An investigation into the interaction of children using a computer-based adventure game

Jeffrey Mountjoy

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AN INVESTIGATION INTO THE INTERACTION
OF CHILDREN USING A COMPUTER-BASED
ADVENTURE GAME

by

Jeffrey Mountjoy

B.Ed. (Hons), W.A.C.A.E.

This thesis is presented as part of
the requirements for the degree of
Bachelor of Education with Honours
of the Western Australian College of Advanced Education
August, 1990
ABSTRACT

This study investigated the types of interactions which occurred as children played a computer based adventure game. Year six children (N = 15) from five different schools participated in the study and were observed playing the game over a period of three to four, thirty minute sessions. Video tape recordings and direct observations were made of the groups as they played the game. Individual interviews were conducted with each player at the conclusion of the treatment period. Data collected from each of the groups was used to study and the forms of interaction displayed by players noted. It was found that the interactions which occurred could be classified into twelve (12) distinct categories.

1. Moves Taken
2. Suggestions Offered
3. Proposal Made
4. Questions Asked
5. Help Offered
6. Statement of Move
7. General Discussion
11. Verbal Conflict
12. Physical Conflict.

Of these twelve forms of interaction, it was proposed that in the context of this study seven may be used as a possible means of
identifying the level of co-operative behaviour in each of the groups. The frequency at which these seven interactions occurred within each of the groups was recorded and the results analysed to identify the presence of any significant differences which existed between the groups. Findings showed that in four of the groups, the playing of the game had no effect upon the development of co-operative behaviour among the players. In the remaining group, which was initially selected as comprising co-operative members, results showed that the level of co-operative behaviour displayed initially, remained constant during the course of playing the game.
DECLARATION

"I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education: and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text."

Jeffrey Mountjoy
ACKNOWLEDGEMENTS

The author acknowledges the guidance and advice given by Mr. Ron Oliver, Lecturer, Mathematics and Computing Department of the Western Australian College of Advanced Education.

The author is also grateful to those schools which participated in the study.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT ..................................................</td>
<td>ii</td>
</tr>
<tr>
<td>DECLARATION ..................................................</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS ........................................</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS .......................................</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES ...........................................</td>
<td>x</td>
</tr>
<tr>
<td>1.0 INTRODUCTION ........................................</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem ................................</td>
<td>2</td>
</tr>
<tr>
<td>Research Questions ......................................</td>
<td>3</td>
</tr>
<tr>
<td>Significance of the Study ................................</td>
<td>4</td>
</tr>
<tr>
<td>Background to the Study ..............................</td>
<td>5</td>
</tr>
<tr>
<td>Current Use of Computers in the School ........</td>
<td>5</td>
</tr>
<tr>
<td>Traditional Simulations in Education ..........</td>
<td>10</td>
</tr>
<tr>
<td>Design Characteristics of Computer Based Simulations</td>
<td>12</td>
</tr>
<tr>
<td>2.0 REVIEW OF LITERATURE .............................</td>
<td>16</td>
</tr>
<tr>
<td>Interactions in the Classroom ....................</td>
<td>17</td>
</tr>
<tr>
<td>Characteristics of Co-operative Learning Situations</td>
<td>19</td>
</tr>
<tr>
<td>Benefits of Co-operative Learning ................</td>
<td>20</td>
</tr>
<tr>
<td>Co-operative Learning Using Micro Computers ....</td>
<td>21</td>
</tr>
<tr>
<td>Research on the Effects of Adventure Game Software</td>
<td>24</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>3.0</td>
<td>30</td>
</tr>
<tr>
<td>METHOD</td>
<td></td>
</tr>
<tr>
<td>Procedure</td>
<td>31</td>
</tr>
<tr>
<td>Software</td>
<td>32</td>
</tr>
<tr>
<td>Hardware</td>
<td>35</td>
</tr>
<tr>
<td>Subjects</td>
<td>35</td>
</tr>
<tr>
<td>Grouping</td>
<td>36</td>
</tr>
<tr>
<td>Ethical Considerations</td>
<td>37</td>
</tr>
<tr>
<td>Methods of Data Collection</td>
<td>38</td>
</tr>
<tr>
<td>Method of Data Analysis</td>
<td>39</td>
</tr>
<tr>
<td>Limitations of the Study</td>
<td>39</td>
</tr>
<tr>
<td>4.0</td>
<td>42</td>
</tr>
<tr>
<td>RESULTS</td>
<td></td>
</tr>
<tr>
<td>Categories of Interaction</td>
<td>43</td>
</tr>
<tr>
<td>Observations of Group One</td>
<td>49</td>
</tr>
<tr>
<td>Session One</td>
<td>49</td>
</tr>
<tr>
<td>Session Two</td>
<td>51</td>
</tr>
<tr>
<td>Session Three</td>
<td>52</td>
</tr>
<tr>
<td>Discussion of Tables for Group One</td>
<td>53</td>
</tr>
<tr>
<td>Summary of Observations</td>
<td>56</td>
</tr>
<tr>
<td>Responses to Informal Interview</td>
<td>57</td>
</tr>
<tr>
<td>Observations of Group Two</td>
<td>57</td>
</tr>
<tr>
<td>Session One</td>
<td>57</td>
</tr>
<tr>
<td>Session Two</td>
<td>59</td>
</tr>
<tr>
<td>Session Three</td>
<td>60</td>
</tr>
<tr>
<td>Session Four</td>
<td>61</td>
</tr>
</tbody>
</table>
CHAPTER.................................................................PAGE

5.0 ANALYSIS AND DISCUSSION OF RESULTS.........................90

   Moves Taken.........................................................92
   Suggestions Offered..............................................96
   Proposals Made.....................................................99
   Questions Asked...................................................101
   Help Offered........................................................102
   Group Planning.....................................................105
   General Discussion...............................................107

6.0 CONCLUSIONS AND RECOMMENDATIONS..............................109

   Significance to Teachers.........................................110
   Significance to Software Developers............................112
   Recommendations for Further Research..........................113

APPENDIX 1..................................................................115

REFERENCES.............................................................117
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>17</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION
CHAPTER 1

INTRODUCTION

Statement of the Problem

Many primary schools are currently adopting the policy of introducing computers into the classroom. As a result of this, and the influx of associated software, the classroom teacher has been provided with a diverse range of applications which may be incorporated into the teaching program to enhance children’s learning.

Despite these factors, in many primary school classrooms the potential associated with these computer applications is not fully exploited. A major reason for this is that in many instances there is only one computer per class. This results in many teachers electing to assign small groups of children to work on the computer at one time. One common application used widely by teachers for this purpose is computer-based simulation games.

Computer-based simulation games are designed to replicate real life or imaginary situations. Essentially these simulations present problem solving activities in which participants role play characters, deduce commands and determine a series of actions. Some simulation games present graphics and display lines of text at the bottom of the screen, others consist entirely of text that informs players where they are, what is visible from that location, and where it is possible to move. The games typically give information about what the players are carrying and the
current state of the game. For example, how much time is left and how much strength the players have.

The fact that these games require children to work together in small groups may lead teachers to believe they are capable of fostering the development of co-operative behaviour among children. This capability has not yet been proven.

In order to establish whether computer-based simulation games foster the development of co-operative behaviour, it is necessary to investigate the types and patterns of interaction which develop between group members as they undertake playing these games.

Research Questions

This study investigated the interactions of children as they worked together on a computer-based adventure game. The study sought to answer the following questions:

1. What social interactions are observed when a computer based adventure game is played by children in small groups?

2. What differences in co-operative behaviour exist between different groups of children?

3. Does the playing of the game develop co-operative behaviour between children within each group?
Significance of the Study

Computer-based simulation games represent one of the most widely used applications of the computer in primary schools. Many of these games require children to interact within small groups and work together to achieve a common goal. Many such games claim to foster the development of co-operative behaviour. Little research has been undertaken investigating their potential to foster the development of this behaviour. Studies to date (Grabe & Dosmann, 1988; McClurg & Chaille, 1987; Okey & Oliver, 1987) have focussed largely upon assessing the educational value of these games in terms of their potential to develop skills and processes related to the cognitive domain of children's learning. Research is lacking and needed into their impact on the affective domain of learning.

The outcomes of the current study will provide classroom teachers with information regarding the types of interaction which develop between children when these games are played within small groups. Such information will assist teachers to make more informed judgements relating to the learning potential of this form of software, its suitability for use within the classroom and its potential to foster co-operative behaviour among children.

Information pertaining to the types of interactions occurring between children playing a computer based simulation game may also assist in providing guide-lines for the development of similar software, ensuring future games are structured so as to best maximise their potential to develop co-operative behaviour.
Background to the Study

Current Use of Computers in the School

The development of the microcomputer and computer based learning software has forced many educators to re-address their views on the use of educational technology within the classroom. Some say that the computer is probably the most significant new educational tool since the printed book and many hold the view that computing will play an increasingly important role in future human learning (Maddison, 1982; Taylor, 1980). The application of computers in education has been the focus of many recent studies, including those by Bright & Harvey, 1984; Drage et al. 1986; Sewell & Rotheray, 1987; Bitter, 1988. Not all, however, support their implementation. Lieber and Semmel (1987) express caution at the wholesale adoption of computers into the classroom and see the computer currently being incorporated more on the promise of its potential than on empirical evidence of its effectiveness.

Many people hold the general assumption that if computers are introduced into the classroom, the learning process will somehow be enhanced (Sewell et al. 1987). In some situations, however, the desire to explore this new technology co-exists with a deep seated reluctance to disturb a well established and effective classroom routine (Widmer, 1984). In order to provide children with an accurate picture of how the computer may assist their learning, teachers need to become aware of, and confident in using, the computer's many diverse applications. It is also important that the computer be used across the various curriculum areas and not just confined, as often is the case, to just one application in one subject area, for example drill and practice games in maths or spelling. Another possible misuse of the microcomputer is as Caffarella (1987, p. 19) states, "There is a tendency to
use computer-based instruction for all types of instruction, many times this use is inappropriate and the objectives could be learned more effectively with other media". Teachers need to use their knowledge of the learning process in combination with the needs of the children, to identify the most appropriate times when the computer, and specific programs, should be utilised as a resource to learning.

The incorporation of computers into the classroom, and their use as part of the learning process may be justified in many ways. Sewell et al. (1987, p. 379 - 380) outlined three broad statements that provide a solid rationale for computer use within the classroom.

1. The use of computers will enhance employment prospects by preparing students for a high technology world.

2. The use of computers will enhance computer literacy in terms of understanding the capabilities and limitations of computers.

3. The use of computers will improve the quality of teaching and learning.

These statements outlining the benefits of incorporating computers into the classroom and their use as resources for learning are supported through the concepts expressed in the literature by Taylor (1980); Hoffmeister & Maggs (1984); and Oliver (1986).

Many educators currently classify the various applications of the computer in accordance with the categories proposed by Taylor (1980). This system of
classification requires the different applications to be grouped according to their
degree of user interaction or learner control. The three categories used are:

1. tutee;
2. tool;
3. tutor.

When the computer is used in the mode of tutee, the children, through such
means as the programming language Logo, learn to control the actions of the
computer and develop simple programming skills. In effect, the children assume
the role of tutor and the computer becomes the tutee.

In the mode of tool, the computer is used in conjunction with utility programs
such as word processors, databases and spreadsheets to help teachers and
students with tasks related to the teaching/learning program (Oliver, 1986, p. 16).
Here the computer is used as a tool to perform tasks which may perhaps be
tedious in nature or which may require the complex manipulation of large
amounts of information. Essentially the computer assists the user by streamlining
the desired functions.

The mode of tutor is the most common application of the computer in schools
(Vargas, 1986; Bell, 1985; Hoffmeister et al. 1984). In this mode, the computer
presents the student with information, accepts the student's responses, evaluates
these responses and determines what information to present next. This interactive
ability of the computer is seen as the key component which distinguishes it from
other educational resources (Caffarella, 1987; Jones, 1986; Hoffmeister et al. 1984;
Oliver, 1986). The three most common applications used within the tutor mode
are:
1. drill and practice;
2. tutorials;
3. simulations.

Drill and practice programs usually adopt a game format and involve children in responding to questions based on previously learned skills and concepts. These programs are useful for revising and consolidating important information, and especially useful for children who need extra practice to achieve mastery. Many drill and practice games revolve around competition, either between the student and the computer, or between the students themselves. Drill and practice games are present in many classrooms and in some instances represent the only exposure children receive to the technology of the computer.

Tutorial programs are designed so as to exploit the interactive ability of the computer. These programs are designed to teach children skills and concepts without the intervention or assistance of the classroom teacher. Essentially, children using these programs are required to adopt an individualistic approach to learning in order to complete the required task. After assessing the ability level of the child, the computer presents examples of the skill or concept to be learnt. These examples are followed by a series of exercises for the child to attempt. The child’s responses to these exercises are evaluated by the computer as either right or wrong, and depending upon the child’s comprehension of the material, based upon the number correct, the computer presents a new set of tasks. These may range from the revision of the concept just presented, to the extension of a more difficult concept. Subject areas best suited to this type of approach are those where the skills and concepts develop sequentially, commonly in the areas of science and mathematics.
Simulation programs represent one of the most widely used applications of the computer in primary schools.

In simulation programs, the interactive capability of the computer is often used, to a further extent than used in tutorial programs. In this form of program, the computer is used to create a unique learning environment through modelling or creating real or fictitious situations and events which due to such factors as time, cost, danger and practicality, would be otherwise impossible for children to experience. Unlike the previous applications, simulation programs are frequently designed to encourage children to work together to achieve success at the required task. Simulated situations may range from such tasks as undertaking complex chemical experiments to mining for gold during the gold rush. Of the various simulation programs available possibly the most common are computer-based adventure games.

A distinction should be drawn between these forms of educational adventure games and the games played by children in arcades and on many home computers. Grevatead (1983) in Maher (1986, p. 56) described the difference between arcade style game players and educational adventure players. He stated, "game players live by their reflexes, adventure players live by their wits, game players say yikes!, adventure players say hmmm".

The potential associated with computer-based adventure games is enormous. Many of these games have as their objectives, the fostering of language, communication and reading comprehension, the development of co-operative behaviour, and the development of problem solving and decision making skills.
Further attributes of computer-based adventure games relate to the fact that they maximise the use of the computer in several ways. First, many games combine the presentation of excellent graphics with the use of descriptive text. This helps to motivate children and maintain their interest. Second, the programs are interactive in nature, that is, children are required to continually respond to prompts put forward by the game requiring them to enter in information through the keyboard. This interactive feature assists to keep children on task and provides the players with control of the situation they are in. Third, the games commonly require children to work in small groups. This factor helps solve the dilemma faced by many classroom teachers of having to manipulate one computer within a whole class of children.

In all, there are many applications of the computer available to the classroom teacher, and appear to hold some value in relation to the children's learning. The characteristics of computer-based adventure games and their potential to foster learning and development in a broad range of social and cognitive areas indicates that these games, as compared to other forms of software, may hold the greatest potential for the classroom teacher.

Traditional Simulations in Education

Prior to examining the specific nature and characteristics of computer-based simulations, it is necessary to briefly discuss the non computer alternatives. The concept of simulations has been a key learning strategy for many years in the field of education (Lunetta & Peters, 1985). The traditional forms of simulations are classified as either case studies, role plays, or games. The principle aim underlying all these forms of simulation is to better understand a specific situation or process as it occurs in reality through participating in a simplified model of the
specific instance. These experiences may range from activities undertaken in single subject areas to highly complex activities encompassing a variety of subject areas and lasting possibly several days (Ellington, 1975).

The distinguishing aspect between these three forms of simulation is the degree of student participation. Case studies involve students discussing a given situation, either real or imaginary, analyzing the different features, assessing possible alternatives and hypothesizing on the consequences of those alternatives (Tansey, 1973). Role plays and games involve a far greater degree of personal involvement. Jones (1980, p. 10) described role plays as being closely related to case studies except that "in the role play situation the participants are on the inside, not on the outside". Participating members in these simulations (role plays and games) are not passive. They have the power, duty and responsibility to shape events. In both role plays and games, causes have effects, and decisions have consequences (Jones, 1980). The major difference distinguishing role plays from games is that in a game situation, groups or individuals are put into conflict with each other and the process takes on a competitive nature (Tansey, 1973).

Both situations, however, require the participating students to become personally involved in the issues and decisions that are carried out, resulting in a large degree of interaction occurring between participants.

The educational value of such simulations can be justified through their ability to foster the development of broad skills in the cognitive and affective domains of participants. Learning is seen to occur in such areas as communication skills, problem solving skills, decision making skills and interpersonal skills (Percival, 1977, p. 166).
The inherent nature of these traditional simulations as enjoyable experiences for students to participate in, and their potential to aid children's learning, make them an ideal medium through which the teacher can convey educational content. With the advent of the microcomputer, and its introduction into the classroom, it has become possible to undertake these simulations in a computerised environment, incorporating a further dimension into the concept of simulations within the learning process. Bright et al. (1984 p. 73) state, "It seems likely that computer simulations could become valuable additions to the teachers' instructional materials and strategies".

In certain circumstances computer simulations may possess significant benefits over the traditional formats. Using the computer, children can participate in simulated situations which they may be unable to experience in the traditional format due to factors such as cost, time, danger and practicality. In addition, computer simulations provide children with instantaneous feedback as to their performance. Computer simulations also enable children to simulate the same situations as many times as required, holding selected variables constant while manipulating others. It is proposed that computer simulations not replace the traditional techniques already employed as part of the learning process, but serve more to complement them, thus further enriching the children's experiences and learning.

**Design Characteristics of Computer Based Simulations**

When the term computer simulation is discussed in respect to the educational domain, distinction is drawn between two forms - instructional simulations and adventure game simulations.
Instructional simulations are used predominantly to demonstrate to children those processes that may happen too quickly or too slowly, or which for some other reason, such as risk, cannot be experienced by children in real life (Perez & White, 1985). They commonly involve children entering in information or manipulating variables, then observing the simulated outcome or result. Examples may range from performing dangerous chemical experiments, to observing the growth rates of plants, or sailing trading vessels from England to Australia. Instructional simulations often have set objectives related to learning in curriculum areas such as mathematics, science and social studies.

Adventure game simulations commonly assume a fantasy aspect and place the participant in a real or fictitious situation. In these games the player becomes personally involved through accepting the role relating to the simulated situation proposed by the computer. "In this environment the student through this gaming approach is permitted to stumble, to err, to attempt different and dangerous things, and most importantly to learn by discovery" (Williams, 1984, p. 11). Some adventure games are composed entirely of text, others combine text and graphics. Participation in both instructional and adventure simulations require children to use cognitive strategies and problem solving skills. In adventure games particularly, the learning occurs not so much in succeeding, but more in the process which students undertake to achieve that state (Bright et al. 1984; Perez et al. 1985; Bell, 1985). Both formats, however, rely upon similar design characteristics.

A key element that relates directly to the learning potential of any computer simulation and specifically to computer-based adventure games, is the degree of user participation, also termed user interaction (McClurg et al. 1987; Lunetta et al. 1985). "As a general principle, the less a computer is prominent in a
simulation, the more the human and social elements of participation predominate, and therefore the higher its learning potential" (Crookall & Martin, 1985 p. 55).

The differing degrees of user interaction enables simulations to be classified as either:

1. Computer controlled simulation (CCS). In these programs the computer is essential to the simulation process. Participants have little or no role to play, except that of manipulating variables and observing outcomes. The computer models the entire process while the participants look on.

2. Computer based simulations (CBS). In these programs the computer remains vital to the process as it provides the simulated situation. However greater importance is placed upon the continual input into the computer, and the interaction between participants necessary for the simulation to proceed.

3. Computer assisted simulations (CAS). In these programs the computer is seen merely as an aid to the simulation process. The social interaction which occurs between participants is seen as constituting the main activity. (Crookall et al. 1985).

Of the three categories, computer controlled and computer based simulations represent the most widely used formats within the primary school classroom. The majority of instructional simulations can be classified as computer controlled simulations as many of these programs require minimal input from the students. Adventure games, however, can be classified as computer based simulations. This increase in learning potential is represented by the fact that in adventure games
children are encouraged to actively participate in the analysis and discussion of
the simulated situation. The simulation proceeds on the decisions made by the
players. In these games learning is associated more with the process in which
children participate in and not in the actual solving of the game.

In addition to the degree of user interaction, several other factors influence the
learning potential of computer simulations. All simulations, except those adopting
a fantasy aspect, serve the purpose of simplifying reality. To a large extent,
therefore, their educational value and potential for success, rely greatly upon the
program's ability to accurately match the variety of responses and circumstances
in the simulated situation with those which would occur in reality (Vargas, 1986).
Levin & Waugh (1987) refer to this characteristic as the program's degree of
fidelity. In addition, computer simulations should be totally free of grammatical
errors, allow for players to respond frequently, and be related to the
understanding level of the players. Participants in simulations must be equipped
with the necessary background information and cognitive skills needed to
participate in the simulation at a competent level. Simulations should also engage
the players in the process of inquiry.

Another important feature influencing the success of the simulation program is
the extent to which the simulation utilises the capabilities of the computer in
terms of graphics reproduction, colour and sound. The importance of these
characteristics and their effects on children's interest and motivation in relation to
simulation programs is described by Bright et al. (1984). It is also important that
the text presented in the simulation is of the correct reading level for the user.
This applies both to text on the screen as well as to text contained in the
supporting information booklets.
CHAPTER 2

REVIEW OF LITERATURE
CHAPTER TWO

REVIEW OF LITERATURE

Interactions in the Classroom

Classrooms can be organized according to a variety of formats. Children at their desks may be seated individually, in rows, in small groups or in a combination of these styles. The format which is adopted by the classroom teacher relates closely to his/her teaching style and philosophy on learning (Eruat & Hoyles, 1988). When small groups are used, the formation and composition of the groups is an important consideration which should be addressed by the teacher. Cosden & Lieber (1986) found that heterogeneous groups, made up of a mixture of both high and low achievers, performed better on a variety of tasks compared to those groups composed entirely of children of the same or similar ability. This finding is supported by Hooper & Hannafin (1988) and Eruat et al. (1988).

In undertaking activities within the classroom, there are essentially three major ways in which students may interact with each other (Johnson & Johnson, 1984). Children can compete, work individually or co-operate.

In adopting a competitive approach, children work against each other, striving for a goal that only a few students can attain. Essentially, children compete against each other to see who is best.
An individualistic approach requires students to work on their own toward a personal goal. The achievements of others have little or no influence upon their own progress (Johnson et al. 1984). In adopting a co-operative approach, tasks are undertaken by students working within small groups, with each member having a vested interest in the other members learning as well as their own. In this approach students work together, discussing material, helping each other toward the desired goal and encouraging each other to stay on task. In addition, in co-operative situations children are motivated to work together and celebrate each others successes (Johnson & Johnson, 1985).

In a meta-analysis of 122 studies examining the effectiveness of these three approaches on children's learning, Johnson, Maruyama, Johnson, Nelson & Skon (1981) concluded that co-operative learning among students was superior to competitive and individualistic learning in promoting achievement and productivity.

Many teachers see the value in co-operative learning and actively seek to employ it within the classroom as part of the overall learning process. In some situations, however, the full potential is not achieved. Richardson (1986, p. 42) states:

> Although teaching methodologies such as group work are apparently widespread, much of this "group work" entails individual work within a group setting. Some teachers claim to be employing group work as a major strategy, whilst actually organising teaching and learning within their classrooms for individual instruction.

This observation is supported by Galton (in Fox, 1985, p. 29) who makes a distinction between "co-operative" group work and "joint" group work, in which children tend to work individually towards a common goal. It appears the latter is the most common approach. This view is also supported by Eruat et al. (1988, p. 4) who observed that a majority of teachers, although incorporating the use of
small groups, developed tasks for children which required them to co-act alongside, rather than co-operate with their neighbours. "It appears much of what is being passed by teachers as group work amounts to little more than sitting on opposite sides of a table and looking sideways at a blackboard" (Fox, 1985, p. 29). For co-operative learning situations to be effective, teachers need to ensure that they are correctly structured.

**Characteristics of Co-operative Learning Situations**

Co-operative learning within small groups is characterised by the presence of six essential elements. Firstly, students must perceive that they are positively interdependent with the other members of their group. This is demonstrated by the establishment of mutual goals, the division of labour, materials, resources and information, the assigning of role to each group member, and the giving and receiving of joint rewards. The second element requires for students to interact in a face to face situation. Thirdly, members must assume individual accountability for mastering the assigned task. Fourth, co-operative learning situations should require and encourage students to use interpersonal and small group skills to ensure that good working relationships are developed and maintained between group members. Fifth, in co-operative learning situations, the leadership role is shared among group members, with each member at some stage during the task assuming the mantle of leader. Finally, in co-operative learning groups, the responsibility associated with the task is shared by all group members (Johnson et al, 1984; Johnson, Johnson & Stanne, 1986).

These six elements distinguish co-operative learning situations from situations which may adopt an individualistic or competitive format. When children
participate in tasks which are structured co-operatively, they may be exposed to a variety of potential benefits to their learning.

Benefits of Co-operative Learning

The learning environment which is created when tasks are structured co-operatively provides a context in which positive interaction has the opportunity to occur (Lieber & Semmel, 1987). Extensive research on co-operative learning indicates that there are positive social and academic benefits to be gained through the use of small group co-operative instruction (Cosden et al. 1986; Lieber et al. 1987; Erurat et al. 1988). Studies have identified that co-operative small group learning promotes: greater oral discussion, higher levels of achievement and productivity, the use of higher level reasoning strategies and problem solving skills, longer retention of material, increased motivation, more positive attitudes toward school, subject areas and teachers, more positive attitudes toward classmates regardless of ability, race, sex, ethnicity or physical handicaps, greater self esteem and psychological health, better concept attainment, and the development of collaborative skills and strategies (Cosden et al. 1986; Johnson et al. 1986; Wizer, 1987; Mevarech, Stern & Levita, 1987; Vermette, 1988; Erurat et al. 1988).

Small group learning is a strategy adopted by many classroom teachers. Research on this form of learning indicates that when children work within small groups, the greatest benefits are experienced when the task is structured co-operatively. These benefits relate to learning in both the cognitive and affective domains of learning.
Co-operative Learning using Micro Computers

Although in many classrooms students work on computers in small groups, the underlying reason is usually to maximise access to a limited number of keyboards (Eruat et al. 1988; Johnson et al. 1985; Moore, 1987; Light, Foot, Colburn & McCelland, 1987; Wizer, 1987). As a result, the potential which is associated with group work is rarely exploited, and any co-operative learning which occurs results more by accident than by deliberate design (Eruat et al. 1988, p. 1). As the scarcity of computer resources in schools is likely to remain for some time, teachers would benefit in becoming familiar with the techniques and strategies associated with the area of small group learning. This will help ensure that the full potential associated with small group learning using the microcomputer is exploited (Wizer, 1987; Eruat et al. 1988).

A key factor which influences the degree to which the computer is used as a resource within the classroom is the availability of appropriate software (Wizer, 1987; Moore, 1987). Despite initial fears that the computer was a sterile machine which isolated children, and inhibited the development of social relationships, it is now frequently seen as a means of stimulating active collaboration and discussion between children (Moore, 1987; Light et al. 1987; Mevarech et al. 1987). Therefore, an important function of the computer is its use within the classroom as a means of stimulating interactive learning with small groups, encouraging children to become involved in discussions, solving problems, and making decisions (Richardson, 1986).

The opportunity to work on a task within a small group at the computer provides children with a situation in which they may share and discuss ideas, act jointly in the process of decision making, provide help to others and receive assistance from
others when required (Mevarech et al. 1988). Richardson (1986) observed that when children working on the computer were provided with the opportunity to think, plan and talk about their learning, their motivation, enjoyment and understanding increased substantially. In addition, Fox (1985) found that children were more likely to co-operate on tasks involving the computer than on tasks away from the computer. This observation is supported by Moore (1987) who noted that children’s rates of collaboration and on task talking significantly increased during small group sessions using the computer. Computer based simulation games may be one form of software which teachers can use to achieve these benefits as these games utilise small groups and actively involve children displaying control over their learning. Working together to discuss ideas, solve problems and make decisions.

As with traditional forms of learning, children working on computers can interact in three basic ways. They may compete against each other, they may work in isolation, or they may work co-operatively together (Johnson et al. 1986).

The advantages of children working in collaboration with each other during a computer based task are many fold. Johnson et al. (1985) proposed that when students work collaboratively together at the computer they are provided with a situation in which they can:

- Observe and imitate each others use of the computer, which increases their speed in mastering hardware and software.

- Experience the encouragement, support, warmth and approval of a number of classmates.
• Have peers evaluate, diagnose, correct and give feedback on their conceptual understanding and orally summarise the material.

• Be exposed to a greater diversity of ideas and procedures, more critical thinking and more creative responses while completing the assignment.

• Have classmates encourage them to stay on task and exert concentrated effort.

These benefits go together to provide children with a rich learning environment in which to work. Such behaviours are not experienced when children work competitively or individually. In addition, Johnson et al. (1986) found that in co-operative learning situations communication between students working on the computer tended to be frequent, open, accurate and effective. Children also demonstrated greater degrees of on-task student–student interaction.

Studies which have examined the effects of co-operative learning at the computer have indicated that it holds many potential benefits over the competitive and individualistic approaches. Fletcher (1985) in a study of 55 children aged between nine and eleven demonstrated that groups of children working together on a computer–based task showed superior problem solving performance compared to children working in isolation. Mevarech (1988) observed that children who worked in pairs on the computer become more altruistic toward their team-mates compared to those that worked alone.

Further studies (Johnson et al. 1986; Lieber et al. 1987) indicate that computer assisted co-operative learning leads to superior achievement, more successful problem solving, more task orientated student–student interaction and higher
performance on factual recognition and application tasks. These studies also found that in co-operative learning situations the status of group members tended to be equalised, with all members being liked and valued.

Johnson et al. (1986) also stated that if the benefits of co-operative learning were to be maximised, groups need to be provided with a clear co-operative goal structure. The instructional format of many computer-based simulation games provides children with such a co-operative goal structure, encouraging players to work together in order for the group to achieve success.

Children working at computers can either work individually, competitively, or co-operatively. The greatest benefits are often achieved when children work within small groups on tasks which are structured co-operatively. Computer based simulation games utilise this format, and if they can be shown to foster co-operative behaviour, then they could become valuable resources for the teacher to use when grouping children on the computer.

If the use of simulation games can be shown to encourage the development of co-operative behaviour, then children may be exposed to these many benefits and the classroom teacher provided with a powerful learning resource.

Research on the Effects of Adventure Game Software

"Computer assisted instruction and co-operative learning is a partnership that maximises the advantages of each" (Johnson et al. 1985, p. 13). Adventure games represent one common application used by many classroom teachers in an attempt to fully exploit the benefits associated with this relationship. Research into the
effects of these games on children's learning has identified that they may possess significant potential for fostering development in a variety of areas relating to the child's cognitive domain and language development.

In a study involving subjects from years five, seven and nine, McClurg & Chaille (1987) found that after participating in a computer-based adventure game which utilised spatial skills, children demonstrated significant improvements in their spatial ability.

Jarchow & Montgomery (1985) observed that computer-based adventure games encouraged the development of problem solving skills and organisational abilities as well as fostering the development of language patterns and reading comprehension. These outcomes are experienced due to the fact that many games require participants to use skills related to areas such as reading, maths, decision making and problem solving. In addition, map reading and directionality are key ingredients of many games.

When these games are played by children in small groups, the various situations which are encountered serve as stimuli for discussions between children which are rich in new vocabulary. Children interact with each other in the process of discussing alternatives, negotiating decisions, planning strategies and reaching consensus. These situations in turn may help to foster the development of leadership skills and co-operative behaviour (Jarchow et al. 1987). The interaction which is generated when adventure games are used in small groups can be largely attributed to the problem solving context provided by the program (Richardson, 1986).
Jones (1986), in a study which examined the influence of the computer-based adventure game "Yellow River Kingdom" on children's speech patterns, concluded that adventure games may serve as excellent forms of speaking practice, provided that emphasis is not placed entirely upon the computer program to stimulate discussion, and provided that the adventure game is integrated into a larger, planned, teacher managed activity. In this study the computer-based adventure game was used as a basis for a role play situation in which students discussed the circumstances proposed by the game prior to entering an alternative into the computer. Through adopting this approach, Jones further raised the possibility that simulation games may be used as means of fostering the development of cooperation between children.

Adventure games may also possess significant learning potential for children belonging to special populations. Maher (1986) observed that when computer-based adventure games were used by children with learning disabilities, the students often became so involved in the game, they forgot they were undertaking tasks which required the use of such skills as reading, writing, spelling, comprehension and problem solving. In addition, Maher noted that the children's degree of perseverance and on task behaviour increased significantly during the playing of the game.

These behaviours may be based to some degree upon the fact that adventure games target a strength inherent in all students; the desire to have fun (Baltra, 1986). Maher also emphasised that the educational value attached to adventure games lies essentially in the processes which children experience in trying to find solutions, rather than in actually solving the game.
Children from non English speaking backgrounds may also benefit from interacting with adventure game software. Baltra (1986, p. 6) states:

*Teachers have in these games powerful tools for language learning since they encourage the development of communicative fluency in the target language (English) through lively discussions, reading, vocabulary building, note taking and essay writing. This can be achieved in the classroom by placing three or four students in front of the computer and encouraging them to establish group consensus.*

Baltra states this potential is best realised when the games: integrate the various communication skills of reading, writing, speaking and listening; create ample opportunities for players to interact with each other; encourage meaningful discovery learning through requiring players to analyse situations and solve problems, and when emphasis is not placed upon the mere manipulation of vocabulary and grammar, but more on the usage of words in a situational context. Baltra noted challenge, fantasy and curiosity as the major motivating factors of adventure game software.

The potential of simulation software to foster the development of co-operative behaviour has not been specifically researched. Several studies have observed, however, that in the process of playing these games children appeared to display increased levels of co-operative behaviour.

In a study of fifty year six children playing the computer based adventure game titled "Raft-Away River", Okey and Oliver (1987) observed that during the course of playing the game, children working in small groups moved from a mode of individualistic behaviour to a mode characteristic of co-operative behaviour. This occurred as players realised the need that in order to achieve success the group would need to work together.
This observation on co-operative behaviour is reinforced by Cummings (1987) who found that in the course of playing the computer based adventure game "Treasure Island", children treated each other as resources, displaying such co-operative behaviours as:

a. completing their peers' unfinished sentences;
b. encouraging others to continue;
c. inviting others to contribute;
d. modifying another's statement;
e. offering evidence and justification in support of this modification.

Cummings attributed these behaviours to a combination of factors which made up the learning (game playing) environment. These included:

1. the adventure game contained minimal screen output of words;
2. the computer was relegated to a passive role;
3. the teacher assumed no part in the learning process;
4. children were isolated from the class and had privacy for discussion.

These observations by Okey & Oliver (1987) and Cummings (1987), demonstrate that computer based simulation games may provide an environment in which co-operative behaviour is encouraged between children.

Computer based simulation games are popular applications in many classrooms. Of the three forms of interaction, developers of software design many computer based simulation games around the need for children to work co-operatively, compared to individually or competitively. Several studies (Jarchow et al. 1987; Jones, 1986; Okey et al. 1986; Cummings, 1987) have proposed that computer-based adventure games may have some benefits in terms of their ability to foster
co-operation among players. Little research has been undertaken which investigates this potential. To date research has largely revolved around qualitative reports of children's working habits and quantitative analysis of outcomes resulting from 'pretest - post-text' designed studies.

To analyse data, Herzberg, Mausner & Snyderman (1959, p. 37) outlined two basic methods. The first of these is termed the priori approach. This approach involves the data collected being systematically analysed using previously designed sets of criteria. Although having defined sets of criteria may make the analysis of data a somewhat 'easier' task, there exists the possibility that the interactions may be molded to fit the set criteria. Thus, there is a risk that the categories of analysis may be inappropriate and not accurately reflect the data.

As the focus of the proposed study is to investigate the interactions resulting as children participate in a computer-based adventure game, any previously designed checklist or similarly designed tool would be unsuitable for the analysis of data.

The second approach to analysis described by Herzberg et al. and the procedure adopted for the proposed study, is termed the posteriori approach. This procedure involves the categories of analysis being extracted from the data after it has been collected. This particular approach to analysis is supported by Lasswell in Herzberg et al. who states that a posteriori approach "tends to set up categories that are meaningful in terms of the empirical material gathered during the course of a study". Miles & Huberman also support this technique, suggesting that the posteriori approach, as compared to the priori approach, allows the researcher to be "more open minded and context sensitive".
CHAPTER 3

METHOD
CHAPTER 3

METHOD

Procedure

The study was undertaken at five large suburban primary schools in Western Australia. From each school, three year six children were selected by the classroom teacher in consultation with the researcher using set criteria. These children were removed from the classroom environment and placed in a less distracting environment (vacant work areas, staffroom) to play a selected computer based adventure game. All groups were observed playing the game for a series of three or four 30 minute sessions held over consecutive days. The computers were situated on rectangular work desks, with the computer monitor positioned above the keyboard. This format required the children to sit in a line in front of the computer, resulting in the middle player having the greatest access to the keyboard. All children could clearly view the information presented on the monitor. Groups received no assistance from the researcher in the playing of the game. Data was collected through video recordings and direct observations of the groups as they played the game, and through informal interviews held at the completion of the treatment period.
The learning package selected for this study was a computer-based adventure game titled "Raft-Away River" published in 1984 by Jacaranda Software. The courseware package consisted of a teacher's guide, student manual and program disk. The instructional format, and a key component of the game, is its apparent need for players to work co-operatively together and communicate with each other in order to achieve success at the required task. The game is designed for between two and six players.

The adventure takes place beside a river in a remote wilderness area. The players are stranded following a rafting accident which resulted in their raft being destroyed and carried off downstream. The players' aim is to build another raft using the equipment they saved and the resources available, and to sail back to safety before the river floods. The student manual provides the players with a detailed description of the rafting accident, their present position and the dangers that may confront them. The manual also provides players with useful information and clues on how to survive and build the raft. Players read this information prior to commencing the game.

The software was designed to make the building of the raft a team effort. Players need to communicate with each other to discuss plans, allocate tasks and organise working parties. Success is dependent upon all group members working together and co-operating with each other. Thus the game states as one of its objectives "to provide students with an opportunity to develop skills in co-operative behaviour".
The players begin the adventure stranded on the west bank of the river. On this bank they have access to a cave, a fireplace and a tree. The cave provides shelter from the rain and a place to rest when ill or starving. The fireplace is the only location where fish can be cooked. The tree provides players with only seven logs of wood – not enough to build the raft. On the east bank of the river there is a forest which supplies an unlimited quantity of wood. Also on the east bank are berry trees – some of which make the players ill. Between the two banks is situated an island upon which players may search for, and collect, gemstones. Each player possesses two items of equipment. These are allocated by the computer at the commencement of the game and include - matches, axe, rope, and fishing line. These tools are essential for the group's survival, and for building the raft.

The game commences with each player (represented by a stick figure) in a cave on the west bank. For each move the computer states whose turn it is (using the player's name), their current position and what equipment they are carrying. For example, "It is your turn JOHN. You are at the cave. You have matches and an axe. What do you wish to do?" The player must then use the choices provided in the student manual to make a move. There are twenty-one possible choices. Each choice has a corresponding letter which the player types into the computer (A – U). For example, the choice, "Go to the tree", is defined by the letter B. Before each move, players should consider where they are, what tools they are carrying and what resources are available.

Although the game is continuous in nature, there are essentially four major stages through which the players must progress in order to succeed. The first stage involves the players in cutting wood from the tree on the west bank, catching a fish from the west bank, building and lighting a fire at the fireplace, cooking and
eating the fish. This ensures the players have enough energy to continue with playing the game. The second stage requires the players to cut wood from the trees on the west bank, carry the logs to the west bank and build a bridge across to the island.

The third stage requires the remaining wood to be cut from the tree and carried across to the island to build a bridge to the east bank. The final stage requires the players to cut wood from the trees on the east bank, carry the logs across to the west bank and build the raft. The players must complete these stages before the rains make the river rise and flood the valley. If the valley floods before the players have completed the raft, all players are killed and the game must be recommenced from the start.

Random problems are provided by the computer to foster co-operative behaviour. As the players progress through these stages they may become hungry, this requires them to repeat the moves described in stage one. If the players neglect to eat they soon begin to starve. In this stage the player is unable to perform tasks such as cutting or carrying wood, and must go to the cave and rest or eat some food. If all players become starving the computer declares the situation as hopeless and abandons the game. This again requires the players to recommence the game from the beginning.

Choices can only be successfully completed if the player is in the appropriate location and is carrying the necessary tools required for the task. For example, a player cannot cut wood if he/she is not carrying an axe or is not positioned at the tree. If a player makes an incorrect or unsuccessful move, the move is ineffective. It is, however, added to the total, thus bringing the river closer to flood.
Hardware

The study was undertaken using BBC Compact Microcomputers which were housed at the various school locations. This model of computer is in wide use within the educational system in which the study was undertaken. Each machine consisted of a keyboard, colour monitor, and a 3.5 inch (9 cm) disk drive.

Subjects

Subjects for the study were drawn from year six classes at five large suburban primary schools (four government and one non government). Schools with which the researcher had had some form of professional association were selected as those to participate in the study. The schools were located across a broad range of socio-economic levels. Three subjects (one group) were selected from each school. A total of fifteen subjects (five groups of three) made up the sample population. This total comprised eight girls and seven boys. All subjects had previous experience using a range of software, including a variety of adventure games, on the BBC Master Compact Microcomputer. None of the subjects had been exposed to the selected computer-based adventure game to be used in the study.

The selection of subjects was undertaken by the respective classroom teachers in accordance with the following criteria.
Group 1

Three children who enjoy each other's company and who have previously demonstrated that they can work effectively and co-operatively together within a small group on a set task.

Groups 2 - 5

Three children who would not normally select each other as working partners to complete a set task within a small group situation, but who could work co-operatively together if motivated.

Teacher opinion was used as the basis for the selection of subjects as it is believed he/she is in the most appropriate position to make judgments on the personality and social skills of children within the class. This form of sampling, based upon personality traits, is supported in the literature by Wizer (1987).

Grouping

In accordance with the selections made by the respective classroom teachers, the following group formations were used in the study.

Group One

Two girls and one boy from school A who enjoy working together and who have demonstrated the ability to work co-operatively within a small group situation.
Group Two

Three boys from school B who would not normally select each other as working partners, but who possess the ability to work together if motivated.

Group Three

Three girls from school C who would not normally select each other as working partners, but who possess the ability to work together if motivated.

Group Four

Two boys and one girl from School D who would not normally select each other as working partners, but who possess the ability to work together if motivated.

Group Five

Two girls and one boy from school E who would not normally select each other as working partners, but who possess the ability to work together if motivated.

Ethical Considerations

Prior to undertaking the study, a formal letter was sent to the respective Principals seeking approval to undertake research within the school. In addition, letters were also sent to the parents of the subjects, seeking consent for their child to participate in the study and assuring them of the confidentiality of all information.
collected. Informed consent was obtained from the subjects during informal discussions held prior to the commencement of the study.

Following the completion of this study, data appropriate to the various groups was made freely available to the Principal of the school, teachers and parents of the subjects, and the subjects themselves. To ensure the confidentiality and anonymity of all information collected, the names of the schools and subjects participating in the study were replaced with letter and number codes. This procedure was adopted during the collection of data through to the presentation of the final report.

Methods of Data Collection

Videotape Recording: A video camera was used to record the interactions which occurred between subjects for each session in which they played the game. The camera was situated on a tripod approximately three metres away and to the side of the group, enabling the researcher to view all discussions, actions and reactions, and to follow the group's progress in the game. An extension microphone was attached to the camera and positioned beside the computer monitor on the desk at which the group was working to record the verbal interactions.

Direct Observation: During the course of each session, the researcher positions himself out of the direct view of the subjects and made anecdotal notes of any significant interactions which occurred as the game was played.

Informal Interviews: On the completion of the three or four sessions, each subject was informally interviewed in private by the researcher to gather data on the children's perspective of the game, their role as a player and group member.
Method of Data Analysis

Data collected from the co-operative group (Group 1) was viewed and the discrete forms of interaction noted. This data was used to create a checklist of interactions which was then used to analyse the interactions in the remaining groups. In viewing the data from the remaining groups, further interactions of an unco-operative nature were noted. These were subsequently added to the checklist. The resulting data was tabulated and analysed using the statistical analysis program STAT VIEW 512+ (1986). Differences in the data were established through the use of a one-way analysis of variance and further differences between groups were measured using the Fisher PLSD Statistic.

The chosen form of data analysis, that of creating the categories for the checklist as the data is analysed, allows the researcher to identify interactions specific to the data which he/she has collected. It also ensures that irrelevant classifications or categories are not imposed on the data. Support for this posteriori approach to the categorisation of interactions is offered by Miles & Huberman (1984, p. 57) who suggest that posteriori categorisation allows the researcher to be "more open minded and context sensitive".

Limitations of the Study

The results obtained in the current study may be limited in terms of their external validity due to the influence of several factors and conditions.
Firstly, the study investigated the interactions occurring in groups of year six children playing a selected computer-based adventure game. The results obtained therefore may not be generalised to groups of children outside of this year level.

Secondly, the sample population consisted of a small number of groups (five), different outcomes or categories of interaction may have been observed if a greater number of groups had participated in the study. These two limitations were imposed on the researcher due to the time constraints associated with the study.

Thirdly, the fact that the subjects realised they were participating in a research project and were being video recorded may have influenced the behaviours observed during the course of the study. An attempt was made to alleviate the effects of these two factors by having subjects play the game in a familiar environment and by positioning the recording equipment out of the group's direct line of vision.

A fourth limitation relates to the quality of the software used in the study. Although many computer-based adventure games state that they develop cooperative behaviour and foster communication between players, nearly all require players to complete different tasks. This fact indicates that the interactions observed through the playing of the game RAFT-AWAY RIVER may only be applicable to that game and not to other adventure games. Different games may result in different categories of interaction being observed.

A fifth limitation relates to the number of subjects chosen to participate in the study, in particular the small number of subjects comprising the control group (Group 1). The study also did not attempt to investigate the effects associated
with different sex mixes in each of the groups. The groups used in the study were chosen on the basis that they comprise the different grouping structures available to the teacher within the classroom.

The fact that the game was played out of context and was not integrated into the children's planned learning program, may have also influenced the interactions observed during the course of the study. If the game had greater relevance to the children's learning, it may have resulted in different levels of interest and different forms of interaction.

Finally, the experimental design used in the study required the players of the game to be removed from the "normal" classroom situation. This situation therefore led to the group receiving no feedback, attention or advice from the class teacher, circumstances which may be seen as being in contrast to how the developers of the game suggest that it be played. It is acknowledged that had the game been played within the normal classroom environment, certain of the observed behaviours may not have been displayed, whilst other behaviours may.
CHAPTER 4

RESULTS
CHAPTER 4

RESULTS

Categories of Interaction

The various categories of interaction were established following an analysis of the data collected through the use of the video recorder and direct observation. Once all groups had completed the treatment phase of the study, the data was viewed and the categories identified.

The first stage in the analysis process involved the viewing of the data collected in relation to the co-operative group (Group 1). These tapes were analysed to identify the distinct forms of social, physical and verbal interactions occurring between the players in the group. From this analysis eight distinct forms of interaction were identified:

1. Moves taken.
2. Suggestion offered.
4. Group planning.
5. General discussion.
6. Question asked.
8. Independent planning.

A sample of the data relating to each of the remaining four groups was then observed. From these observations it became evident that additional forms of interaction could be identified:
Information on the various categories of interaction was supported through data collected by way of direct observation. This procedure ensured that information pertaining to the working environment and the interpersonal relationships between players was also collected and in turn subjected to analysis.

In all, twelve distinct forms of interaction were able to be identified.

1. **Moves Taken**

The instructional format of the game prompts each player, using the player's name, to make a move in the game. This indicates that each player has a designated move. In viewing the tapes it became evident in some groups that players did not take their allocated moves and that in some groups certain players demonstrated dominance over the keyboard, taking the turns of other players. This led to the creation of the first category of interaction titled "Moves Taken". This category was designed to record the amount of times players made a choice in the game through pressing a key on the keyboard. As the turns follow a set order, it could be presumed that in the process of playing the game each player would take the same amount of turns at the keyboard.

2. **Suggestion Offered**

In each of the five groups, it was observed that in the course of playing the game players would offer each other suggestions. These suggestions related to the possible moves which were available to the player who was taking the move.
Suggestions were put forward as the player whose turn it was, was contemplating their move. This behaviour led to the second category of interaction titled “Suggestion Offered”.

3. Proposal Made

It was observed in each of the groups that on occasions players would propose their move to the other players in the group. This was done to encourage others to contribute possible suggestions, and to ensure that all members of the group agreed with the choice. After making a proposal the player would wait for a short period of time, allowing for the contributions of others, before pressing the key on the keyboard. This form of interaction was classified as “Proposal Made”. The combination of players proposing their move and others offering suggestions, often resulted in discussion developing between players.

4. Statement of Move

In contrast to the interactions of proposing moves and offering suggestions, players in the groups also executed moves in the game without the consultation of other players and without any discussion. Frequently in some groups players were observed stating their move aloud to the other players but not allowing them the opportunity to offer any input. This was due to the fact that the player would state the move while simultaneously pressing the key on the keyboard, thus allowing others little if any chance to contribute. This form of interaction was categorised as “Statement of Move”.

5. Direction/Order

As the tapes of the groups were analysed, it became quite apparent that particular
players in some groups developed a degree of domination over the others. In exerting this dominance it was observed that players would direct or order others to make certain choices. These directions and orders were frequently delivered in a harsh tone of voice, and did not allow the player whose turn it was to voice any sort of opinion as to the choice they had in mind. The giving of directions and orders usually coincided with one player attempting to force the other players to follow a certain plan. This form of interaction was classified as "Direction/Order".

6. Question Asked

In an attempt to develop an understanding of the game situation, players in each of the groups were observed asking each other questions. This form of interaction led to the category of "Question Asked". Within this category only those questions which were task related were recorded. Any questions which were not task specific were recorded as off task behaviour. The types of questions asked by players differed across the groups. In the co-operative group the questions often related to the situations experienced in the game, as well players seeking the advice of each other. In the groups two to five, a large number of the questions revolved around players asking others their position, and what others thought they should do. Despite this difference, all were classified as task related and all were recorded within this category.

7. Help Offered

In the process of playing the game it was observed that players offered help to each other through answering questions and clarifying situations which arose in
the game. This form of interaction gave rise to the category of "Help Offered". Although this behaviour was evident in each group, the degree to which it was demonstrated varied between the groups.

8. **Individual Planning**

Success in the selected game required the players to devise and follow a set plan. Ideally, all players should contribute to the formulation of this plan. During the analysis of the tapes, however, it became evident that in some groups this planning was being dominated by one or two players in the group. This form of interaction was classified as "Individual Planning". In the co-operative group, individual planning was often the stimulus that resulted in all members of the group planning together. Individual planning in the remaining groups, however, rarely led to the group planning strategies together and was most often associated with one player exerting dominance over the others.

9. **Group Planning**

In contrast to individual planning, it was observed that on occasions all players in the group would get together to plan and analyse strategies. This interaction was recorded as "Group Planning". In this situation, all players in the group offered some degree of input into the development of the plans and strategies which the group would follow.

10. **General Discussion**

As with category nine (Group Planning), category ten - "General Discussion" involved the participation of all group members. This form of interaction involved
all members of the group getting together and discussing situations which arose as they played the game. General discussion was often stimulated through an unusual happening in the game, such as when players first lit the fire, or following an unsuccessful move. The distinguishing factor between categories nine and ten is that in category ten the players did not discuss plans or formulate strategies.

The following two forms of interaction were observed as occurring only in groups two to five.

11. **Verbal Conflict**

Through analysing the groups two to five it was observed that during the course of playing the game the players within these groups became involved in differing degrees of verbal conflict. Such conflict ranged from players refusing to obey an order, to all players becoming involved in an argument over what moves the group should take. The category of "Verbal Conflict" recorded the frequency of these interactions.

12. **Physical Conflict**

Physical conflict was also evident as the players from groups two to five played the game. These situations ranged from players preventing others from taking their turn at the keyboard, to an instance in group five which saw two players strike each other with their fists. As with the category of verbal conflict, the category of physical conflict recorded the number of instances this form of interaction was displayed by players.
Both the categories of verbal conflict and physical conflict often involved the dominant player in the group, and was often initiated following the stating of a move, the giving of an order or the incorrect taking of a player's turn by another player in the group.

In total, these twelve distinct categories enabled all of the interactions which occurred between players to be recorded.

Observations of Group One (2 Girls and 1 Boy)

This group functioned as the control group for this study.

Session One

The session commenced with each player taking a turn in reading the information contained within the students' manual. This information was read aloud so that all players could clearly hear the story. On completion of reading, the book was placed in front of the monitor, in the clear view of all players. The atmosphere throughout the first session remained relaxed and friendly. As the session progressed the players freely asked each other questions relating to the game, and in turn freely gave each other help and clarification when required.

For each move, players were given ample time to propose a possible choice to the group. Following the proposal, the other group members would often make further suggestions, often resulting in the players getting together to undertake group planning or general discussion. In putting forward a suggestion, the players
regularly pointed at the screen to assist in explaining their idea. At no time was one player ordered by another player to make a move.

Whenever a player was in the process of suggesting a move, he/she was given the opportunity to fully express the point. Players did not interrupt or criticise the input from others. Any disagreement that did occur was resolved through controlled discussion, with players always justifying their viewpoint. Any statements that were made were delivered as with all interactions, in a polite and friendly manner.

On several occasions the players had difficulty in locating the required key on the keyboard. When this occurred other players politely indicated its location and allowed the player to press the key.

If an incorrect move was made by a player, the player was not criticised, instead the group often got together and discussed the situation and the reason behind the failed move. During session one the players made very few incorrect moves. The players realised the need for role diversification early in the game, at this point the group discussed the tasks each player could perform and developed a sound strategy which they followed. In this first session players worked cooperatively to cut wood, catch fish, light the fire and cook the fish.

At the completion of the session the players were given time to discuss and plan possible strategies. During this time the group showed keen interest, talking excitedly and developing several possible plans. All players offered input into this planning session.
Session Two

Prior to the commencement of the second session, the players revised the tasks each had to perform, and the plan the group was going to follow. All players were in agreement to the plan.

All of the interactions evident in session one were also observed in session two. Players openly asked each other for help and advice which in turn was consistently provided, players also helped each other locate required keys. In addition, as with the first session, players made many proposals and offered each other a number of suggestions. If one player took the turn of another it was accompanied by an apology and an offer for the player to take the next shot. As with session one, the game was played in a friendly and relaxed atmosphere, with all players gladly accepting their assigned roles. In this second session the players regularly undertook group planning. During these stages all players contributed to the formulation of plans and strategies which the group then implemented. When the plan appeared not to be working, all players stopped the game and discussed the situation.

As with session one, any differences of opinion between the group members was resolved through polite and friendly discussion, with each player having the opportunity to fully state their point of view. In the second session the group followed the plan which was developed at the commencement of the session and revised during the session.

From this plan, the group managed to cut all the wood from the tree on the west bank, build and light the fire, catch, cook and eat fish, and transport the remaining logs to the west bank. Once all wood was placed at the west bank the
group decided to commence building the raft. On discovering that there was not enough wood the group undertook a further session of group planning. As a result of this, the players began dismantling the raft and building the bridge. On the successful completion of the bridge all players showed visible excitement, with Player A clapping the success. The session concluded at this point.

In both session one and session two, the players, when not making a move, sat back from the keyboard. This allowed all players a clear view of the monitor and the choices available. No one player showed dominance over the control of the keyboard or manual containing the choices.

Session Three

In the planning time allocated at the commencement of the session, the group revised the procedure which they had followed in the previous session, adding to it a possible strategy for building the raft.

Players adopted the same seating arrangements in session three as they had in sessions one and two. Player B placed the choices book on top of the keyboard, in clear view of all players. The game commenced with players engaging in little discussion compared to the previous sessions. It appeared that all players were conversant with what was required, and as such went ahead as planned. All players, however, despite following a set plan, still proposed their move to the rest of the group. In addition to this, all of the co-operative interactions identified in the previous sessions were again observed in session three. These included, players asking for and giving help and advice, players helping each other locate required keys, players interacting with each other in a friendly and polite manner, players allowing each other time to decide upon their move, and players sitting
away from the keyboard so that each member of the group had equal access to viewing the information on the screen. In addition, all players continued to propose their move to the group and offered each other a large number of suggestions. As with previous sessions, the players remained on task for the total duration of time and worked together in a friendly, relaxed and non threatening environment.

In the third session the players achieved success in the game following 142 moves. At no stage in any of the sessions was the group required to recommence the game due to starvation or flooding. On achieving success, all players cheered and physically and verbally congratulated each other.

Discussion of Tables for Group One

The low number of moves recorded in session one, compared to sessions two and three, was due to the players spending a large portion of time in the initial session reading the information contained within the student’s manual. Sessions two and three were totally devoted to the group playing the game.

In all sessions the players in group one were observed making far greater numbers of suggestions and proposals as compared to the number of statements (Table 1). This indicates that a large percentage of moves made by the players were accompanied by some form of co-operative discussion. This behaviour is reinforced by the absence of any directions/orders in any of the three sessions.

Although the players were observed to undertake no individual planning in the first session, they did participate in a large number of group planning sessions
As the players became more familiar with the game, the number of individual plans put forward increased, with eight instances recorded in session two. The number of occasions in which all members of the group got together to plan also increased, with 29 instances recorded in session two. This process of group planning along with the high number of suggestions and proposals indicated the co-operative nature in which this group worked over the duration of all three sessions.

The co-operative nature of the group is also reinforced by the large number of questions which the players asked each other in each of the sessions (Table 1). In addition, players frequently provided help and clarification to each other (seven times in session one, 16 times in session two, 15 times in session three).

In each of the sessions the players took approximately the same number of moves as each other, as evidenced by the totals recorded for the category of "Moves Taken" (Table 1). In addition to this, the players in each of the three sessions recorded similar totals for each of the categories of interaction (Table 1). These facts demonstrate that in each of the sessions the players participated equally, and that in no one session was any player dominant or submissive.

The categories of "Group Planning" and "General Discussion" both recorded their highest totals in session two. In this session "Group Planning" was observed on 29 occasions and "General Discussion" on 20 occasions. In session three the instances of these two interactions decreased noticeably with only thirteen instances of group planning and eleven instances of general discussion being recorded. This trend appeared to indicate that in session two, through planning and discussion, the group had reached a point in the game where all
Table 1
Interactions of Players Within Group One

<table>
<thead>
<tr>
<th></th>
<th>SESSION 1 (Player)</th>
<th>SESSION 2 (Player)</th>
<th>SESSION 3 (Player)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td><strong>Moves Taken</strong></td>
<td>11</td>
<td>13</td>
<td>11 (35)</td>
</tr>
<tr>
<td><strong>Suggestion Offered</strong></td>
<td>6</td>
<td>5</td>
<td>5 (16)</td>
</tr>
<tr>
<td><strong>Proposal Made</strong></td>
<td>4</td>
<td>6</td>
<td>5 (15)</td>
</tr>
<tr>
<td><strong>Statement of Move</strong></td>
<td>2</td>
<td>1</td>
<td>1 (4)</td>
</tr>
<tr>
<td><strong>Order Given</strong></td>
<td>0</td>
<td>0</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Question Asked</strong></td>
<td>4</td>
<td>2</td>
<td>1 (7)</td>
</tr>
<tr>
<td><strong>Help Offered</strong></td>
<td>2</td>
<td>2</td>
<td>3 (7)</td>
</tr>
<tr>
<td><strong>Individual Planning</strong></td>
<td>0</td>
<td>0</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
players clearly understood the requirements of the situation. In session three, therefore, the players were not required to talk and plan as much.

Summary of Observations

The following points highlight the most important aspects of interaction which were observed as group 1 participated in the three sessions.

1. Players worked together as a cohesive group within a warm and friendly environment.

2. Players asked many questions and provided each other freely with assistance during the course of playing the game.

3. A large percentage of the moves were made by players proposing the choice and others offering suggestions.

4. All players in the group regularly got together to plan and analyse situations in the game. Input in these sessions came from all players.

5. The language used by players was always friendly and polite.

6. The players did not criticise each other or become involved in any instances of verbal or physical conflict.

7. All players remained on task for the total duration of each session.
8. Players took their own moves in the game.

9. Players shared each others success.

10. Players participated in the game equally in each session.

Responses to Informal Interview

When questioned informally at the conclusion of the three sessions, all players in the group indicated that they enjoyed playing the game. In addition, all players stated that they enjoyed working with the other members of their group and that they believed the group worked well together and co-operated in all sessions of playing the game.

Observations of Group Two (3 Boys)

Session One

The players spent little time reading the information contained within the student's manual. As a result of this, the players approached the game in an unco-ordinated way, without a plan and making choices at random. Following the realisation that this approach was incorrect, Player B proposed to the group a strategy he believed the group should follow. This strategy was to undertake the choices (A-U) in alphabetical order. From this point on, Player B exerted dominance for the remainder of the session over all facets of the game – controlling the book containing the choices and directing others to make certain moves.
Players A and C on occasions attempted to offer suggestions but these were often ignored by Player B. The players got together on only a few occasions to discuss the group's position in the game. These discussions however, although involving all players, were largely dominated by Player B. In addition, these discussions contained little order, with players interrupting each other and talking all at once. This resulted in each player stating their own individual plan and then implementing that plan despite the wishes of the other players.

On several occasions the players were involved in verbal conflict resulting from disagreements on the strategies being used. These situations were resolved through Player B convincing the others that his plan would work and that his plan was best for the group. Several times players took the turn of others if that player was too slow in locating the key or was not paying attention. Player C offered no resistance to this occurring. Player A, however, verbally disapproved and criticised Player B for not allowing him to take his own shot.

All players leaned toward the computer, Player B, however, situated himself leaning over the keyboard, this prevented others from having clear access. As his shot came around Player B would state "now it's my turn". This was to ensure that no-one took his turn, despite the fact he had just taken the turns of the other players. Player B offered few suggestions to other players but ordered them to make a large number of their moves. Players A and C offered a number of suggestions early in the game but decreased their input as Player B increased his dominance.

During Session One, the players died of starvation after the first 34 moves in the game. Following this setback, in their second attempt, the group managed to cut the wood, build and light a fire, catch and cook a fish, and begin building a
bridge. All players in the group showed visible excitement at the building of the bridge.

Session Two

In the time allocated for planning at the commencement of session, all players contributed ideas and offered suggestions. Player B, however, stated what the group would do, the other players, although disagreeing, offered little resistance.

Player B assumed control of the group early in the session by directing other players to take moves which corresponded to the strategy he had proposed. If a player showed signs of disagreeing with the plan, or was too slow in pressing the key, Player B completed the shot and quickly moved on. This often left the other players upset and annoyed. As with Session One, Player B situated himself close to the keyboard, thus he prevented the other players from having clear access. During the session, Player B physically prevented both Player A and Player C from making moves in the game. This resulted on most occasions in verbal conflict between the players. All throughout the session, Player B assumed possession of the book containing the choices, allowing others to view it but not to take hold of it. Both Player A and Player C offered a large number of suggestions during the session. These, however, had little influence on the game as Player B did not allow them to be implemented. Both Players A and C became off task and disinterested in the game as Player B assumed total control. As with the previous session, the players continually took the turns of others.

During this session the group managed to make their way across to the east bank, cut some wood and transport it back to the west bank. Much of this was achieved through Player B ordering the others to make certain moves. The group
undertook few group planning sessions and became involved in few instances of
general discussion. When these situations did occur, they were largely dominated
by Player B. Despite Player A offering several possible plans for the group to
follow, they were all ignored by Player B. The participation of Players A and C
decreased during the session.

Session Three

During session three, the behaviours exhibited in the previous sessions became
more exaggerated. The players often became involved in both verbal and physical
conflict situations. All of these situations involved Player B. During this session
much of the interaction was between Players A and B. Player C showed little
interest in becoming involved and as a result assumed a rather passive role,
occasionally making suggestions and offering help. Player C was also observed on
several occasions to be off-task. In this session the student manual was placed in
front of the monitor, enabling all players to clearly view the choices.

Players A and B assumed responsibility for the majority of Player C’s moves. In
this session, Player A contributed little in the way of planning. Despite this he
offered Player B a large number of suggestions. Despite offering these
suggestions, Player A was continually ordered to make moves by Player B. A
great deal of interaction occurred between Player A and Player B in the initial
stages of the game. This, however, decreased noticeably as the session progressed
and as Player B began to assume control of the game.

As in sessions one and two, Player B assumed a position which allowed the other
players limited access to the keyboard. During session three, Player B physically
prevented both Player A and C from making moves in the game. Player A often
became upset at being constantly ignored and prevented from playing the game. As a result he continually levelled criticism toward Player B. Player C appeared not to mind the domination of the game by Player B.

In the third session the group, essentially through the influence and control of Player B, managed to commence the building of the raft.

Session Four

Session four was undertaken almost entirely by Player B. Player C assumed a totally passive role and participated little in any aspect of the game, except for offering a few suggestions, making an occasional statement, and offering the players some help. Player A also assumed a relatively passive role but offered at the commencement of the game a series of suggestions to Player B. Player B assumed control of the keyboard from the commencement of the session, preventing Player A on several occasions from taking his turn. Eventually Player B assumed total control of all aspects of the game, making all the moves for every player. At this point, Players A and C sat back from the computer and observed Player B as he played the game. Any comments by Players A or C to Player B on what should be done were ignored by Player B. Players A and B became involved in several instances of verbal conflict when Player A attempted to make a move. On each occasion Player B raised his voice and demanded that Player A stop interfering with the game.

At the point of success, Players A and C showed little excitement. Player B stated that the task was easy and showed visible signs of excitement as the raft floated downstream.
Discussion of Tables for Group Two

In group two, Player B established an early dominance in the game, taking the most number of moves and giving a large number of directions and orders to other players. This trend continued to develop and strengthen over the four sessions, culminating in session four with Player B assuming practically total domination of the game, taking 86 of the total 98 moves and making 11 of the 13 orders (Table 2).

Further signs of unco-operative behaviour were demonstrated by the fact that in each of the sessions, the totals recorded for the categories of statement and orders far outnumbered the totals for the categories of suggestions and proposals (Table 2). This indicates that a large number of the moves were made without any discussion occurring between players. For each of the sessions, Player B recorded the greatest number of statements and orders. This highlights his domination of the game.

In sessions one and two, the majority of individual planning was undertaken by Players A and B (Table 2). Player A's input, however, decreased dramatically as Player B's dominance in the game increased. Player C's participation in the game also decreased as the dominance of Player B increased (Table 2). In all sessions Player C's input into the game was considerably lower than that of Players A and B. In the final session all of Player C's moves were taken by Player B. In this session she participated little in the playing of the game as evidenced by the extremely low totals recorded for her in each of the interaction categories.
<table>
<thead>
<tr>
<th></th>
<th>SESSION 1</th>
<th>SESSION 2</th>
<th>SESSION 3</th>
<th>SESSION 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Player)</td>
<td>(Player)</td>
<td>(Player)</td>
<td>(Player)</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Moves Taken</td>
<td>24</td>
<td>36</td>
<td>29 (89)</td>
<td>45</td>
</tr>
<tr>
<td>Suggestion Offered</td>
<td>11</td>
<td>4</td>
<td>9 (24)</td>
<td>12</td>
</tr>
<tr>
<td>Proposal Made</td>
<td>3</td>
<td>7</td>
<td>1 (11)</td>
<td>4</td>
</tr>
<tr>
<td>Statement of Move</td>
<td>7</td>
<td>13</td>
<td>13 (33)</td>
<td>9</td>
</tr>
<tr>
<td>Order Given</td>
<td>2</td>
<td>34</td>
<td>6 (42)</td>
<td>2</td>
</tr>
<tr>
<td>Question Asked</td>
<td>2</td>
<td>6</td>
<td>2 (10)</td>
<td>0</td>
</tr>
<tr>
<td>Help Offered</td>
<td>1</td>
<td>0</td>
<td>2 (3)</td>
<td>4</td>
</tr>
<tr>
<td>Individual Planning</td>
<td>5</td>
<td>10</td>
<td>6 (21)</td>
<td>8</td>
</tr>
</tbody>
</table>

In session one the players became involved in a large amount of group planning. These instances, however, decreased over the duration of the sessions as Player B assumed control of the game and implemented his own strategies. The same
trend also applied to the category of general discussion. As Player B assumed control less interaction occurred between all three of the players.

Summary of Observations

The following points highlight the most important aspects of interaction which were observed as group 2 participated in the four sessions.

1. The game was largely dominated by one player. The remaining players had little input into any stage of the game.

2. Directions and orders were frequently given by the players to force others to make certain moves.

3. In all sessions the players became involved in verbal and physical conflict.

4. There was a noticeable lack of group planning in each of the four sessions.

5. In sessions one and two the players approached the game in an individual way.

6. Players in the group were observed as being off task on several occasions.

7. In each session the group recorded low numbers of proposals and suggestions.

8. In each of the sessions the players recorded high numbers of statements and orders.
Responses to Informal Interview

When questioned informally at the conclusion of the treatment period, all of the players indicated that they enjoyed the game. Both Players A and C expressed the view that the group did not co-operate in any of the four sessions. Player A stated that he felt Player B assumed too much control over the game and did not allow himself or Player C to have much of a say in what the group should do. This view was supported by Player C who expressed her disappointment at not being allowed to participate in the game as much as she would have liked. Player B, however, expressed the opinion that the group co-operated in each of the sessions. He elaborated to explain that he felt the other group members did not mind him taking their shots as they trusted his plan and knew that it would achieve success. All players stated that they enjoyed working with each of the other members of the group.

Observations of Group Three (3 Girls)

Session One

Players commenced the session by alternating in reading aloud the different sections of information contained within the student manual. Once the players had completed reading, the book was placed on top of the computer monitor. In this position the choices available were in full view of each player.

Prior to commencing the game all players discussed what tasks they could undertake with their equipment and what they had to do to build the raft. It was initially proposed by Player B that all the group had to do was to cut down the
tree on the west bank and build the raft. Once the game was commenced, much of the early discussion was undertaken between Players A and B. Player C was involved little in the formulation of plans and discussion of moves. As a consequence, while Players A and B interacted, Player C was observed to be off-task, coming back on-task when the discussion between A and B was completed. As the game progressed Player A assumed control of the options book. Although Player B was still able to view the choices, Player C was forced to either lean across the group or ask the other players what his choices were. This resulted in Players A and B either ordering Player C to make certain moves, or in Players A and B physically taking Player C’s moves for him. On several occasions Player C expressed his annoyance and became visibly upset.

The first session was concluded after 35 moves had been taken. Of these moves a large number were the result of orders given by Player B (Table 3). Up to this point the group had managed to cut wood and build a bridge. They did, however, neglect to eat, despite Player C having caught a fish, and therefore died of starvation. During the session, Players A and B demonstrated dominance over Player C. The group planned strategies together on only a few instances. Much of the planning undertaken in this session occurred between Players A and B. Quite often the suggestions and proposals put forward to the group by Player C were ignored or discarded as unworkable by Players A and B.

Session Two

During the time allocated for planning, Player A outlined a possible strategy he believed the group should adopt. The strategy was accepted by both Players B and C.
In the second session much of the planning and analysis was undertaken by Players A and B. Player C was given few opportunities to participate in discussion. When suggestions were made by Player C they were often ignored by Players A and B. As the game progressed Players A and B began to work together, telling Player C what to do and occasionally taking his move. Physical and verbal conflict occurred between Player C and Player B as Player C attempted to implement one of his suggestions. This resulted in Player C sitting back from the computer and not participating in the game for a short duration of time (two minutes). Players A and B sat close together and close to the keyboard. Throughout the session these two players discussed a variety of strategies between themselves. On many occasions they took each others move. Neither player, however, became upset at this situation. It appeared that these Players (A and B) had decided that it was not important whose move it was, but more what move was made. As the game progressed Player C became less and less involved in any of the decisions related to the game. He did, however, continue to suggest moves to Players A and B.

During this session the group died of starvation after 34 moves. Following this set back, the group, almost entirely directed by Players A and B, managed to cut the wood from the tree, build and light a fire, catch, cook, and eat a fish. With all the wood at the west bank, Players A and B then began to build the raft. On discovering that there was not enough wood, Player B voiced his disappointment and declared the situation as hopeless, blaming the failure on the strategy proposed by Player A.
Session Three

Prior to the commencement of this session, all players were involved in a discussion of possible strategies. Player C offered considerable input, but the majority of discussion occurred between Players A and B.

Observations recorded during the third session closely paralleled those patterns evident in sessions one and two. During session three Players A and B continued their domination over all aspects involved in playing the game. Despite offering a reasonable number of suggestions, Player C again assumed a relatively passive role in the development and implementation of plans and strategies.

During session three, Player C was observed on several occasions to be off-task. As in the previous sessions, much of the interaction in session three occurred between Players A and B. During this session, these players offered to each other a large number of suggestions. The suggestions of Player C were often not considered relevant. During session three, Players B and C were involved in several instances of verbal and physical conflict, usually as a result of a situation in which Player C was prevented from participating in the game. Both Player A and Player B took many of Player C's moves, with Player A also taking many of Player B's moves.

As the game progressed, the talk between Players A and B became quick and excited as they rushed to implement their agreed upon plan. Often during the session, Players A and B stopped to assess their progress. At these points in the game Player C became involved in the group and together the players undertook group planning and analysis. Once the group completed its planning, however, Player A and Player B again resumed total control of the situation. Player C
appeared to have accepted the fact that he was not involved, he sat back from the computer and watched the moves made by the other players. On occasions Players A and B together asked Player C what move he wanted to make, but these situations usually ended with either A or B pressing a key before Player C had an opportunity to reply. This is evidenced by the differences in the number of moves made by Player C in comparison to Players A and B (Table 3).

As the group neared success, all players sat up close and leaned toward the computer. The final sequence of moves was made by Players A and B with Player C sitting and watching. Success brought jubilation to the faces of all group members. In addition, all players shook hands and patted each other on the back.

Discussion of Tables for Group Three

As with group one, the players in group three spent a large portion of the initial session reading the information contained in the student manual. This fact accounted for the low number of moves recorded in session one as compared to sessions two and three. In the first session each player took approximately the same number of moves. In session two, the category of moves was dominated by player B taking 45 of the total 96 moves. In session three, the category of moves was dominated by Player A taking 67 of the total 136 moves. In session two and three Player C took considerably less moves than Players A and B (Table 3).

This dominance of the game by Players A and B is also supported by the high totals recorded for the categories of statements and order for each of these players over the three sessions (Table 3). Of these two players, Player B recorded
Table 3
Interactions of Players Within Group Three

<table>
<thead>
<tr>
<th></th>
<th>SESSION 1 (Player)</th>
<th>SESSION 2 (Player)</th>
<th>SESSION 3 (Player)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A     B     C (   )</td>
<td>A     B     C (   )</td>
<td>A     B     C (   )</td>
</tr>
<tr>
<td>Moves Taken</td>
<td>12 3 10 (35)</td>
<td>39 45 12 (96)</td>
<td>67 47 22 (136)</td>
</tr>
<tr>
<td>Suggestion Offered</td>
<td>3 4 3 (10)</td>
<td>3 10 17 (30)</td>
<td>27 25 13 (65)</td>
</tr>
<tr>
<td>Proposal Made</td>
<td>4 6 3 (13)</td>
<td>11 6 4 (21)</td>
<td>11 8 3 (22)</td>
</tr>
<tr>
<td>Statement of Move</td>
<td>4 9 4 (17)</td>
<td>16 21 18 (55)</td>
<td>26 29 19 (74)</td>
</tr>
<tr>
<td>Order Given</td>
<td>3 13 3 (16)</td>
<td>11 31 0 (42)</td>
<td>21 32 2 (55)</td>
</tr>
<tr>
<td>Question Asked</td>
<td>2 2 1 (5)</td>
<td>1 9 3 (13)</td>
<td>4 7 4 (15)</td>
</tr>
<tr>
<td>Help Offered</td>
<td>2 1 3 (6)</td>
<td>4 7 2 (13)</td>
<td>4 11 3 (18)</td>
</tr>
<tr>
<td>Individual Planning</td>
<td>2 3 0 (5)</td>
<td>8 14 4 (26)</td>
<td>5 6 3 (14)</td>
</tr>
</tbody>
</table>
the highest number for each of these categories in each of the sessions. In comparison, Player C made a total of only two orders during the total duration of the game (Table 3).

As with group 2, the totals recorded by group three for the categories of statements and orders were far greater than the totals recorded for the categories of suggestions and proposals. This difference was evident in each of the three sessions (Table 3). Unlike the previous group, however, the number of suggestions and proposals remained relatively high for each of the sessions.

In addition, players asked each other a large number of questions and provided each other with a large degree of help in each of the sessions (Table 3). This pattern of behaviour was also evident in the co-operative group (group 1). During the sessions, Player B asked the most questions and offered the most help.

The participation of Player C declined over the sessions as the dominance of Players A and B increased. This trend is similar to the one observed in group two and is reinforced by the totals recorded in each of the interaction categories (Table 3). Despite a large number of individual plans being proposed by all players, the group undertook very few sessions of group planning (Table 6). Much of the planning for the group was undertaken by Players A and B in isolation from Player C. This was especially evident in session three where Players A and B made a large number of suggestions (Table 3). General discussion was held consistently in each of the sessions (Table 7).
Summary of Observations

The following points highlight the most important aspects of interaction which were observed as group 3 participated in the three sessions.

1. The game was dominated largely by two players in the group.

2. The unequal participation of players is evident in all of the categories of interaction.

3. Several of the sessions involved both physical and verbal conflict between players.

4. The group undertook few instances of group planning.

5. Each session contained a large number of statements and orders.

6. One player in the group was observed to be off-task on frequent occasions.

7. The players asked a high number of questions and provided each other with help when required.

8. The players offered a high number of suggestions in each session.
Responses to Informal Interview

When questioned informally at the completion of the treatment period, all players indicated they enjoyed playing the game and enjoyed working with each other. Player A stated he believed the group co-operated in all of the sessions. Player B also stated that he felt the group co-operated during all sessions but also added that he thought Player A wanted to complete the game himself. Both Players A and B made no reference to the lack of involvement from Player C. Player C stated that he felt the group co-operated in the first sessions, but not in sessions two and three. He attributed this to the fact everyone had different ideas and that they were unable to agree on the best one. Player C indicated that he felt Players A and B did not allow him to participate in the game as much as he would have like to.

Observations of Group Four (2 Boys and 1 Girl)

Session One

The session commenced with the players scanning the information contained within the student manual. Player C began reading, but because she was reading too slow, Player B snatched the book off her and continued reading. Player A read the final section. The reading was done aloud so that all players could hear. On the completion of reading, the book was placed on the keyboard so that the choices were in full view of each player.

During session one, players became involved in several instances of physical and verbal conflict. This often involved Player B, who would either criticise another
player or take another player's turn. During session one the players did not involve themselves in any planning at the group level (Table 6). The choices made in session one were largely the result of plans proposed by Player A. Other players contributed little to the formulation of strategies and were quite content to follow those put forward by Player A. Although Player A devised the plans for the group, Player B exerted dominance over the keyboard - ordering others to make moves, and taking the turns of other players. Player C had little input into the session (Table 4). The questions she asked dealt mainly with her trying to find out where she was and what the other players wanted her to do. This resulted in Players A and B directing her to make certain moves. In comparison, the questions asked by Player A dealt essentially with trying to understand the situations which arose as the game progressed. Player C was observed to be off-task several times during the session.

In this first session the group, following the plans proposed by player one, managed to cut all the wood from the tree on the west bank, build and light a fire, catch, cook and eat fish. All players showed visible excitement at the graphic displayed on the screen associated with the cooking of the fish.

Session Two

In the time allocated for planning at the commencement of the session, Players A and B shared a series of sound strategies. Player C did not offer any plans to the group.

The players commenced the game by implementing the strategy proposed by Player A. Player C appeared not to understand what the plan involved and on many occasions reverted to asking the other players what she had to do. As with
session one, a great deal of the planning for the group in session two was undertaken by Player A. Player B also proposed several plans during the session. When this occurred, Players A and B stopped the game and discussed the situation. Player C was again involved rarely in the development of plans and strategies for the group. On several occasions during the session Player C was observed off-task.

During the session the players made very few proposals. The vast majority of their moves were made without discussion and on many occasions were the result of orders given by Players A and B. During session two several instances of verbal and physical conflict were observed between Player B and Player C. Toward the end of the session the majority of the game was played by Players A and B. Player C offered little input and was quite prepared to allow the other players to tell her what to do. She did, however, take most of her own moves (Table 4).

The second session was concluded at the point at which the players died of starvation (68 moves). Up to this point in the game the players had been able to cut all the wood from the tree, build and light the fire, catch, cook and eat fish. In addition, the players had transported the wood to the west bank and had begun to build a raft.

Session Three

The planning period associated with session three, as with sessions one and two, was largely dominated by Player A. Players B and C offered little input and indicated that they were quite happy to adopt the plan developed by Player A.
Session three followed a similar trend to that which occurred in sessions one and two, Player A continued to assume responsibility and control over the plans for the group, Player B continued to dominate the keyboard and ordered others to make certain moves, and Player C continued to offer little input into the game.

The group undertook a large amount of interaction early in the game, however as the plan became obvious to all players the amount of interaction decreased. If a player hesitated in making an obvious move Player B quickly pressed the key. On occasions this resulted in verbal conflict between players. Player B also physically prevented Player C from making her move on several occasions.

As the group realised they were approaching success in the game, all players began to become excited, leaning close to the computer and rushing to make their move. The final stages in the game were completed by Player B. On achieving success all players congratulated each other and laughed as the raft floated downstream.

Discussion of Tables for Group Four

As with groups two and three, group four recorded a noticeable difference in the number of suggestions and proposals, compared to the number of statements and orders in each of the sessions (Table 4). This indicates that a large number of the moves in the sessions were made without discussion.

The domination of Players A and B in each of the sessions is demonstrated by the high totals recorded for these players in the categories of moves taken, orders given, and statements made (Table 4)
Table 4
Interactions of Players Within Group Four

<table>
<thead>
<tr>
<th></th>
<th>SESSION 1 (Player)</th>
<th>SESSION 2 (Player)</th>
<th>SESSION 3 (Player)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A  B  C</td>
<td>A  B  C</td>
<td>A  B  C</td>
</tr>
<tr>
<td>Moves Taken</td>
<td>27  40  26 (93)</td>
<td>16  28  24 (68)</td>
<td>52  60  47 (159)</td>
</tr>
<tr>
<td>Suggestion Offered</td>
<td>18  15  0 (33)</td>
<td>11  6  1 (18)</td>
<td>26  11  0 (37)</td>
</tr>
<tr>
<td>Proposal Made</td>
<td>2  1  4 (7)</td>
<td>4  1  3 (8)</td>
<td>4  5  1 (10)</td>
</tr>
<tr>
<td>Statement of Move</td>
<td>17  16  2 (35)</td>
<td>17  6  2 (25)</td>
<td>30  24  4 (58)</td>
</tr>
<tr>
<td>Order Given</td>
<td>9  24  0 (33)</td>
<td>6  17  0 (23)</td>
<td>14  27  0 (41)</td>
</tr>
<tr>
<td>Question Asked</td>
<td>5  4  5 (14)</td>
<td>6  4  1 (11)</td>
<td>9  3  10 (22)</td>
</tr>
<tr>
<td>Help Offered</td>
<td>5  5  3 (13)</td>
<td>6  4  1 (11)</td>
<td>6  14  0 (20)</td>
</tr>
<tr>
<td>Individual Planning</td>
<td>21  1  0 (22)</td>
<td>14  6  0 (20)</td>
<td>20  3  2 (25)</td>
</tr>
</tbody>
</table>
The players undertook very few sessions of group planning in each of the three sessions with no instances recorded during sessions two and three (Table 4). The plans for the group were essentially all proposed by Player A. This fact is demonstrated by the large amounts of individual planning offered by Player A in each of the sessions (Table 4). Player A also made a high number of suggestions in each of the three sessions (18 in session one; 11 in session two; 26 in session three).

In each of the three sessions, Player C contributed little to the formulation of strategies or the offering of suggestions. In addition, she proposed few moves, made only a small number of statements, gave no orders, and offered little help (Table 4). She did, however, ask a large number of questions in each of the sessions (five in session one; six in session two; ten in session three).

Summary of Observations

The following points highlight the most important aspects of interaction which were observed as group four participated in the three sessions.

1. It became apparent that two players assumed dominant roles during the game.

2. In each of the sessions players experienced verbal and physical conflict.

3. One player in the group was occasionally off-task.

4. There was a lack of group planning and general discussion.
5. The group recorded a high number of statements and orders in each of the three sessions.

6. In each of the sessions a low number of suggestions and proposals were recorded.

7. Planning in the game was largely dominated by one player.

Responses to Informal Interview

When questioned informally at the completion of the treatment period, all players indicated that they enjoyed playing the game. Both Players B and C stated they enjoyed working with the other members of the group. Player A stated she felt that Player B was a "little bit bossy" but overall stated she enjoyed working as part of the group. Player B believed the group co-operated in all three sessions. Player C believed the group co-operated in the first and third sessions but not in the second, stating that in the second session the players did not get along well because they all had different ideas and that Player B wanted everyone to do what she said. Player A also stated that she believed the group did not co-operate in session two, attributing this to the fact that everyone wanted to do different things. She did, however, believe the group co-operated in sessions one and three.
Observations of Group Five (2 Girls and 1 Boy)

Session One

Players alternated in reading aloud the different sections of information within the student manual. Despite reading the information, the group commenced the game with little direction, pressing keys at random and laughing at the various outcomes. Players had not realised the importance of the choices listed in the book.

Following approximately ten moves into the game, Player A discovered the choices but refused to allow Players B and C access to them, this was despite Players B and C politely requesting to see them. This situation resulted in the first of many verbal and physical conflicts between the players. During the first session there was very little co-operation between players. Much of the session was spent by the players arguing amongst themselves, with Player A continually criticising the other players for not knowing what to do and for constantly making incorrect moves.

On many occasions Players A and B became involved in physical and verbal conflict. In session one the group failed to undertake any form of constructive group discussion or planning (Tables 6 and 7). The only plan offered during the session was by Player B. None of the other players, however, agreed with the plan as such. In the first session all three players worked individually, undertaking the tasks they were capable of doing with the equipment they possessed.

During session one, Player A was observed to be continually off-task, talking, singing and showing little interest in the game. This behaviour often forced the
other players in the group to also become off-task. In general, however, despite
the behaviour of Player A, Players B and C demonstrated on several occasions the
ability to work together, suggesting to each other possible choices.

Once Player B assumed control of the options book she began to order other
players to make certain moves, in addition she also physically took the moves of
others. This again resulted in conflict between herself and the other players. The
atmosphere generated between the players was hostile and unsettled. This is
reinforced by statements from Player A such as, "Shut up will you ...." and, "I will
break your fingers if you don't watch it". Each of these statements was forcefully
and aggressively directed at Player B.

As previously mentioned, players in this session essentially worked individually.
As a consequence of this, the group progressed little toward succeeding in the
game. The players were required to recommence after 34 moves (starvation).
After this the group, mainly through the direction of Player B, managed to cut the
wood off the tree and carry it to the west bank.

Session Two

During session two, many of the unco-operative behaviours demonstrated by the
players in session one were again observed. Player A continually displayed both
verbal and physical aggression toward Players B and C. Little discussion occurred
between players, no group planning was undertaken, and all players continued to
work individually. This individual behaviour was demonstrated by the following
comments made by Player A, "I am going to build a raft", and "I am not going to
cut wood for you guys". After the first failure (35 moves – starvation), Players B
and C criticised Player A, and blamed the situation on him. As a result of this accusation Player A verbally abused both Player B and Player C.

Following this altercation the members of the group settled down and got back to work on the game. Player B again assumed the dominant role. In this role she ordered players to make certain moves, if her ideas were not complied with she often pressed the key herself while the player was disputing the move. As a result of this, the players began to take each others moves at random. This situation led to all players arguing about the aim of the game.

In session two, as with session one, the players demonstrated an inability to solve problems which confronted the group, with all three players being unable to reach consensus. Many of the moves were rushed and made without any discussion. In addition, player A was observed on several occasions to be off-task, looking around the room and making silly comments to the other players. Both Players B and C demonstrated restraint in not being influenced by the behaviour of Player A.

Toward the end of the session the players agreed to try a plan which was developed by Player B. Once this plan showed signs of failure however, Player A reverted back to working individually. This resulted in the players continually criticising each other as they found themselves in a hopeless situation, starving and unable to perform tasks.

During the session players rarely proposed their move for others to comment upon. In addition, they offered each other few suggestions. Those suggestions which were put forward were often ignored. Most moves in the game were made as statements or as the result of orders given by Player B.
Session Three

During session three the unco-operative behaviours displayed in the two previous sessions continued to be observed. At the commencement of the game Player A assumed possession of the options book and verbally abused and physically resisted Player B in her attempts to get the book off him. During this encounter, Player C worked quietly at the game.

From the outset of the game Player B assumed control and delivered orders to the other players. Despite some initial resistance, the players elected to follow her plan. As the session progressed both Player A and Player C also offered plans to the group but these were overridden by Player B who insisted that her plan would achieve success. The players died of starvation at 35 moves.

At this point in the session the players got together and formulated a group plan. It appeared that for the first time the players realised the importance of each of the pieces of equipment and the various tasks they allowed players to perform. Once the players agreed upon the strategy to be followed they all appeared to work well together, with each player being encouraged by the others to take their turn. This situation, however, lasted for only a short duration of time before Player B again began to assume a dominant role.

As the session neared completion, Player A appeared to deliberately stimulate conflict between himself and the other players through continually complaining about the performance of the other players and by constantly criticising their moves.
In the third session the group failed twice at 35 moves, both times due to starvation. On both occasions the players blamed each other for the group's predicament. In their third attempt the group managed to cut some wood and build and light the fire.

Session Four

During session four, criticism, conflict and domination continued to be observed behaviours. In this session the seating arrangements of the players altered, with Player C assuming the centre position. The session commenced with little interaction occurring between any of the players. This was due to the fact the players were following the plan that was devised in the previous session. The players died of starvation at 35 moves. At this point of the game Player A angrily directed blame for the failure at Player B. Player B in turn blamed the failure on Player C. Despite undertaking several instances of group discussion the players again showed difficulty in solving problems that faced the group. As occurred in previous sessions, problem situations and points of disagreement commonly resulted in players arguing with each other. The instances of conflict, however, in session four were less than in the previous sessions.

Player B, although sitting to the side of the group, still exerted a dominant influence over the actions of the other players. Both Players A and C appeared to accept this situation and showed a willingness to follow her instructions. After experiencing several more failures, players in the group reverted back to playing the game individually. Player C withdrew herself from the game and undertook her moves without any discussion. Players A and B continued to disagree with each other right up to the point of the group getting flooded out. The session
concluded with players blaming each other for the group's failure to achieve any sort of success over the four sessions.

Discussion of Tables Relating to Group Five

As with groups one and three, group five spent a large part of the first session reading the information contained in the student's manual. This accounted for the low number of moves recorded in session one, as compared to the subsequent sessions.

Group five possessed many of the characteristics of the previous unco-operative groups. In all sessions the number of statements and orders far outweighed the number of suggestions and proposals (Table 5).

From the data contained within the table (Table 5), it can be seen that Player B assumed some degree of dominance over the other players in the group from session one. This dominance increased in each of the sessions, and is reflected by the totals recorded for Player B in the category of orders given (Table 5).

The players in group five demonstrated little evidence of co-operative behaviour throughout any of the four sessions. They undertook only three instances of group planning (Table 6) and only six instances of general discussion (Table 7). Of these six, five occurred in the final session. In addition, despite the apparent similarity in the number of moves taken by each of the players (Table 5), further analysis of the tapes indicated that the players took the turns of others quite frequently.
### Table 5
Interactions of Players Within Group Five

<table>
<thead>
<tr>
<th></th>
<th>SESSION 1 (Player)</th>
<th>SESSION 2 (Player)</th>
<th>SESSION 3 (Player)</th>
<th>SESSION 4 (Player)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Moves Taken</td>
<td>19</td>
<td>23</td>
<td>16 (58)</td>
<td>29</td>
</tr>
<tr>
<td>Suggestion Offered</td>
<td>7</td>
<td>3</td>
<td>1 (11)</td>
<td>4</td>
</tr>
<tr>
<td>Proposal Made</td>
<td>0</td>
<td>1</td>
<td>6 (7)</td>
<td>2</td>
</tr>
<tr>
<td>Statement of Move</td>
<td>3</td>
<td>6</td>
<td>4 (13)</td>
<td>16</td>
</tr>
<tr>
<td>Order Given</td>
<td>4</td>
<td>9</td>
<td>1 (14)</td>
<td>2</td>
</tr>
<tr>
<td>Question Asked</td>
<td>1</td>
<td>11</td>
<td>3 (15)</td>
<td>8</td>
</tr>
<tr>
<td>Help Offered</td>
<td>4</td>
<td>2</td>
<td>0 (6)</td>
<td>1</td>
</tr>
<tr>
<td>Individual Planning</td>
<td>0</td>
<td>1</td>
<td>0 (1)</td>
<td>5</td>
</tr>
</tbody>
</table>
A further factor which reinforces the unco-operative nature of this group is the noticeable lack of help and clarification offered by the players in each of the sessions (six times in session one; seven in session two; ten in session three; seven in session four). This occurred despite the players asking each other a large number of questions (15 in session one; 17 in session two; 16 in session three, 9 in session four).

The greatest input into the sessions was made by Players A and B. Player C, despite making a large number of moves, undertook little interaction with the other group members. Player C made noticeably less orders and statements than Players A and B. In addition, Player C offered the least amount of help and individual plans (Table 5).

Summary of Observations

The following points highlight the important interactions which were observed as group five participated in the four sessions.

1. The game was dominated by one player giving orders to others.

2. Excessive amounts of verbal and physical conflict were observed.

3. Players were observed criticising each other.

4. In each of the sessions a large number of statements were made.

5. In each of the sessions a large number of orders were given.
6. The game was played in a hostile and tense working environment.

7. Players were observed on several occasions to be off-task.

8. The group undertook very few instances of group planning and group discussion.

9. Players were observed working at the game independent of each other.

10. In each of the sessions the players made few suggestions to each other and made very few proposals.

11. Despite asking a large amount of questions the players offered each other little help and assistance.

Responses to Informal Interview

When questioned informally at the conclusion of the treatment period, all players stated that they enjoyed the game but would have liked to have built the raft. Player A stated that he thought three boys would have succeeded at the game. Player A also stated that he did not enjoy working with either of the other members in the group. Player B stated that she enjoyed working with Player C because she "listened to what was said", but not with Player A because he mucked around too much and did not want to work as a group. Player C stated that she did not mind working with Player B, except that she felt Player B tried to control the game too much. Player C stated she did not like working with Player A. All players agreed that the group did not co-operate in any of the sessions.
Table 6  
Frequency of Group Planning  

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SESSION 1</th>
<th>SESSION 2</th>
<th>SESSION 3</th>
<th>SESSION 4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE</td>
<td>11</td>
<td>29</td>
<td>13</td>
<td>-</td>
<td>53</td>
</tr>
<tr>
<td>TWO</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>THREE</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>FOUR</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>FIVE</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 7  
Frequency of General Discussion  

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SESSION 1</th>
<th>SESSION 2</th>
<th>SESSION 3</th>
<th>SESSION 4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE</td>
<td>5</td>
<td>20</td>
<td>11</td>
<td>-</td>
<td>36</td>
</tr>
<tr>
<td>TWO</td>
<td>18</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>THREE</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>FOUR</td>
<td>8</td>
<td>5</td>
<td>12</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>FIVE</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
CHAPTER 5

ANALYSIS AND DISCUSSION OF RESULTS
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ANALYSIS AND DISCUSSION OF RESULTS

From the twelve forms of interaction which were identified as occurring between children as they played the computer-based adventure game Raft-Away River, it is possible to identify seven categories which may be used to assess the level of co-operative behaviour evident among children. These seven categories are:

1. Moves taken.

2. Suggestions Offered.

3. Proposals Made.


5. Help Offered.


7. General Discussion.

As the members of group one were selected on the basis that they could work co-operatively together, the interactions which they demonstrated in each of the above seven categories has been used as representing the forms of co-operative behaviour which teachers and software publishers may expect children to show as
they play this particular adventure game. Therefore, for the purpose of this study, the interactions which were observed as occurring between the players in group one in each of the seven categories can be used as a standard against which the remaining four groups may be compared in an attempt to assess their levels of co-operative behaviour. If the groups are co-operative, their interactions should not be different from group one.

Moves Taken

The first category of interaction which may be used as an indicator of the level of co-operative behaviour displayed by group members is that of moves taken. Using the interactions which were observed as occurring between the players in group one, it is possible to identify what may constitute co-operative behaviour in terms of this form of interaction.

In each of the three sessions in which group one participated, it was observed that the players within the group each assumed responsibility for their own turn in the game. This resulted in the three players taking approximately the same number of moves as each other in each of the three playing sessions. Co-operative behaviour, therefore, in regards to this category may be seen as players in the group taking equal amounts of turns at the keyboard, with no one player assuming dominance over the number of moves made.

In comparison to co-operative interactions displayed by group one, an analysis of variance indicated that in groups two, three and four there was a significant difference in the number of moves made by the players within each group (Tables 8, 9, 10).
In groups two and four this difference was caused by Player B taking a far greater number of moves in the game than Players A and C. In group three the difference was due to Players A and B taking a significantly greater number of moves than Player C. The analysis of variance showed that in group five there was no significant difference in the number of moves made by each of the players. Through further analysis of the data however, it became evident that the players within this group continually took the turns of each other.

This statistical analysis indicates that in comparison to group one, groups two to five displayed a form of interaction which may be seen as representing uncooperative behaviour.

The differences evident within groups two, three and four may be due to the influence of several factors. In both groups two and

Table 8
Analysis of Moves Taken by Players in Group Two

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vs 2</td>
<td>5.5</td>
<td>15.175</td>
</tr>
<tr>
<td>1 vs 3</td>
<td>-3.667</td>
<td>16.223</td>
</tr>
<tr>
<td>1 vs 4</td>
<td>4</td>
<td>16.223</td>
</tr>
<tr>
<td>1 vs 5</td>
<td>19</td>
<td>15.175*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
Table 9
Analysis of Moves Taken by Players in Group Three

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>7.667</td>
<td>10.123</td>
</tr>
<tr>
<td>A vs C</td>
<td>18</td>
<td>10.123*</td>
</tr>
<tr>
<td>B vs C</td>
<td>10.333</td>
<td>10.123*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.

In Group Four, Player B assumed the central position within the group. This in turn provided Player B with the greatest access to the keyboard and thus the greatest opportunity to press the keys before the other players. In addition, in each of these two groups, Player B was observed as possessing the most dominant personality of the three members in the group.

Table 10
Analysis of Moves Taken by Players in Group Four

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vs 2</td>
<td>20.583</td>
<td>11.445*</td>
</tr>
<tr>
<td>1 vs 3</td>
<td>5.667</td>
<td>12.235</td>
</tr>
<tr>
<td>1 vs 4</td>
<td>21</td>
<td>12.235*</td>
</tr>
<tr>
<td>1 vs 5</td>
<td>22.083</td>
<td>11.445*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
In group three, the difference recorded appeared to be the result of Players A and B working together on the game and not including Player C in much of the game playing. In addition, in group three, Players A and B had far greater access to the keyboard than did Player C.

A further factor which may have encouraged the domination of certain players was the apparent lack of understanding displayed by other members in the group. This situation was especially evident in group four, where many of the moves of Player C were taken by Player B.

These observations may indicate that when teachers employ the use of small groups of children to play computer-based adventure games they should consider several factors. To ensure that each player in the group has the opportunity to participate equally in the game, the teacher needs to ensure that at all times each player has equal access to the keyboard. In addition, the teacher should ensure that the player with the most dominant personality does not assume a position in the group which may lead to the encouragement of such behaviour. Placing dominant players on the sides of groups, rather than in the middle, may be one possible option which the teacher may employ. Finally, prior to the group commencing the game, teachers should ensure that all players in the group fully understand the aim of the game and each player is fully conversant with how the game is played. This process will help alleviate the situation of certain players in the group dominating due to the lack of understanding of the game by others.
Suggestions Offered

The second category of interaction which may be used to indicate levels of cooperative behaviour is that of suggestions offered. Through again using the players in group one as a model, it is possible to identify what forms of interaction within this category are representative of co-operative behaviour.

During each of the game playing sessions, the players within group one were observed and recorded as constantly offering suggestions to each other. As a result, for each of the three sessions, group one was recorded as making a large number of suggestions. The players within the group each offered similar number of suggestions. This observation is reinforced by an analysis of variance which showed that there was no significant difference in the amount of suggestions offered by each of the players (Table 11).

Table 11
Analysis of Suggestions Offered by Players in Group One

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vs 2</td>
<td>12.083</td>
<td>8.956*</td>
</tr>
<tr>
<td>1 vs 3</td>
<td>5</td>
<td>9.574</td>
</tr>
<tr>
<td>1 vs 4</td>
<td>2.667</td>
<td>9.574</td>
</tr>
<tr>
<td>1 vs 5</td>
<td>9.583</td>
<td>8.956*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
Through offering suggestions, the players in group one demonstrated their willingness to work as a group and to assist each other in ensuring that at all times the best move for the group was made.

This form of co-operative behaviour, however, was not evident in groups two to five. These groups were observed offering noticeably fewer suggestions, with group four offering significantly less than group one (Table 12). A further analysis undertaken within groups two to five also indicated that there was a significant difference in the number of suggestions offered by each of the players within group four (Table 13). This difference can be attributed to Player A offering a far greater amount of suggestions than Players B and C. No significant difference was found in the number of suggestions offered by the players within groups two, three and five (Table 12).

Table 12
Analysis of the Number of Suggestions Offered in Groups 1-5

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>-27</td>
<td>27.285</td>
</tr>
<tr>
<td>A vs C</td>
<td>14</td>
<td>27.285</td>
</tr>
<tr>
<td>B vs C</td>
<td>41</td>
<td>27.285*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
Table 13
Analysis of Suggestions Offered by Players in Group Four

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>2</td>
<td>15.435</td>
</tr>
<tr>
<td>A vs C</td>
<td>22</td>
<td>15.435*</td>
</tr>
<tr>
<td>B vs C</td>
<td>20</td>
<td>15.435*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.

One possible explanation for the low number of suggestions may be that in all of these groups many of the suggestions which the players enthusiastically put forward in the initial stages of the game were ignored by the other players in the group. This initial rejection may have decreased the willingness of players to offer suggestions in the subsequent playing sessions.

The low number of suggestions may have also resulted from the fact that in each of the groups (2-5), much of the game playing was consistently dominated by certain players. As a consequence, other players in the group tended to assume a rather passive role, contributing little to the playing of the game and therefore offering few suggestions.

The low number of suggestions recorded in group five (n=55) appeared to be the result of two factors. Firstly, much of the initial game playing by members of this group was seen to be of an individualistic nature, with the players working
independently of each other. Thus the players had little reason to offer each other suggestions. Secondly, as with groups two to four, the latter sessions of group five were largely dominated by one player. This had the same effect on players as that described for groups two to four, that of decreasing the involvement and contributions of other players.

Although group three was found to be significantly different to group one, the players within this group did record a noticeably higher number of suggestions in comparison to groups two, four and five. Through the observations of this group it appeared that this was again due to Players A and B working together at the game. Although Player C was recorded as offering a large number of suggestions in each of the three sessions, many of these were ignored or discarded by Players A and B as unworkable.

Proposals Made

Observations made of the players in group one showed that in each of the three sessions a large percentage of the total number of moves made in the game were preceded by the players proposing their choice to the other players in the group. This form of interaction allowed the other players in the group the opportunity to firstly give their approval of the move or secondly, offer further possible choices which may have better benefited the group. An analysis of variance showed that there was no significant difference in the number of times each of the players within group one proposed their move.

The players within groups two to five also recorded no significant difference in the number of proposals made by each player. An analysis between the groups,
however, showed that players in groups two, four and five made significantly less proposals than the players in group one (Table 14).

Table 14
Analysis of the Number of Proposals Made in Groups 1 - 5

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>-12</td>
<td>7.387</td>
</tr>
<tr>
<td>A vs C</td>
<td>-2</td>
<td>7.387</td>
</tr>
<tr>
<td>B vs C</td>
<td>10</td>
<td>7.387*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.

The relatively low number of proposals made by players in groups two to five was evident in each of the working sessions. A possible explanation for this is that the majority of the moves made by players in each of these groups were made as either statements, or as a result of players following a direction or order delivered by another player. In addition, once a player assumed dominance over the control of the game, the need for the other players to propose their move was eliminated.

The low number of proposals may have also resulted from the unwillingness of players to appear hesitant in taking their move. On many occasions in each of these groups it was observed that if players were too slow in taking their move,
another player in the group would press the key. This suggests that players may not have proposed their move in the fear of losing their turn at the keyboard.

Questions Asked

As with the previous categories, the interactions displayed by the players within group one for the category of questions asked may be used as a standard which represents a level of co-operative behaviour. Within group one it was noted that the players frequently asked each other questions which were related directly to the game. In addition, the players in group one were also observed asking each other openly for advice on how to best proceed in the game. This second form of question was asked by the players after they had proposed a possible choice. An analysis of the number of questions asked found that there was no significant difference between the players.

Groups two and three recorded noticeably less questions asked than group one. In addition, group two showed a significant difference in the number of questions asked by each player. This difference was due to Player B asking a greater number of questions than Players A and C. The players in groups four and five were observed asking more questions in total than players in group one.

Several factors may have contributed to this low number of questions in groups two and three. Firstly, in these groups the players did not appear relaxed and at ease with each other. On occasions this unsettled working environment resulted in situations of conflict between the players. As a consequence, players within the group appeared hesitant to ask the other players in the group questions.
A further possible explanation of the low number of questions may be that in each of these groups, not all of the players showed equal amounts of interest in mastering the game. This meant that in some groups players made little attempt to understand the game situation.

Finally, the low number of suggestions may have also been due to the fact that in groups two to three much of the planning and game playing was dominated by certain players in the group. This domination of the game reduced the need for the other players to ask questions.

Through observations made of the groups it was also apparent that the types of questions asked by players in groups two to five differed from the types of questions asked by the players in group one. This observation may account for the high number of questions asked by players in groups four and five. The questions asked by the players in groups two to five were predominantly of two forms.

The first dealt with the dominant player in the group asking the other players what move they wished to make. The second form of question involved the passive member of the group asking the other players in the group what he/she had to do. These two forms of questions made up the majority of those asked by the players within groups four and five.

Help Offered

The fifth indicator of co-operative behaviour, as defined through the observations in this study, relates to the amount of help players provided to each other as they
played the game. Using the results obtained from group one, it is possible to identify a level of help which may represent the presence of co-operative behaviour.

Results relating to group one indicated that in each of the three sessions in which the group played the game, the players provided each other with a large degree of help. This interaction took the form of players directly responding to the questions of others as well as to players assisting others through the clarification and explanation of certain situations occurring during the course of playing the game. In all instances, the help given by players was provided freely and without reservation.

In contrast to this frequent provision of help in group one, the players within groups two to five were recorded as providing each other with less help. This observation is supported by an analysis of variance which showed there to be a significant difference in the amount of help offered by the players in group one compared to the amount of help offered by the players within groups two and five (Table 15). Players in groups three and four also offered less help than the players in group one. In addition to the low amount of help recorded, a further analysis showed that there was a significant difference in the amount of help offered by each of the players within group five (Table 16). This difference was due to the extremely low amount of help offered to others by Player C. No significant difference was found between the players within groups two, three and four.
Table 15
Analysis of the Amount of Help Offered by Players in Groups 1-5

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>2.333</td>
<td>8.71</td>
</tr>
<tr>
<td>A vs C</td>
<td>1.333</td>
<td>8.71</td>
</tr>
<tr>
<td>B vs C</td>
<td>-1.000</td>
<td>8.71</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.

Observations made of groups two to five suggest that the apparent lack of help provided by players may have been due to such factors as the type of working atmosphere created by the players, the lower number of questions asked by players within these groups, and the fact that within these groups certain players endeavoured to dominate the game playing.

Table 16
Analysis of Help Offered by Players in Group Five

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher PLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B</td>
<td>-1.5</td>
<td>2.414</td>
</tr>
<tr>
<td>A vs C</td>
<td>2.25</td>
<td>2.414</td>
</tr>
<tr>
<td>B vs C</td>
<td>3.75</td>
<td>2.414*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
Group Planning

The number of occasions in which all of the players in the group got together to formulate plans and strategies may be seen as a further means of assessing the degree of co-operative behaviour displayed by players within each of the groups. As with the previous categories of interaction, the behaviours displayed by the players in group one may be seen as being representative of co-operative behaviour. As such, this behaviour can be used to assess the levels of co-operative behaviour evident in the remaining four groups.

Within group one the players were recorded as becoming involved in a large number of group planning situations in each of the three sessions, with the greatest number occurring during session two. All of the plans adopted by group one were developed during these group planning sessions.

In each of the remaining groups, however, players were observed as undertaking far less group planning sessions. This observation is supported by an analysis of variance which showed that group one undertook a significantly greater number of group planning sessions than any of the groups two to five (Table 17).

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean Diff.</th>
<th>Fisher Plsd</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vs 2</td>
<td>13.667</td>
<td>8.22*</td>
</tr>
<tr>
<td>1 vs 3</td>
<td>14</td>
<td>8.788*</td>
</tr>
<tr>
<td>1 vs 4</td>
<td>17</td>
<td>8.788*</td>
</tr>
<tr>
<td>1 vs 5</td>
<td>16.917</td>
<td>8.22*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level.
The low number of group planning sessions undertaken by the players within groups two, three and four appeared to be directly caused by the presence of domination evident within these groups. In group two, Player B assumed a dominant role over the other players in the group from an early stage in the game. This domination included that of not only assuming control of the keyboard, but also taking responsibility for much of the group's plans and strategies. A similar situation developed within group four. Within this group, practically all of the planning was undertaken by Player A. In group three, the responsibility for planning was undertaken by Players A and B.

The low amount of group planning undertaken by the players within group five appeared to be due to the fact that these players spent a considerable amount of time working independently of each other. In addition, during the latter sessions in which this group participated, much of the planning was undertaken by Player B.

Despite the significant lack of group planning undertaken by the players in groups two, three and four, each of these groups achieved success in the game within the allocated time period. This observation may lead one to assume that in the context of this game, group planning is not an essential element required to be undertaken in order for groups to achieve success. In effect, this observation indicates that groups which apparently work in a clearly unco-operative fashion may achieve success just as readily as groups who co-operate.
General Discussion

The final category of interaction which was identified through this study as representing a possible means of assessing the level of co-operative behaviour, was that of general discussion.

In regards to this category of interaction, the players within group one were observed as frequently undertaking general discussion. In comparison, the players within groups two to five were observed as participating in noticeably less general discussion.

The low number of instances of general discussion occurring within group two appeared to be due to the domination exhibited by Player B. Although group two undertook a reasonable amount of general discussion in the first playing session, this frequency decreased in subsequent sessions. It appeared that as the domination of Player B increased, the need for the group to get together and discuss situations decreased. The same situation occurred in relation to general discussion within groups three and four, except that in these groups the domination of the game was by Players A and B. In group five the low amount of general discussion appeared to be caused by the desire to the players to work independently of each other.

In all groups except group five, it was observed that the frequency of general discussion decreased once the players within the group reached a certain stage in the game. A similar trend was also evident in relation to the category of group planning. The point at which the frequency of interactions within these categories decreased appeared to be at the stage where all players realised what had to be done and how it could be achieved. Following this point, which occurred in most
groups during the second last session, there appeared to be much less need for the players to interact with each other.

These observations may indicate that once players in the group reach a point where they are familiar with how they can achieve success, the potential of the game to encourage players to plan and discuss is decreased. This may further indicate that subsequent sessions of playing the game may hold far less value than the initial sessions in terms of encouraging players to interact with each other.

The differences in interaction displayed by the players within groups two to five, in comparison to the co-operative criteria established by the players within group one, may lead one to assume that the players within groups two to five did not develop in their levels of co-operative behaviour during the course of playing the game. These differences in interaction are supported by observations which clearly showed that within each of these groups (2–5), the players undertook such unco-operative forms of interaction as domination, independence, verbal conflict and physical conflict.
CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS
CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study found that groups composed of children who would not normally work together did not develop levels of co-operative behaviour through interacting with each other during the course of playing the selected computer-based adventure game. Co-operative behaviour, however, was reinforced between the members of the group who were initially perceived as being capable of working together. The results obtained through this study may have potential significance to teachers within the classroom and developers of adventure game software.

Significance to Teachers

The findings of this study provide the classroom teacher with information pertaining to three aspects of computer usage within the classroom.

1. The use of adventure game software within the classroom.

2. The grouping of students while using adventure game software.

3. The positioning of players around the keyboard.

The results of this study indicate that teachers should express caution at accepting the stated objectives associated with computer based adventure games, especially
in relation to their claims of fostering co-operative behaviour and communication among players. The potential of these games to foster co-operative behaviour may not be as great as is currently believed by many teachers. It appears that their benefits may apply only to selected groups of children.

If the full potential of these games is to be achieved, teachers may need to closely address the issue of group composition. It appears the combination of group members may have a vital impact on the degree to which the objectives associated with the game are met.

When grouping children to play these games, teachers should endeavour to elect children who have previously demonstrated the ability to work co-operatively together. This process of selection will ensure the skills of co-operation and communication are given the greatest opportunity to be fostered between the players. Teachers should be hesitant at grouping children who would not normally work together. It appears that in this formation, during the playing of adventure games, behaviours such as domination, submissiveness and independence may be reinforced. This form of grouping has also been shown to result in situations of conflict between players.

The positioning of players within the group and around the keyboard may also affect the degree to which the game's objectives are met. This study found that if equal participation in the game was to be achieved, all players within the group must be provided with equal access to the keyboard. In this study the groups played the game with the keyboard positioned on a rectangular work desk. This had the affect of encouraging the central player in the group to assume control over the input into the keyboard, relegating other members of the group to assume passive positions on the side. If equal access to the keyboard is to be
achieved, one solution may be for teachers to position the keyboard on a round table, enabling all players within the group to be positioned at an equal distance from the keyboard or rotate the players during or between sessions.

Equal participation in the game may also be greater encouraged if the group member possessing the most dominant personality is situated away from the central position.

Significance to Software Developers

Observations made during this study show that in relation to the selected computer-based adventure game, success was not entirely dependent upon all of the players within the group demonstrating co-operative behaviour. It was found that success in some groups was achieved quite easily despite the presence of such behaviours as domination, independence and conflict. This may suggest that future computer based adventure games adopt a format which requires success to be more dependent upon the input and participation of all group members.

One possible format may be to have a game situation in which each of the players has a clearly defined role, but the responsibilities associated with the role are only known by the one player. Success then would be dependent upon all players within the group interacting to reach a consensus. This situation is in contrast to games in which each of the players are familiar with what the other players can and cannot do. This format makes it possible for one player to assume responsibility for all of the moves in the game.
A second limitation observed as being evident within the selected computer based adventure game was that after reaching a certain stage in playing the game, the need for the players within the group to discuss and plan strategies diminished. This was observed at the point where players realised the strategy required for success. This limitation may indicate that the learning potential of these games may be further increased if the need for players to interact and work co-operatively together is maintained up to the point at which the group achieves success.

Recommendations for Further Research

Computer based adventure games are widely used by children in many classrooms. From the findings of this study, further research is needed to examine their influence upon children's affective development. Future studies may include:

1. Investigating the interactions which occur when these games are played by groups composed of children from different populations. Such a study may examine the interactions between children from different cultures, children with learning disabilities, children from mixed ability levels or children with physical or mental handicaps.

2. Investigating the forms of interactions which are displayed by children while using different forms of adventure game software. Although many of these games state they foster co-operative behaviour, the tasks they involve children in undertaking vary considerably. Therefore, the type of task may influence the type of interactions displayed between children.
3. Investigating the effects of computer based adventure games when they form part of a totally integrated learning program. When the game is directly related to a learning task, the interactions displayed by children may differ from when the game is played in isolation and out of context of the children's learning.

4. Studying the effects of the interactions developed during the playing of computer based adventure games over an increased period of time, and outside of the game playing environment. Through undertaking such a longitudinal study, the effects of the interactions which develop between players may be observed in areas outside of the game situation. Such effects may be seen to influence or alter children's behaviour and relationships toward others.

Despite the absence of visible evidence showing the establishment of co-operative behaviour, children may, through the continual interaction with such games, acquire the skills of co-operation sub-consciously through the process of latent learning. This possibility may be researched through a series of studies which investigate a child's level of co-operative skill prior to being exposed to a series of "co-operative" adventure games and observing whether the co-operative skills needed to play the games develop and are applied over time while playing other co-operative adventure games.
APPENDIX 1
APPENDIX 1

DESCRIPTION OF QUESTIONS

1. Did you enjoy the game playing sessions?
   (Session 1 / Session 2 / Session 3 / Session 4).

2. Over the 3/4 sessions, did you enjoy playing the game with -
   Player A
   Player B
   Player C?

3. Do you think that your group co-operated (worked together) during each of the sessions?
   (a) Session 1
   (b) Session 2
   (c) Session 3
   (d) Session 4?

4. If you felt that your group did not co-operate in any of the sessions, what do you think were the reasons?
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