

## Collaborative Interactions Among Preschool Children in a Computer Environment

MOHD SHARANI AHMAD & MOHAMAD IBRANI SHAHRIMIN ADAM ASSIM

*Department of Human Development and Family Studies,  
Faculty of Human Ecology, Universiti Putra Malaysia,  
43400 UPM, Serdang, Selangor, Malaysia*

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### ABSTRAK

Kajian ini melaporkan penyelidikan mengenai pola interaksi kolaboratif yang ditunjukkan oleh kanak-kanak prasekolah berumur 5 tahun dalam suasana pendidikan berkomputer. Kaedah kajian kes digunakan di sebuah prasekolah di kota metropolitan untuk memeriksa paten interaksi kolaboratif di kalangan kumpulan kanak-kanak bersekitarkan komputer dalam suasana kelas sebenar. 243 interaksi telah dikenal pasti dan diklasifikasikan kepada 16 pola interaksi. Faktor-faktor yang memudahkan interaksi kolaboratif telah dikenal pasti seperti: kesesuaian *software*, kompetensi komputer sebelumnya dan sikap terhadap komputer; tolak ansur di kalangan kanak-kanak; tujuan sosial kanak-kanak; struktur persekitaran pembelajaran yang menyeronokkan; kesefahaman dalam sistem gilir sewaktu menggunakan komputer; dan susun atur tanpa pengasingan. Kesannya, kajian ini menunjukkan guru-guru prasekolah berada dalam kedudukan yang lebih baik menggabungkan komputer dalam pengajaran di kelas dan untuk meningkatkan interaksi sosial di kalangan kanak-kanak sewaktu menggunakan komputer seperti penggunaan alatan pembelajaran dan alatan aktiviti lain.

### ABSTRACT

This paper reports on a study which investigated the collaborative interaction patterns exhibited by five-year-old pre-primary children in an educational computer environment. A case study method was used in one pre-primary centre in a metropolitan city, to examine the patterns of collaborative interaction among young children whilst engaged, in dyads, with the computer within a naturalistic classroom environment. A total of 243 interactions were identified and classified into 16 interaction patterns. Factors facilitating and inhibiting collaborative interaction were identified as: developmental appropriateness of the software; preexisting computer competency and attitude towards computer; mutual friendship between collaborators; children's social goals; appropriate structure of enjoyable learning environment; mutual understanding of the turn-taking system; and non-isolated physical settings. In effect, this study shows that early childhood educators will be in a better position to integrate the computer into their classroom and to promote positive prosocial interaction among children whilst engaged at the computer, if it were to be afforded the same status as other traditional early childhood learning materials and activities.

### INTRODUCTION

Computer technology plays a central role in education. However, most of this technology has not been fully integrated to make child-computer and child-child interaction optimal (Crook 1995). While there were earlier concerns of computers being too abstract and difficult for young children to use (Hattie and Fitzgerald 1987;

Clarke 1990), many educators now believe that computers can be used to promote learning and development in early childhood education if they are used appropriately. Children need to be aware of the nature and uses of computers in order to meet the challenges presented by the present and future technological society.

*Computers in Schools*

The growing use of computers in offices, factories, homes, and schools is often cited as a reason for introducing computers to children at ever earlier ages. Hattie and Fitzgerald (1987) reported that, students of upper primary and lower secondary years demonstrated very positive attitudes towards computers. Clarke (1990) advances the argument that most primary-aged children display a high interest in using computers, with boys demonstrating a greater interest than girls. As indicated by Silvern and Silvern (1990), as long as computers are emotionally satisfying, satisfy the "need to know", and provide self-constructive activity, then using computers with young children is as appropriate as any other "good" early learning activity. Hohmann (1994) argues that for preschoolers and kindergarteners, the addition of computers and appropriate software to their environment has positive social consequences and appears not to disrupt other classroom social interactions. Hohmann (1994) advances the argument that computer activity can also enhance young children's self-esteem and effectively promote self-control.

*Computers in Early Childhood Classrooms*

Children have their own style of learning about themselves and the world. They acquire skills and learn about their world through exploration and discovery, through trial and error, and through experiencing cause and effect relationships (Berk 1994; Berk 2000a; Berk 2000b; Haugland and Wright 1997). Children need to be aware of the nature and uses of computers in order to be able to cope with the present and future technological society (Lipinski, Nida, Shade and Watson 1986; Nastasi and Clements 1992; Lomangino, Nicholson and Sulzby 1999; Nicholson, Gelpi, Young and Sulzby 1998; Teng 1997; Solomon 1998; Haugland 2000b). Computers allow for development, adaptation and delivery of tools which may facilitate more effective thinking, problem solving and learning (Papert 1993; Haugland and Wright 1997). Together with an appropriate program, children are able to experience enjoyment by playing games in education (Haugland and Wright 1997; Haugland and Shade 1988; Teng 1997; Papert 1993).

Learning to use computers can also assist children's development. The computer provides

us with the view that it is not an end in itself (a new task for children to master) but one more tool for children to use in discovering and mastering the world of familiar experience (Hohmann 1994). Research has also convincingly demonstrated that teachers who are involved in integrating computers into their early childhood classrooms often believe that with appropriate strategies and techniques, computer activities can support autonomy and facilitate the normal activities of early childhood classrooms (Hohmann 1994). Early childhood educators often develop effective learning techniques and devise appropriate strategies to incorporate computers into the classroom. Such strategies are comfortable for teachers and in harmony with the social and emotional needs of young children (Shade 1994; NAEYC 1996; Haugland 1997b).

Research has indicated that the computer area in the classroom is rich ground for social interaction, as children frequently prefer working with peers to using the computer alone (Bergin, Ford and Hess 1993; Haugland 1997a; Haugland 2000a). According to Haugland (1997a), speculations on characteristic patterns of interacting with computers may serve to organise distinctive patterns of interacting around computers. Thus, it is argued that there is a need to research task structures and the way in which they promote different styles of interaction (Crook 1994).

*Collaborative Interactions in Early Childhood*

The word 'collaboration' is often used in research on computer-mediated collaborative learning in the fields of education, psychology and computer science, even though the elements embedded within the definition can be interpreted in different ways (Dillenbourg 1999). Literature reveals that collaborative computer use is often associated with the social nature of interactions occasioned by the social demands of complex collaborative activities on computers (Lomangino *et al.* 1999; Permuter, Behrend, Kuo and Muller 1989; Haugland and Wright 1997). Lomangino *et al.* (1999) and Nicholson *et al.* (1998) convincingly demonstrate the successfulness of children's computer-mediated collaborative composing activities within the early childhood classroom context. However, in both studies, the notion of collaborative interaction implicitly refers only to composing activities, which are

task-focused and concentrated on localized task completion.

Clements and Nastasi (1988) state that the investigation of social interactions within different educational environments is significant, not only because social development is a fundamental educational goal, but also because these valuable interactions are essential components of children's cognitive growth. Literature also confirms that the social effects of using computers in the classroom are "overwhelmingly positive" (Bergin *et al.* 1993). However, Lomangino *et al.* (1999) suggest from their study that teachers need to be aware of both the positive and negative peer discussions and behaviours that often accompany young children's collaborative interactions. Identifying these interactions may provide understanding and empower teachers to carefully structure other collaborative activity settings for success. Information about these discourses will assist educators to make informed judgments on the learning benefits and potential of educational computer software packages, and their suitability and potential to foster positive collaborative behaviour among young children. Also, information pertaining to the patterns of collaborative interaction occurring between young children whilst engaged in educational computer programs will assist in providing guidelines for the development of children's educational software. It is important to ensure that future educational computer software packages are structured and developed so as to best maximise young children's collaborative behaviour, so they may scaffold one another's learning. Moreover, it is up to the teachers of young children to ensure that computers live up to their potential. The educational goals of computer usage can only be achieved, however, if the teachers, early childhood educators, and researchers are informed of the relevant issues, demand that computer programs used with children are appropriate, and contribute to both theoretical and experimental data bases to guide computer use with children (Silvern and Silvern 1990).

### THEORETICAL FRAMEWORK

Over the preschool years, cooperative play becomes common in most early childhood classrooms, although solitary and parallel play are also frequent (Berk 2000a). Central to the

neo-Vygotskian analysis of social interactions, the emphasis on negotiation and joint construction of understanding between children has been previously studied (Mercer 1999; Littleton and Hakkinen 1999). Even though preschoolers do not have a mature understanding of relationship, interactions between friends are already more positive, emotionally expressive, rewarding, and they may also assume greater responsibility for keeping a conversation going, cooperating, planning, and setting goals for a play theme than with adults or other siblings (Berk 1994; 2000a; 2000b). Moreover, these responsibilities concerning social interactions have been demonstrated in the studies of young children whilst collaboratively engaged at the computer (Mercer 1994; Mercer 1999; Lomangino *et al.* 1999; Nicholson *et al.* 1998)

More recently, educationists have drawn upon theories such as those of Vygotsky (1978) to show that learning takes place in a social context, and thus cognitive and social frameworks can be structured by teachers to mutually support learning (Littleton and Hakkinen 1999). For example, Vygotsky (1978) saw make-believe play as the ideal social context for fostering cognitive development in early childhood. Language was seen as the foundation for all higher cognitive processes, including controlled attention, deliberate memorisation and recall, categorisation, planning, problem solving, and self-reflection (Berk 2000a). As children repeatedly see that others hold viewpoints different from their own, the egocentric speech gradually declines and is replaced by social speech, in which children adapt what they say to their listeners (Werstch 1991).

The benefits of collaborative computer activity have both theoretical and empirical support from the developmental theories of Vygotsky which stress the importance of interaction with others for learning (Lomagnino *et al.* 1999, Teng 1997; Burgess and Trinidad 1995). While Piaget emphasized social interaction, and more specifically peer interaction, from the perspective of its specific role in the development of logical reasoning (Wertsch 1985), Vygotsky (1978) however, conceptualised social interaction as being at the core of the developmental process.

### Research Study

Given the fact that computers are an integral part of education, with most primary schools

having at least one computer between two classrooms and most having one computer per class, including preschools and pre-primaries (Burgess and Trinidad 1995; Trinidad 1992), and given the importance of social interaction and discourse with others in extending children's learning, it is important to investigate the appropriateness of collaborative computer social interactions in the naturalistic classroom setting. The specific questions this study sought to answer were:

- What are the patterns of collaborative interaction exhibited by five-year-old pre-primary children whilst engaged collaboratively with the computer?
- What factors facilitate collaborative interaction of five-year-old pre-primary children whilst engaged collaboratively with the computer?;
- What factors inhibit collaborative interaction of five-year-old pre-primary children whilst engaged collaboratively with the computer?

## METHOD

### *Subjects*

Subjects for the study were six pairs of children, aged five years, from a Kuala Lumpur pre-school centre. Six children were randomly selected by the classroom teacher, and assigned to the study. Each of the six randomly chosen children in turn subsequently chose a partner with whom to collaborate and interact at the computer.

### *Procedure*

The participants were observed and interviewed using a semi-structured questionnaire to guide the researcher to ascertain data from four recurring themes in relation to the research questions. The themes were:

- attitude and experience towards computers at home and preschool;
- knowledge about software (computer games and educational software);

- accessibility to computer(s) at home and preschool; and
- cooperative activity with friends in relation to computer activity.

The classroom teacher was also informally interviewed to gain relevant information on the children's general social skills, computer experiences and her educational philosophy and beliefs in relation to computer use in the early childhood environment. Each child was videotaped once, together with their partner for a total of 10 minutes. All observations took place during the children's daily classroom activities.

## ANALYSIS OF RESULTS

The interaction patterns of each dyad, obtained from verbal transcripts and audio taped interviews between the participants and the researcher were presented in written and narrative forms. The findings served to construct the emerging patterns of, and factors associated with, the collaborative interactions. The results are also presented and discussed in the context of three variables: teacher variable; children variable, and; software and environment variable. Overall, there were 243 interactions exhibited by twelve five-year-old pre-school children, over a period of three weeks of observation. Prior to each observation session, the classroom teacher would invite the subjects to take and randomly choose a child and assign them to the researcher. Each of the six randomly chosen children in turn subsequently chose a partner with whom to collaborate and interact with at the computer. On two separate occasions, two of the children selected by the teacher to participate in this study were chosen again by two other participants as their partners. Sex/gender dyads by case and control of the mouse device are shown in Table 1.

Data collected from the naturalistic non-participant observations were analysed according

TABLE 1  
Sex/gender dyads by case and control of the mouse device

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Controller	Female	Female	Female	Female	Male	Female
Partner	Male	Femal	Male	Female	Male	Female

to three sources. These were after the study of Mercer (1994); a partial application of the System for Observation of Children's Social Interactions (SOCSI), developed by Brown, Odom and Holcombe (1996); and the study of Nastasi and Clements (1992). A second coder reviewed the videotapes and recorded observations to ensure inter-rater reliability. Initially, the researcher decided that agreement between coders could be checked by looking at totals of categories across each dimension in the interaction patterns. However, this was not considered sufficiently rigorous since a measure of agreement across totals would not necessarily mean a close agreement in the coding, making the validity of any claims made from the results suspect. An early decision, therefore, was that agreement between coders would be measured pattern by pattern, comparing within a pattern each coder's analysis for each conversational sequence. The inter-rater reliability proceeded as follows: (1) The coding was completed by the researcher, with some checking for consistency included at this stage. (2) The coding rules and procedures were given to the second coder along with a sample of tapes so that the identification of the patterns could be checked for reliability. It was found that there was 50% agreement on the identification of relevant patterns, although only 8% were in disagreement. The discrepancy arose because the second coder tended to define the social behaviours exhibited by the participants, without using the appropriate instruments (as listed above), thus merging the first coder's patterns into a smaller number. (3) The researcher and the second coder then agreed on the definition of a pattern and the second coder returned to step (2). There was a high degree of agreement (91%). (4) The second coder tested the reliability of the categories by coding the conversation according to the agreed definition of a pattern. There was a high degree of agreement on the categories of collaborative interactions (93%), and non-collaborative interactions (90%). The goal of the analysis was to distinguish all collaborative and non-collaborative behaviour.

Directing partner's actions was the most frequently occurring interaction pattern (23.0%). Other interactions exhibited included: providing information (19.8%); asking for information/explanation (10.3%); self-monitor/repetition (9.5%); declarative planning (7.0%); disagreeing

with partner (6.2%); showing pleasure (6.2%); suggesting ideas (3.7%); defending control (2.9%); showing displeasure (2.5%); terminal response (1.2%); defending competence (1.2%); correcting others (1.2%); accepting guidance (0.8%); and sharing control (0.8%). Directing other's actions was exhibited in relation to their partner who was in control of the mouse. All the interaction patterns exhibited by the children are presented in Fig. 1.

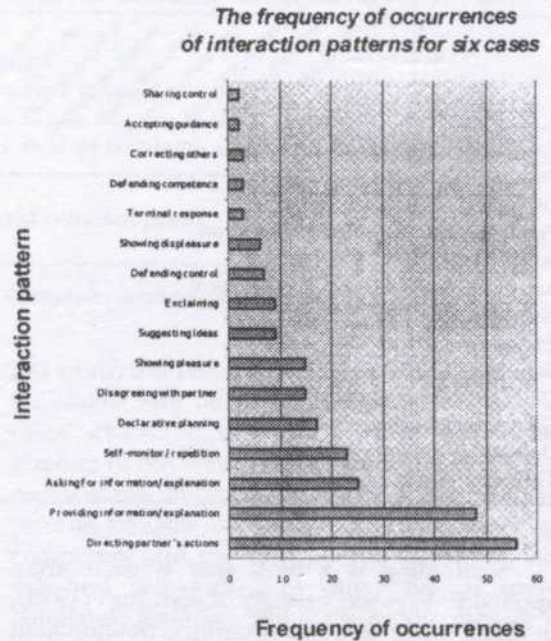


Fig.1: The frequency of occurrences of interaction patterns

The first research question examined the patterns of collaborative interaction exhibited by five-year-old pre-primary children whilst engaged collaboratively with the computer. The results of six observational sessions conducted during the course of this research give valuable insight into the collaborative interaction patterns of pre-primary children whilst engaged with the computer. According to Vygotsky's sociocultural theory (1978), cooperative dialogues between children and more knowledgeable members of society is necessary for children to acquire the ways of thinking and behaving that make up a community's culture (Van der Veer and Valsiner 1991). The findings of Case 2 (Table 2) and Case 4 (Table 3) suggest that even with minimal or no adult assistance, five-year-old children exhibit many constructive patterns of interaction whilst working on computers.

TABLE 2  
Case 2 - Girl 2 and Girl 3: Percentages of occurrences of interactions

Frequency of interaction patterns employed by both children throughout interaction	
Directing partner's actions	19.6% (11 out of 56 times)
Providing information/explanation	20.8% (10 out of 48 times)
Suggesting ideas	11.1% (1 out of 9 times)
Asking for information/explanation	16.0% (4 out of 25 times)
Self-monitor/repetition	30.4% (7 out of 23 times)
Showing pleasure	46.7% (7 out of 15 times)
Exclaiming	11.1% (1 out of 9 times)
Showing displeasure	16.7% (1 out of 6 times)

TABLE 3  
Case 4 - Girl 4 and Boy 2: Percentages of occurrences of interactions

Frequency of interaction patterns employed by both children throughout interaction	
Directing partner's actions	21.4% (12 out of 56 times)
Providing information/explanation	16.7% (8 out of 48 times)
Suggesting ideas	33.3% (3 out of 9 times)
Asking for information/explanation	8.0% (2 out of 25 times)
Showing pleasure	6.6% (1 out of 15 times)
Exclaiming	11.1% (1 out of 9 times)
Showing displeasure	33.3% (2 out of 6 times)
Declarative planning	11.8% (2 out of 17 times)
Disagreeing with partner	26.7% (4 out of 15 times)
Defending control	28.6% (2 out of 7 times)
Terminal response	66.7% (2 out of 3 times)

Scaffolding is a term that is most often applied to Vygotsky's theory of learning (1978), in which it is believed that cognitive development in children occurs through the interaction of a child with more capable members of the same culture, such as adults or more knowledgeable peers. These people serve as guides and teachers for the child, providing information and support necessary for the child to grow intellectually. Even so, conflicts may arise within these interactions as exhibited by Girl 4 (in Case 3) and both Girl 7 and Girl 8 in Case 6 (as depicted in Fig. 2). Mercer (1994) suggests that when conflict arises between children whilst they are engaged in collaborative interaction at the computer, disputational talk may occur. According to Mercer (1994), disputational talk displays the speakers challenging other speakers' views, or actions, without attempting to justify their challenge by building on previous utterances, or offering no information. In a certain context, Teng's (1997) terminal response category of interaction pattern supports the features of this negative behaviour. However,

Mercer (1994, 1999) emphasized that the features and characteristics of these verbal interactions are representational of the children's social mode of thought.

The second and third research question examined the factors that facilitate and inhibit collaborative interaction of five-year-old pre-school children whilst engaged collaboratively with the computer. Interaction patterns observed within all cases involved a continual process of an integrated turn taking system for control over the computer. The children's discourse reflected the successive efforts to gain physical control of the mouse device and share the technology with their partner. Children's differential levels of computer competencies within the peer group were reflected in the range of social behaviours they displayed and the amount of control over the technology and the success of accepting suggestions and ideas from their collaborative partners. Even so, some of the collaborative partners exhibited different interactive patterns, thus reflecting the diversity of their social relationships, social configurations,

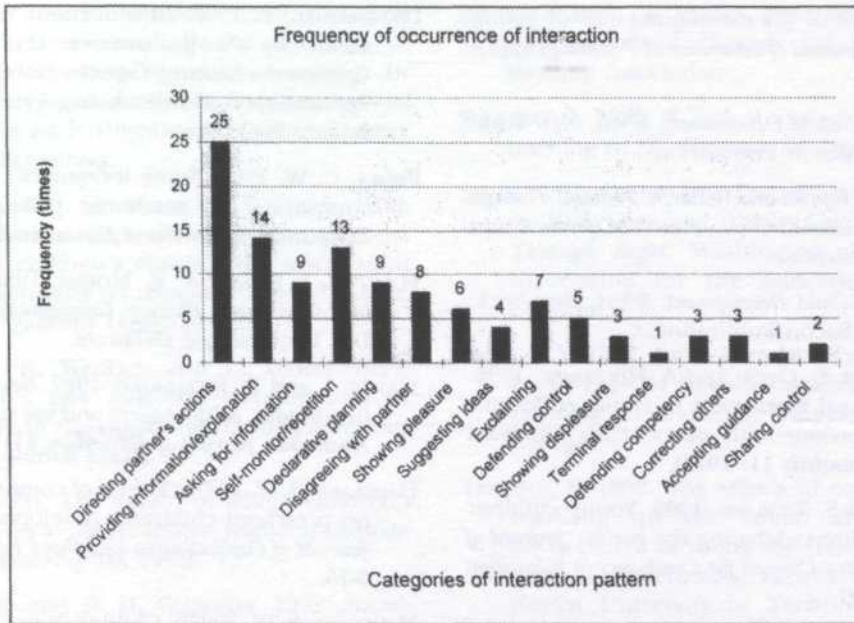


Fig. 2: Frequency of occurrence of interactions exhibited in Case 6

and social goals. Based on the observation of all six cases, these variables were identified as possible factors, that may facilitate or inhibit the collaborative interaction of five-year-old preschool children whilst engaged collaboratively with the computer:

- Social relationships between collaborators
- Social goals of each child
- Social status hierarchies among the children
- Developmental appropriateness of the computer program
- Task structure of the computer program
- Turn taking system applied by the teacher
- The physical setting of the computer environment
- Prior experience and computer competency of children
- Interest in and attitude towards computer

*Implications for Early Childhood Education*

The findings of this study have been examined and discussed in relation to the broader sociocultural and sociocognitive contexts that shaped and produced the interactions of the children. Collaborative interactions, did not always reflect accepted developmental theory. This highlights the need for research which investigates the relevance and suitability of neo-Vygotskian theory. In view of the emphasis placed upon a drill and practice software package in

this study, this research investigation needs to be replicated with an open-ended software and a more structured task, in order to determine whether or not they differ in facilitating children's collaborative interactions. Furthermore, it may provide valuable insight on how integration of computers into the classroom is similar to the use and integration of other typical early childhood materials and activities theories, in a range of socially and culturally diverse early childhood settings. Also, it is recommended that research be conducted among children with special needs.

**CONCLUSIONS**

Computers are here to stay. Computers have enormous potential as well as limitations. By integrating computer technology through appropriate strategies, and promoting and modelling prosocial behaviours, teachers can help children develop positive interaction patterns during collaborative activities on computer. Therefore, it is imperative for early childhood educators to afford appropriate ICTs the same status as other traditional early childhood learning materials and activities.

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