not successful** in this assignment, how much shame do you feel with your performance ?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
no				some				lots of
shame				shame				shame

SECTION B

6. How capable do you think your team-mate is in programming ?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at								very
all capable								capable

1

7. How much reward do you think your team-mate deserves for what he/she has done ?

1	2	3	4	5	6	7	8	9
no reward								maximum reward

8. Do you agree that besides problem solving and programming skills, your team-mate possesses other abilities and talents required for the assignment ?

1	2	3	4	5	6	7	8	9
strongly disagree								strongly agree

Answer either Question 9 or Question 10

9. If your team **was successful** in this assignment, how proud is your team-mate with his/her performance ?

1	2	3	4	5	6	7	8	9
not at all proud				some pride				very proud

10. If your team **was not successful** in this assignment, how much shame do you think your team-mate feels with his/her performance ?

1	2	3	4	5	6	7	8	9
no shame				some shame				lots of shame

Appendix E : Interview Schedule

<u>Students' Perceptions on the Collaborative Team Assignment</u>

○   <u>**Questions on Group Norms**</u>

      Are you happy with your choice of team-mate?

      Were you able to work well with your team-mate?

      What difficulties did you encounter when working with your team-mate?

      Did you and your team-mate contribute equally to the assignment?

      Who made most of the decisions in the team, e.g. who should do which tasks?

      Were you able to communicate with your team-mate?

○   <u>**Questions on the Assignment**</u>

      How much time did you and your team-mate spend on the assignment?

      Did you find the assignment interesting, relevant and meaningful?

      Did you compare what your team has done with other teams?

      Were you pleased with what you have done?

      Was your product tested? Was it working? How could it be improved/enhanced/augmented?

○   <u>**Questions on Giving and Seeking Help**</u>

      What help did you gave to (or received from) your team-mate?

      Was your team-mate helpful?

      Did you turn to other people/sources for help?

      Did you ask for help when you were facing difficulties? Why/ why not ?

      Did you need to offer your help when not asked?

      Did you benefit from the help given to you? How?

      Did you benefit from giving help to your team-mate? How?

- **Questions on Accountability**

    Who contributed more to the team?

    Is it fair for you and your team-mate to get the same grade?

    Is there a fairer way to reward the team?

    Do you think the viva/test was necessary?

    How else can we find out whether a student has learned?

    What did you contribute to the team?

    Which tasks were done by you/ your team-mate?

    What did your team-mate contribute?

- **Questions on Group Size and Composition**

    Was team-work necessary for this assignment?

    Were two students sufficient for the team?

    How did you form your team?

    What do you think of their team-mate?

    What do you feel about the composition of your team and other teams?

    How and what did you and your team-mates contribute to the team?

    Did you have problems communicating with your team-mate?

    Did that take up too much time?

Appendix F : Coded Interview Script – Interview with HP in MPT

Line	Text	Code
001	IT 04 Lee	]] Student Name(s) Class
002		TT(AL) : MPT(HP)
003	April 2001	] Date Of Interview
004		
005		
006		
007	WHO IS YOUR TEAM MATE ?	
008		
009	My team mate ...	
010	actually before I even got	
011	my team mate .... my friend	
012	collected the assignment paper for me...	
013	I did not come to school that	
014	day ... some of them have classes	
015	that day so they got the assignment	
016	paper first ... I think the	
017	majority of my classmates were already	
018	paired up ... so I was like left out.	
019	.... When I got the assignment paper	Interest in Subject–
020	the following week ... I went home	Performance Approach–
021	and did the assignment ... I	
022	completed the program within1-2 nights	
023	..... I emailed it to Allen	] Tutor
024	.... When I got a team	Choice of Assignment–
025	mate ... I took out part of	Performance Approach–
026	the program for my partner to do	

```
027
028   THAT IS HIS SHARE ?
029
030   Yes ... that is his share
031
032   HOW DO YOU RATE THE ABILITY
033   OF YOUR TEAM MATE ?
034
035   He is pretty weak ... I have                              ] Evaluation of Other : Ability~
036   to guide him.                                             ]
037
038   WHAT WAS YOUR GOAL IN DOING
039   THIS TEAM ASSIGNMENT BESIDES GOOD
040   GRADES ?
041
042   I find that the assignment shud                           ] Teamwork : Benefits/Advantages
043   be more for gaining knowledge and  experience
044   in teamwork ...but it is a bit                            ] Teamwork : Disadvantages
045   difficult ... firstly the team
046   is small ... nothing much to plan
047    ... assignment is pretty small scale
048   ... very messy to work as a team.
049
050   ARE THERE ANY ADVANTAGES IN PAIRING
051   UP WITH SOMEBODY WHO IS WEAK ?
052                                                             ] Help Giving
```

053 | I consider myself experienced to   Teamwork : Benefits/Advantages
054 | teach Programming ... because I
055 | am the better one in OOP ...
056 | sometimes I teach my classmates
057 |
058 | WHEN YOU TEACH DO YOU GAIN ANYTHING ?
059 |
060 | Nothing ... when they need help   Help Giving
061 | and have problems ... I will   Rewards~
062 | teach them after school
063 |
064 | WHEN YOU EXPLAIN CONCEPTS TO PEOPLE
065 | DO YOU FIND THAT IT IS HELPING YOU
066 | TO HAVE A BETTER UNDERSTANDING ?
067 |
068 | Yes ... when I teach ... when I   Teamwork : Benefits/Advantages
069 | encounter something I don't understand
070 | ... I have to make sure I know it first
071 | before I teach somebody ... so it
072 | forces me to find out more about the things
073 | that I am not too certain of.
074 |
075 | YOU HAVE COMPLETED THE WHOLE PROJECT
076 | - WHICH PART DID YOU SUBMIT ?
077 |
078 | I only submit the part I did ...

079 | the other part which I took out
080 | for my partner to do ... I did
081 | not submit.
082 |
083 | SO HOW ABOUT THE TEAM COMPONENT ?
084 |
085 | More like ... we split into
086 | individual components ... the program
087 | is pretty small ... we just integrate
088 | them... one component at a time.
089 |
090 | DID HE HAVE THE CHOICE AS TO
091 | WHAT HE SHOULD DO ?
092 |
093 | I let him choose ... but he said   ⌉ Choice of Assignment~
094 | its up to me to choose for him.   ⌋
095 |
096 | SO HOW DID YOU CHOOSE ? USING
097 | WHAT CRITIRIA ?
098 |
099 | In the assignment sheet, the   ⌉ Help Giving
100 | requirements for each team member are clearly
101 | stated... I just pick those required of
102 | him and give them to him.   ⌋
103 |
104 | DID YOU CONSIDER HIS ABILITY TO DO   ⌉ Choice of Assignment~

105	IT ?	Evaluation of Other : Ability~
106		
107	I did ... because there are two	
108	parts ... I took the slightly	
109	easier part for him.	
110		
111	HOW DO YOU FIND HIS PROGRAMMING,	
112	HIS ABILITY TO PROGRAM ?	
113		
114	Actually he is ok ... at first	Teamwork : Benefits/Advantages
115	he was confused ... blur ... when	
116	I passed my program to him ... he	
117	has to understand and follow exactly what I	
118	have done .... If not his program	
119	will not be able to work with mine ... so I	
120	think that caused the confusion	
121	... as I guided him along ... he	
122	was ok.	
123		
124	YOU THINK HE HAS GAIN SOMETHING	
125	AFTER THIS ASSIGNMENT ?	
126		
127	Yes ... I think so	
128		
129	YOU ARE GIVEN A INDIVIDUAL GRADE	
130	FOR THE THINGS YOU ARE SUPPOSED TO	

131 | DO ON YOUR OWN. YOU ARE ALSO GIVEN
132 | A TEAM GRADE. WHAT GRADE DO YOU
133 | EXPECT FOR THE TEAM COMPONENT ?
134 |
135 | Probably 80   ] Team Grade Goal~
136 |
137 | DO YOU THINK IT IS FAIR FOR BOTH OF
138 | YOU TO GET 80 FOR THE TEAM COMPONENT ?
139 |
140 | It is fair ... we split the work
141 | half-half. He did his share.
142 |
143 | YOU THINK HE HAS ALSO DONE ENOUGH
144 | WORK TO DESERVE 80 ?
145 |
146 | Fair enough for his effort ...   Evaluation of Other : Effort and Contribution~
147 | although he may not have done   Evaluation of Other : Ability~
148 | more than me ... because of his limited   Rewards~
149 | ability, he has put in a lot of effort ... it is ok   Same Grade~
150 |
151 | DID YOU IDENTIFY IN YOUR SUBMISSION
152 | WHO HAS DONE WHAT ?
153 |
154 | Yes ... it is in the written report.
155 |
156 | DID YOU DISCOVER OTHER TALENTS

157	AND ABILITIES BESIDE PROGRAMMING
158	THAT YOUR TEAM MATE HAS DURING
159	THE 2 WEEKS OF THE ASSIGNMENT ?
160	
161	I think he has ... like different	Multiple Intelligence
162	ideas and ways of doing things ... things he
163	did are quite different from what I did
164	... I think he has talents
165	only he did not have the chance
166	to show ... because in the school	Academic Ability
167	environment ... there is nothing
168	much to show except academic work.
169	
170	WHAT ABOUT IN THE VARIOUS TASKS
171	YOU DO ?
172	
173	He is pretty good with languages ...	Multiple Intelligence
174	speaking English, communication.
175	
176	WHAT ABOUT DESIGN ?
177	
178	Quite good ... good colour sense ...	Multiple Intelligence
179	he took the WEB design module ..he designed his
180	own web-site.
181	
182	SO I SUPPOSE YOU BELIEVE YOU ARE

183 | GOOD IN PROBLEM SOLVING AND
184 | COMPETENT IN PROGRAMMING ?
185 |
186 | Sort of ... I agree
187 |
188 | BUT DO YOU BELIEVE THAT SOME PEOPLE
189 | HAVE MORE ABILITY THAN OTHERS ?
190 |
191 | I don't think so ... it depends on the   Ability : Incremental View~
192 | individual .... whether the wants to go   Effort~
193 | learn or not ... so if somebody   Interest in Subject~
194 | has an interest in Programming and wants to learn
195 | programming, he will soon develop the ability to
196 | program ... if he doesn't then he will not
197 | have the ability.
198 |
199 |
200 | SO ABILITY CAN BE DEVELOPED?
201 | Ability : Incremental View~
202 | Yes ... can be improved ...
203 | some are not bale due naturally
204 | born without the ability   Ability : Entity View~
205 |
206 | WHEN YOU CHOOSE .... DO YOU CHOOSE THE
207 | PART THAT IS CHALLENGING OR THE PART
208 | THAT IS EASIER TO DO ?

209

210

211 It depends ... if l can do the

212 challenging one ... I will go ahead

213 with that ....   In school our aim is

214 to get good results ... so we choose the easier

215 tasks to do get good grades

216 ... as assignment comes along ...

217 those not graded then I try to

218 take the challenging ones ... and if

219 I have the time

220

221 DO YOU FEEL HAPPY - DONE ONLY THE

222 EASY ONES EVEN THOUGH YOU GET GOOD

223 GRADES ?

224

225

226 I think ... when we get good results

227 we are happy ....

228 But in terms of

229 value then I felt I shud

230 learn something more if I have

231 done the difficult ones .. but

232 along the way sometimes we can

233 pick it up too ... it depends whether

234 I want grades or learn more.

Confidence~   Mastery Goal~
Self-efficacious

Grades   Performance Goal~
Performance Avoidance~

Mastery Goal~

Performance Approach~ Grades
Performance Goal~
Mastery Goal~
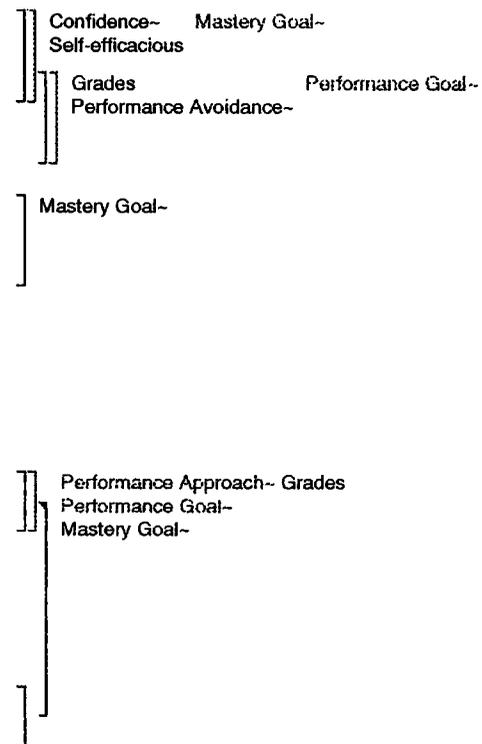
235

236 | DEEP DOWN WHAT DO YOU WANT ?

237

238 | Deep down actually I find learning   ⎤ Mastery Goal~
239 | more is more interesting ...but as students we come   ⎤ Performance Approach~
240 | here to get grades.Future depends on grades.   ⎦ Performance Goal~

241

242 | WHEN YOU GO OUT TO WORK,
243 | ACTUALLY YOUR PERFORMANCE COUNTS ?

244

245 | Yes

246

247 | HAVE YOU CONSIDERED THIS ?

248

249 | Yes ... I did.

250

251 | THE MORE YOU LEARN THE MORE YOU
252 | WILL BENEFIT ?

253

254 | Yes

255

256 | DO YOU HAVE THIS WORRY THAT YOU'LL   ⎤ Fear of Failing~
257 | GET POOR GRADES AND THAT YOU DON'T
258 | HAVE THE ABILITY TO DO PROGRAMMING ?

259

260 | Yes ... the complexity in software

261 | is much more than what I have learned so far ...
262 | ...when I'm free I do some Programming on my own ..I try to.   Mastery Goal--
263 |
264 | HOW DO YOU SOLVE THOSE PROBLEMS ?
265 |
266 |
267 | First I read up more, ask questions.... practise.   ] Self Regulation
268 |
269 | AND DID YOU ACTUALLY COMPLETE THE
270 | ASSIGNMENT ?
271 |
272 | Fully completed.
273 |
274 | AFTER SUBMISSION DID YOU GO BACK
275 | TO MODIFY OR IMPROVE IT ?
276 |
277 | No
278 |
279 | DID YOU IN THE PAST HAVE POOR GRADES IN
280 | PROGRAMMING OR UNSATISFACTORY GRADES ?
281 |
282 | Poor grades ... yes ... actually I
283 | spent a year in JC -- when I was
284 | there my grades in programming were
285 | pretty poor.
286 |

287

288 | DO YOU THINK YOU HAVE TO WORK

289 | VERY HARD TO ACHIEVE WHAT YOU WANT ?

290   Self-Worth Motivated~

291 | I don't feel that way ....   Effort~
                                                                                      Practice
292 | Programming is a skill ...

293 | not unlike maths ... we have to

294 | keep doing it ... does not need

295 | much hard work ... it is like you have to

296 | practise ... my ability is   Ability : Entity View~   Self-Worth Motivated~

297 | there ... don't have to work hard everytime we do it.   Ability in Programming~
                                                                                      Evaluation of Self : Ability
298

299 | DOES THAT MEAN PEOPLE MUST HAVE   Ability : Incremental View~

300 | BE INTELLIGENT TO DO PROGRAMMING?   Ability in Programming~
                                                                                      Lack of Understanding
301   Natural Ability~

302 | Not really .... After I coached my

303 | classmates ... I find out that

304 | they don't understand the concepts

305 | ... but once they understand it is pretty

306 | easy for them then.

307

308 | SO IT IS NOT THAT THEY ARE NOT

309 | INTELLIGENT ?

310

311 | No it is not that ... they were just   Ability in Programming~

312 | confused.   Lack of Understanding

313	
314	WHY DO YOU THINK THEY WERE
315	CONFUSED ?
316	
317	When they do PSP module last year ...
318	it was quite basic stuff ...
319	suddenly this year OOP ... a
320	lot of new things ... everybody
321	is blurr. Too many things happening too fast.
322	
323	DO YOU THINK SUCCESS
324	MEANS GETTING BETTER GRADES ?
325	
326	No
327	
328	SO WHAT IS SUCCESS TO YOU IN
329	THIS ASSIGNMENT ?
330	
331	Getting better grade is one
332	thing ... success is you find what you
333	have learned is useful and you can apply
334	your skills and knowledge.
335	
336	WHEN IS YOUR HAPPIEST MOMENT
337	WHEN DOING THE ASSIGNMENT ?
338	

Lines 317–321: Lack of Understanding

Lines 328–329: Definition of Success : High Grades

Lines 332–334: Definition of Success : Accomplishment/Achievement
Definition of Success : Learned something~

Lines 336–338: Affect~
Definition of Success : Accomplishment/Achievement

339	When my program works !
340	
341	DO YOU LOOK INTO EFFICIENCY
342	IN YOUR PROGRAM ?
343	
344	Yes .. but not for this assignment
345	... I write program for
346	websites ... for those I have to look
347	into system performance because
348	we have to manage the traffic
349	
350	WHO ARE YOU DOING THOSE
351	PROGRAMS FOR ?
352	
353	My father ... he is running
354	a manufacturing company and
355	a dot.com company.
356	
357	SO YOU HAD THE CHANCE TO DO
358	ALL THESE ?
359	
360	Yes
361	
362	IS YOUR KNOWLEDGE OF JAVA
363	HELPFUL ?
364	

Mastery Goal~

Ability in Programming~
Experience

365	I use my past knowledge ...	Experience
366	write programs in Java ... so it was the	Practice
367	knowledge that was helpful.	
368		
369	KNOWLEDGE OF ?	
370		
371	Other languages that I have learned.	
372		
373	YOU MEAN APPLYING THOSE SKILLS	
374	IN YOUR JAVA PROGRAMS?	
375		
376	Yes	
377		
378	DO YOU BELIEVE IN LUCK ?	
379		
380	I don't believe in luck.	
381		
382	WHY NOT?	
383		
384	Sometimes when you encounter	Attribution of Success : Luck
385	unpleasant things ... you say it is bad	
386	luck but things like knowledge	
387	which you picked up along the	
388	way ... and then get good results	
389	... that is not luck ...	
390	sometimes you don't know certain	

260

391	things ... anyhow "tikam" ... may	
392	be that is luck ... I believe if	Attribution of Success : Effort~
393	you do something ... if it turns out	Attribution of Success : Luck
394	well that means it is what you	
395	have done that makes it so.	
396		
397	WHAT IF SOMEBODY FALLS ILL ON	
398	THE DAY OF THE EXAM ?	
399		
400	Not luck ... you are sick ...that is	Attribution of Failure : Luck
401	not luck ... may be you can	Excuse~
402	say he is unlucky ... but	Sick
403	in the end it is because	
404	you don't take care of your health	
405		
406	WHAT OTHER COMMENTS DO YOU	
407	HAVE ON THIS ASSIGNMENT ?	
408		
409	Assignment is quite challenging	Choice -- Control~
410	... wasn't too easy ... but	Choice of Assignment~
411	one thing is the way the assignment	
412	was split up for the individuals was quite	
413	poorly done ... even my tutor	
414	wondered how other tutors can do it	
415	this way ... everybody was confused	
416	... it took us a few days to get the	

417 | students to know how to make the
418 | program work together ... the way
419 | it was split up was confusing ...
420 | so it is unproductive ... it shud be
421 | more flexible ... let the
422 | students come out with their
423 | own ideas ... decide what they want to do.
424 |
425 | THE STUDENT SHOULD BE ALLOWED TO
426 | HAVE A SAY IN WHAT THEY WANT TO DO ?
427 |
428 | Yes ... I have seen other places and   Creativity~
429 | people do that ... in   Risk Taking
430 | general we have to follow
431 | the assignment guidelines
432 | ... of course some
433 | students dare to ....
434 | change the program specifications... come
435 | out with their own ideas.
436 |
437 | DID YOU DO THAT ?
438 |
439 | I did not ... one of my classmates
440 | did ... they produced a very interesting program.
441 |
442 | WHY DIDN'T YOU ?

```
443
444    Firstly they were well-paired ... both                                    ⌐ Risk Taking
445    very strong in Programming ...
446    they can do it together ... I
447    don't want to confuse my team
448    mate ... as long as we satisfy all
449    the requirements .. it is fine with me.                                   ⌐⌐
450
451    HOW DO YOU FEEL ABOUT CHEATING
452    AMONG YOUR CLASSMATES IN THIS
453    ASSIGNMENT ? DID YOU NOTICE THIS ?
454
455    I am not supportive of cheating                                           ⌐ Cheating~
456    .... I believe it does happen ....
457    It is open .... We can do in school
458    .... Bring it home ... obviously
459    people can exchange ideas ...
460    generally cheating is something
461    we cannot stop it ... it is like
462    unfair for the grades ... if I
463    have done well I know myself ...
464    I did not cheat.                                                          ⌐
465
466    WHY DO PEOPLE RESORT TO CHEATING ?                                         ⌐ AAM : Failure Avoider~
467                                                                                 Fear of Failing~
468    I guess it is fear
```

469
470 | FEAR OF WHAT ?
471
472 | Fear of failing ... dropping out
473 | of NA Poly ... or they just don't
474 | care ... willing to take risk ...
475 | get caught ... get kicked out ...
476 | then go some where else and do the things they like.   ]] Interest in Subject~
477
478 | DO YOU THINK THE ASSIGNMENT IS A
479 | FAIR WAY TO GIVE AN INDIVIDUAL
480 | GRADE AND TEAM GRADE ?
481
482 | I am not sure how it was done ...
483 | maybe you can tell me.
484
485 | INVIDIUAL COMPONENT GRADE FOR
486 | INDIVIDUAL PERFORMANCE AND TEAM
487 | COMPONENT GRADE IS GIVEN TO BOTH
488 | TEAM MEMBERS EQUALLY ?
489
490 | Generally it is ok ... if you
491 | grade a team ... when the Team
492 | Component is completed it
493 | shows there is a team work
494 | involved ... I really   ] Rewards~

495	think half of the marks	Team Working Skills~
496	shud be awarded based on	
497	how the team actually works	
498	together ... rather than how	
499	they structure the program	
500	and how it logically works	
501	.... I find by just submitting	
502	a assignment and grading it	
503	... it is not that effective	
504	... teacher shud have few	Rewards~
505	sessions with each team to take note of	Team Working Skills~
506	how the students work together	
507	... that shud be graded based	
508	on the process of how the	
509	students work together	
510		
511	HOW ELSE CAN WE ASSESS THE	
512	TEAM OTHER THAN AWARD A	
513	INDIVIDUAL COMPONENT AND TEAM	
514	COMPONENT ?	
515		
516	It shud be challenging to say	Creativity~
517	... give 40 to team and 40	
518	to individual and 20 left open	
519	for anyone who come out with	
520	new and creative ideas for the program ... that	

521 | means the students should be creative
522 | ... if the assignment says 50%
523 | for this 50% for that ... students
524 | tend to stick to the requirements
525 | ... they are afraid that if they do extra
526 | things ... they will get penalized for it
527 | .... So if the assignment is set in
528 | such a way ... that is certain
529 | marks allocated to those who try out
530 | new things, being different, to
531 | express themselves ...
532 | that will encourage more creativity.
533 |
534 | IS IT BETTER JUST TO GIVE A
535 | TEAM GRADE ?
536 |
537 | Depends ... how the assignment   Performance Approach~
538 | is done ... but if everybody is
539 | given a team grade ... then
540 | everybody gets the same marks
541 | ... how do we differentiate
542 | ....
543 |
544 | DIFFERENTIATE MEANING WHAT ?
545 | Performance Approach~
546 | Means like ... if everybody   Performance Goal~

547	graduate with
548	straight As ... there is no difference.
549	
550	THE OTHER WAY IS WE GIVE INDIVIDUAL
551	GRADE FOR THE TWO STUDENTS IN THE TEAM -
552	THE AVERAGE OF THE TWO INDIVIDUAL GRADES
553	WILL DETERMINE THE TEAM GRADE - DO YOU AGREE ?
554	
555	Not a good idea ... if both are doing
556	individual work ... one guy decides he
557	doesn't care ... whether he does well
558	or drop out ... is not important
559	... if he gets 20 marks ... and I get
560	70 marks ... average is a fail grade
561	... that is not fair
562	
563	WILL THE TEAM MEMBER HELP HIM -
564	MOTIVATE HIM TO DO BETTER ?
565	
566	I find there are difficulties in
567	motivating people ... because
568	people are different in their maturity ...
569	in upbringing ... they think differently
570	... it is very hard to change their
571	thinking ... so the person must
572	already have this self motivation

Fairness
Performance Approach~

Interest in Subject~

573	to work and do something ... to
574	force it down his throat ... it
575	is not going to work ... for myself
576	... my girlfriend who is in the
577	other department ... is not interested
578	in her course ... it is very hard
579	to get her to learn ... like maths
580	... I try to teach her ... it is
581	very hard to get her to learn ....
582	Unless she herself picks up the interest
583	
584	WHY IS SHE SO AGAINST MATHS ?
585	
586	She is not against maths ...
587	it is the structure
588	of the whole course that she doesn't like
589	... may be she doesn't see the purpose ...why
590	she is doing Quality Engineering ...
591	things they learn are too
592	technical ... they don't like it
593	... maybe because they have not
594	worked before and they
595	they don't appreciate all those
596	things taught in class ...
597	they think the technical stuffs
598	are useless ... it is true for all

Interest in Subject~
Relevance

599	courses ... things we learned last
600	year ... this year all is gone, all forgotten ....
601	some don't remember a thing.
602	
603	WHY IS THAT SO ?
604	
605	They don't have to use it ... things
606	we don't use ... we tend to forget .
607	.. Programming I got to use it ...
608	I keep writing and
609	practising.
610	
611	LIKE MATHS ?
612	
613	Maths we get to do it everyday in the
614	semester ... we won't forget ...the maths is use in
615	Programming ....not so easy to forget.
616	
617	
618	WHAT IF WE SAY, WE GIVE YOU THE INDIVIDUAL
619	GRADE BUT THE OFFICIAL GRADE WILL BE THE
620	LOWEST OF THE TWO ? WHAT WOULD YOU HAVE DONE ?
621	
622	If that happens ... if I know before
623	hand ... I have 2 choices ...
624	one is I will be like the

Practice
Relevance

Help Giving
Team Working Skills~

625 | rest of my classmates, why work? ... or 2,
626 | I have to push my team member
627 | to do well
628 |
629 | WHICH IS MORE POSITIVE ?
630 |
631 | The second ... I will try to push   Help Giving
632 | him to do well .... If he doesn't
633 | do well ... I will up to her
634 | and scream.
635 |
636 | DO YOU HAVE MANY SUCH CLASSMATES
637 | IN YOUR CLASS ?
638 |
639 | My class is not that bad compared   Interest in Subject~
640 | to the one in my secondary school ... there,
641 | people were really not interested
642 | to learn ... they just want to
643 | play ... those people are very
644 | hard to push ... if you try to get
645 | them to do something ... they will
646 | avoid ...it is a better environment
647 | here ... classmates are not so
648 | rowdy and most work hard.
649 |
650 | HOW DO YOUR CLASSMATES FIND THE

651 ASSIGNMENT ?
652
653 When the first saw it ... they
654 said 'die' ... but after I told
655 Allen that the class is having
656 problem ... Allen discussed with
657 the class and told us how to go about doing it ...
658 sort of a counseling session ...
659 the class find it ok ... most of
660 their programs are working ...
661 except for one or two teams.
662
663 WERE THEY COPYING ONE ANOTHERS' WORK ?
664 I HEARD SOMEONE PUBLISHED A SKELETON
665 OF THE PROGRAM.
666
667 I believe they didn't copy at all ... because they came to school everyday   ⎤ Cheating~
668 including weekends and even Sundays to do their programming ...   Effort~
669 my handphone was ringing non stop... people were   Willing to Learn
670 asking for help
671   ⎦
672 WERE THEY GENERALLY PLEASED WITH
673 THE ASSIGNMENT WHEN THEY COMPLETED
674 THE ASSIGNMENT ?
675
676

677 | They were very happy ... my
678 | friends were yelling 'I am Free'
679 | ... what I find interesting is they
680 | managed to do the additional
681 | requirements ... which I thought
682 | they will have difficulties ...
683 | but after Allen motivated them ...
684 | they can do it.
685 |
686 | DO YOU THINK THEY HAVE LEARNED ?
687 |
688 | Yes definitely ... some of them
689 | join the IT course because other people
690 | tell them of the good prospects in IT
691 | ... but they don't appreciate
692 | what they are learning ...
693 | like the first few weeks of
694 | OOP they don't remember anything
695 | .... They don't use it ...
696 | practicals they don't do ...
697 | copy from someone else ... just
698 | for submission .... So it is not
699 | effective ... but now like this assignment
700 | ... they have to get the marks ....
701 | they are forced to work ... they will then
702 | learn something.

Definition of Success : Accomplishment/Achievement

AAM : Failure Avoider~
Fear of Failing~
Interest in Subject~

272

703
704　OK. WE WILL END HERE.
705
706　(3259 words)
707
708
709

Appendix G : Coded Interview Script -- Interview with HP and LP in MPT

001	IT 12 Daryl	]]] Student Name(s) TT(AL) : MPT(HP) Class
002	Evelyn	]] TT(AL) : MPT(LP)
003	16/04/2001	] Date Of Interview
004		
005	CAN YOU TELL ME HOW YOU BOTH ENDED	
006	UP IN SAME TEAM ?	
007		
008	D : There were only a few left without a team.	] Choice of teammate~
009		
010		
011	WHAT DO YOU MEAN BY THAT ?	
012		
013	D : Everybody started paring with each other ...	] Choice of teammate~
014	for people who were left behind ...	
015	they will find a partner from the	
016	leftover.	
017		
018		
019	DID YOU WANT TO BE IN THE	
020	SAME TEAM ?	
021		
022	D : More or less... no choice.	
023		
024	HOW DID YOU DECIDE WHO SHOULD	
025	DO WHAT? DID YOU BOTH AGREE WITH	
026	THE TEAM GRADE TO WORK FOR?	

027

028

029 D : Initially I wanted to take the vending   ⎤ Choice of Assignment~

030 machine ... she has to take the other.   ⎥

031   ⎥

032 EVELYN, DID YOU AGREE TO THAT ?   ⎥

033   ⎦

034 E : Yes ... I felt it was reasonable because   ⎤ Evaluation of Other : Ability~

035 he is better than me in OOP ... my part   ⎥⎤ Choice of Assignment~

036 was much easier.   ⎦⎦

037

038 D : That's what you tutors wanted to do, try to put people   ⎤ Choice of teammate~

039 together ... put the stronger ones with the weaker ones ?   ⎥

040   ⎥

041 WHAT'S THE REASON BEHIND IT ?   ⎦

042

043

044 E : Stronger with stronger .... Definitely   ⎤ Competition

045 weaker students will not be able   ⎥ Fairness

046 to compete with them. When we put   ⎥⎤ Teamwork : Benefits/Advantages

047 stronger with weaker ones, the weaker   ⎥

048 ones will learn.   ⎦

049

050 WHAT IF YOU PUT TWO STONGER ONES IN

051 ONE TEAM ?

052

053	D : Then they will have a very good product.	] Choice of teammate~
054	But those who can really from them will not	Competition
055	get benefit.	
056		
057	IS IT POSSIBLE THAT 2 VERY GOOD STUDENTS	
058	MIGHT NOT BE ABLE TO CO-OPERATE ?	
059		
060	D : There are two types of good students	]] Help Giving Ability in Programming~
061	Those who know it and willing to help ...	
062	the other ones are those who know it but are	] Selfishness
063	selfish ... for them to teach you is	
064	like you have to beg them	
065		
066	EVEYLN, HOW HAVE YOU BENEFITED FROM	
067	THE TEAM ?	
068		
069	E : I understand OOP better now I	] Teamwork : Benefits/Advantages
070	learn to work more as a team ...	
071	because in past assignments ...	
072	all were individual work	
073		
074	D : Only this one is a team assignment.	
075		
076	WHAT DO YOU MEAN WHEN YOU SAID	
077	YOU UNDERSTAND BETTER ?	
078		

079	E : I was distracted from learning	Excuse~
080	OOP ... because of my personal	
081	problems ... it is because of this	
082	assignment that someone is there to help me	
083	allowed me to understand more about what is	
084	going on.	
085		
086	HOW DO YOU GET TO UNDERSTAND MORE	
087	ABOUT IT ?	
088		
089	E : Let say when I'm stuck at a problem	Teamwork : Benefits/Advantages
090	... he will teach me step by step	
091	... how to solve it.	
092		
093	IN THE PAST, YOU COULD HAVE ALSO	
094	APPROACHED SOMEBODY FOR HELP ?	
095		
096	E : I was pretty afraid to ask ...	Help seeking~
097	everybody was so busy with their	
098	own work ... they don't have time for me.	
099		
100	E : I always disappear from campus immediately after	Helplessness~
101	lessons.	
102		
103	YOU HAVE TUTORS TO APPROACH. DID YOU	
104	DO THAT ?	

105
106   E : No   ] Help seeking~
107
108   D : Some students have difficulties   ] Help seeking~
109   communicating with their tutors.   ] Teamwork : Benefits/Advantages
110
111   WHEN YOU SAY STRONG STUDENTS
112   EARLIER - WHAT DID YOU MEAN ?
113
114   D : Students who have a good grasp of   ] Ability in Programming~
115   OOP or Programming.
116
117   WHAT ABOUT THE NOT SO GOOD ONES ?
118
119   D : Those who don't pay attention during   ] Dependence
120   lessons ...they rely on classmates all
121   the time.
122
123   WHICH CATEGORY EVELYN FALLS INTO ?
124
125   D : She falls into another category ... who   ] Willing to Learn
126   really wants help ...but no one was
127   kind of free ... until the last minute
128   then everyone starts to help.
129
130   SHE DOES NOT FALL INTO YOUR CATEGORY

131	OF NOT SO GOOD ?
132	
133	D : No
134	
135	HOW DO YOU FEEL ABOUT HIS COMMENTS ?
136	
137	E : I think it is true
138	
139	ARE YOU KEEN TO LEARN MORE ?
140	
141	E : I want to know more but it is difficult] Willing to Learn
142	... very difficult for me to understand
143	Programming ... very glad I have]] Teamwork : Benefits/Advantages
144	friends like Daryl and some other
145	classmates who are willing to help me.
146	
147	WHAT HAVE YOU GAINED FROM THIS TEAM
148	PROJECT? DARYL ? DO YOU BELONG TO
149	THE FIRST CATEGORY ?
150	
151	D : No I don't belong to the first] Ability in Programming~
152	category ... I belong to the middle but Self-efficacious
153	... I learn fast.
154	
155	WHAT HAVE YOU BENEFITED ?
156	

279

157	D : Deeper understanding of OOP ... for the OOP	] Teamwork : Benefits/Advantages
158	assignments ... the practicals ... I have	
159	been applying knowledge learned from the PSP	
160	... my previous background in Programming	
161	... so it is like trial and error thing ...	] Lack of Programming Technique
162	in order to do the practicals ... in order	
163	to do this assignment I realised I only got	] Lack of Time~
164	Friday night to complete it ... I only	
165	started vending machine on Friday ... it	
166	is like don't have much time for	
167	trial and error	
168		
169	HOW WILL THAT AFFECT YOUR INDIVIDUAL COMPONENT ?	
170		
171	D : Not being able to complete all share ... my	] Definition of Success : High Grades
172	aim was the highest 'A' grade ... that will	Help Giving
173	make me feel both successful in the assignment and	Sense of Achievement
174	also happy to have helped Evelyn in the sense that in case	
175	of anything ... she has the safety net to	
176	fall back on ... she completed her part	
177	.... so I had to put in my best to complete my part.	
178		
179	TEAM COMPONENT - WHAT GRADE	
180	DID YOU WANT AT FIRST ?	
181		
182	D : 'A' grade.	

183
184 | WHAT GRADE ARE YOU EXPECTING NOW ?

185
186 | D : A 'C' or 'D'

187
188 | DO YOU FIND THAT YOU HAVE BEEN SUCCESSFUL ? YOU
189 | WANTED SOMETHING HIGHER?

190
191 | D : Not up to my expectation ...but in terms of the limited time   ⎤ Lack of Time~
192 | availbale ... it was pretty successful.   ⎦

193
194 | DO YOU BLAME IT ON EVELYN ?

195
196 | D : No ... I won't blame anybody ... just   ⎤ Attribution of Failure : Effort~
197 | feel that the time given was a constraint...   Attribution of Failure : Lack of Time
198 | we were told of the assignment ...   Excuse : Other Assignments
199 | but the time given was only announced   External factor : Uncontrollable
200 | when they give out the assignment ...   Lack of Time~
201 | we have other assignments to do ... kind of
202 | like concurrent with the OOP assignment ...
203 | we have to concentrate on WEB-F because
204 | we had to hand it in first ...
205 | we were left with the second week to do the OOP
206 | assignment ... it was also a busy Good
207 | Friday week in church ... our time was taken up by compulsory
208 | church events   ⎦

209

210 | ARE BOTH OF YOU IN THE SAME CHURCH ?

211

212 | D : No ... different churches ... but similar
213 | events and activities ... that means less time
214 | ... time constraint ... I did the best I
215 | could ... to complete the minimum
216 | requirements.

217

218 | DO YOU THINK ABILITY HAS A PART TO PLAY IN
219 | COMPLETING THE ASSIGNMENT SUCCESSFULLY ?

220   External factor : Uncontrollable

221 | D : I am still having a hard time now ...
222 | on Friday I had to finish the assignment so that I can
223 | submit by 12 pm on Saturday. I got to work ... have not been sleeping and still
224 | have to work ... try to keep myself awake ...Saturday night
225 | there's a church event ...managed to get some sleep only on Sunday.

226

227 | DID THAT AFFECT YOUR DEMO ?

228

229 | D : Certain areas may be.

230

231 | EVELYN, WHAT DID YOU EXPERIENCED
232 | AT THE DEMO ?

233

234 | E : Pretty tough ... she asked me questions ...

235 | I could not answer ... I tried my very best
236 | .... She was really disappointed with me ...
237 |
238 | WHY WERE YOU UNABLE TO ANSWER THE QUESTIONS ?
239 |
240 | E : I could ... but I got worried ... I got excited   Viva~
241 | ... I got tongue-tied ... I could not go on
242 | ... I try my very best ... I think she
243 | understood me in the end.
244 |
245 | WHY IS THAT SO ?
246 |
247 | E : Sometimes we understand but we   Understanding of Work Done
248 | don't know how to put it in words ...   Viva~
249 | I know OOP ... I can do this ... I can do that ...
250 | I know why I do this ... but in order to
251 | explain in words ... it is difficult ...it just the way
252 | my mind works.
253 |
254 | WHAT DID YOU FIND DIFFICULTY
255 | TO EXPRESS ? IS IT THE CONCEPTS ?
256 |
257 | D : Probably she did not recognised the code .   Team Working Skills-- Lack of Communication
258 | .. she handed me her codes ... I
259 | implemented the vending machine ...
260 | I have to change some of Evelyn's program

261 | .. because two persons doing two different
262 | part, part A and B of the assignment ...
263 | both parts had to be integrated in order for the
264 | programs to work ... so I did change her program
265 | to make it work with my vending machine part ... so
266 | probably she did not recognise this change.
267 |
268 | CAN THERE BE AN AGREED STANDARD AS TO
269 | WHAT BOTH COULD AND SHOULD DO?
270 |
271 | D : Could be ... but still falls on the person
272 | who does the coding ... I could put ...
273 |
274 |
275 | DOESN'T SHE READ YOUR CODE OR YOU READ HER
276 | CODE ?
277 |
278 | D : Yes ... we are still more clear with our own code
279 | ... rather than somebody's code.
280 |
281 | HOW BIG ARE THE PROGRAMS ? IN TERMS OF LINES OF
282 | CODES ?
283 |
284 | D : My is the shortest - hundred over lines
285 |
286 | HOW ABOUT YOURS, EVELYN ?

287
288 | E : About the same.
289
290 | DID YOU THINK YOU ARE UNLUCKY BECAUSE DURING
291 | THAT PERIOD YOU HAVE ANOTHER ASSIGNMENT
292 | TO COMPLETE ?
293
294 | D : Not exactly ... I won't called it unlucky ...   ] Excuse : Other Assignments
295 | but I will called it being challenged ... or maybe I
296 | was forced into it.
297
298 | YOU HAD YOUR SCHEDULE FOR THE PROGRAMMING
299 | ASSIGNMENT ?
300
301 | D : Yes
302
303 | DID YOU ALL RAISE THE ISSUE WITH YOUR TUTORS ?
304
305 | D : No ... we students could not do much   ] Excuse : Other Assignments
306 | ... once something is finalised we   External factor : Uncontrollable
307 | cannot do much about it.
308
309 | ACTUALLY YOU CAN BRING IT UP. WE
310 | DON'T WANT ASSIGNMENTS TO CLASH ...
311 | IF CAN BE AVOIDED.
312

313 | WOULD YOU RECOMMEND WE SHUD CONTINUE
314 | WITH SUCH TEAM ASSIGNMENT IN FUTURE FOR
315 | THE FIRST YEAR STUDENTS ?
316 |
317 | EVELYN ?
318 |
319 | E : It depends on the module ... it is   ] Teamwork : Benefits/Advantages
320 | pretty good for team work experience... I
321 | benefited ... I'm poor in OOP ... it
322 | helped me a lot
323 |
324 | DARYL ?
325 |
326 | D : I think it is ok ... I can work   ] Teamwork : Benefits/Advantages
327 | either individually or in a team.
328 |
329 | WHAT ABOUT FOR ALL PROJECTS?
330 |] Help Giving
331 | D : It is just like the course is giving   Help seeking~
332 | students the excuse to ask for help ...
333 | providing a more acceptable way ...to do it ...
334 | If they are all individual assignments ... the
335 | poorer students will still ask for help ....
336 | But whether they can get help or not is another
337 | thing .... But if it is team work ... they will feel free to ask for help
338 | and will get it because they are in one team ... but it also depends on

339	who we are paired up with.	⌉
340		
341	IS IT WRONG TO ASK FOR HELP ?	
342		
343	D : It is not wrong ... but whether the person being	⌉ Help Giving
344	asked will offer the help ... especially when	
345	at the beginning ... people are more willing	
346	to help ... as we are closer to the deadline	⌉ Reluctance to Help
347	... people are getting more reluctant to help	
348	... either because they have not finish their own	
349	work or they find it quite impossible to help the other	
350	person.	⌋⌋
351		
352	WHAT ABOUT OTHER TEAMS FROM YOUR OBSERVATIONS ?	
353		
354	D : Some do not work as a team.	
355		
356	WHY NOT ?	
357		
358	D : In every course ... they are always students	⌉ Fairness
359	who are not willing to work ... you are really unlucky	Teamwork : Disadvantages
360	to get paired up with one of them ... then you	
361	have to do the work for them.	⌋
362		
363	WHY ARE THEY NOT WILLING TO WORK ?	
364		

365 | D : Probably because they don't understand ... or   ]] Teamwork : Disadvantages Lack of Skill and Knowledge
366 | they don't think the assignment is worth their
367 | time ...   or they really have confidence that somebody will   ] Dependence
368 | help them do their work.   ]]
369 |
370 | DID YOU NOTICE ANY WIDESPREAD CHEATING GOING
371 | ON ?
372 |
373 | D : I guessed so .. very obvious cheating ...   ] Cheating~
374 | someone posted a skeleton of the code   ] Performance Approach~
375 | on the web ... this skeleton is really
376 | very basic ... he is pretty dumb ...   Competition
377 | because each person software, the logic
378 | and the linkages are so different
379 | ... if I pick it up, it
380 | will be useless because I cannot
381 | link it to my own programs.
382 |
383 | WHAT WAS THE PURPOSE OF DOING THAT ?
384 |
385 | D : Maybe they want to show how smart they are   ] Performance Approach~
386 | to get recognition and approval ?
387 |
388 | WHO WILL GIVE THEM THE CREDIT ? YOU MEAN
389 | EVERYBODY KNOWS HE IS THE ONE WHO PUT IT UP ?
390 |] Help Giving

391 | D : It was being done in the 1st few lines
392 | with comments saying that they are only
393 | a skeleton and if you want to
394 | make it more useful, you can refer to the
395 | certain chapters in a book
396 | ...he gives his name and said that the code is given to you
397 | by so and so
398 |
399 | EVELYN, HAVE YOU SEEN THAT SEGMENT ?
400 |
401 | E : Have not.
402 | D : I feel that she will not benefit from it.
403 |
404 | THERE MUST BE A REASON FOR THE GUY
405 | DOING THAT ? DO YOU THINK HE IS
406 | TRYING TO HELP OR WHAT ?
407 |
408 | D : If you really want to help, you won't
409 | broadcast to everyone .... you are
410 | wasting other people's time. If
411 | I really need help now and try
412 | taking his file but do not really understand
413 | ...without understanding the file ...
414 | and then submit the assignment ... during
415 | the demo ... I won't be able to
416 | explain ... he can help someone

Cheating~
Copying
Help Giving

289

417 | to submit his assignment
418 | but if he does not
419 | understand how the program works... he
420 | cannot probably demonstrate and explain it ...he
421 | will suffer in the end.
422 |
423 | ASSIGNMENT IS OVER. WHAT ARE
424 | YOUR FEELINGS ABOUT THE WHOLE
425 | ASSIGNMENT ?
426 |
427 | EVELYN ?
428 |
429 | E : My feeling is that I'm very grateful　　　　　　Help Giving
430 | that I have Daryl as my partner ...it　　　　　　Teamwork : Benefits/Advantages
431 | kind of giving us a push to study
432 | harder for the exam.
433 |
434 | DO YOU UNDERSTAND THE CONCEPTS BETTER ?
435 |
436 | E : Much better　　　　　　　　　　　　Teamwork : Benefits/Advantages
437 |　　　　　　　　　　　　　　　　　Understanding of Work Done
438 | DARYL ?
439 |
440 | D : I still feel that for a subject like OOP　　Lack of Understanding of Subject
441 | that need to be more explanations given in class...　Lectures
442 | in all Programming subjects ... people　　　　Poor Teaching

Tutorials

443 | understand well because during lectures
444 | they explain in greater detail ... in
445 | tutorials tutors should explain in greater
446 | detail when asked ... so that there is better
447 | understanding. In semester one
448 | we were spoon-fed for the PSP ... we
449 | are used to that kind of approach... when
450 | we came to OOP ... we were given the
451 | task of referring to books ... people don't
452 | like to read ... they attend lectures
453 | ... expect everything to be fully explained
454 | ... in return we were given slides
455 | and small slices of programs ... which
456 | show us the codes ... but with no
457 | comments and explanations...
458 | lecturers did not even
459 | go thru with us ... we can read the
460 | codes but we want to know why we do
461 | it like this ... why we call this OOP.
462 | Lecturers and tutors are always
463 | very vague ... students
464 | will not pay attention
465 | to OOP ... concentrate more on other
466 | subjects ... in some lectures ... there   Self Regulation
467 | are cases where we were told to refer

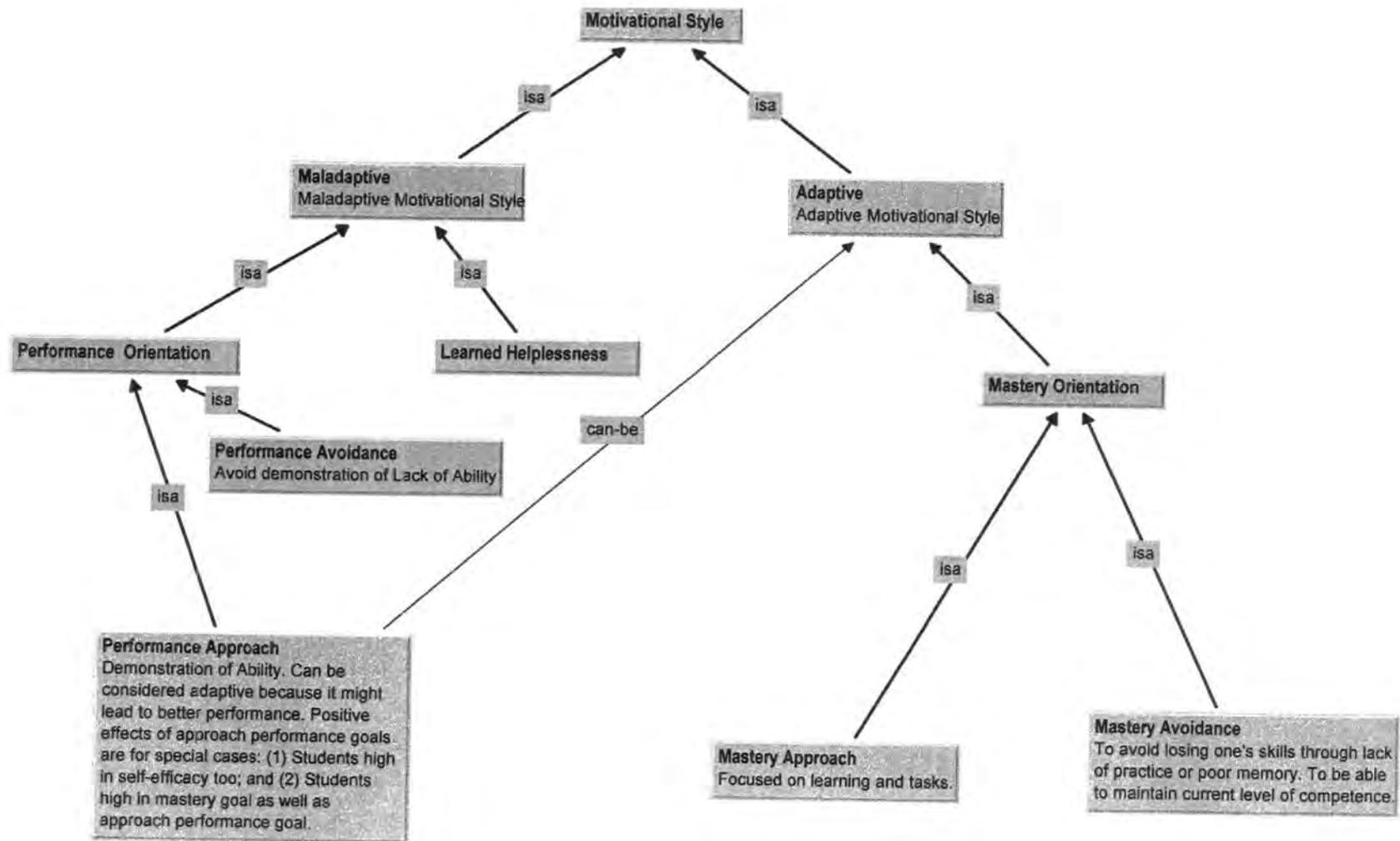|	
468	to a JAVA book if we don't understand ...
469	but not every student understood what they read.
470	
471	EVELYN, DID YOU MAKE USE OF THE
472	OPPORTUNITY TO READ THE BOOK ?
473	
474	E : I tried... I can't get what the
475	book is trying to say.
476	
477	OK.
478	
479	THANK YOU.
480	
481	(2376 words)
482	
483	
484	

Self Regulation
Textbooks

Appendix H : Network of Categories and Relationships

Motivational Style

isa ← Maladaptive / Maladaptive Motivational Style

isa → Adaptive / Adaptive Motivational Style

isa ← Performance Orientation

isa ← Learned Helplessness

isa → Mastery Orientation

isa → Performance Avoidance / Avoid demonstration of Lack of Ability

can-be

isa ← Performance Approach / Demonstration of Ability. Can be considered adaptive because it might lead to better performance. Positive effects of approach performance goals are for special cases: (1) Students high in self-efficacy too; and (2) Students high in mastery goal as well as approach performance goal.

isa → Mastery Approach / Focused on learning and tasks.

isa → Mastery Avoidance / To avoid losing one's skills through lack of practice or poor memory. To be able to maintain current level of competence.

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