

Learning through teaching: Peer-mediated instruction in minimally invasive education

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Abstract

The current paper provides insight into the learning strategies adopted by children working at Minimally Invasive Education (MIE) Learning Stations. Previous research has clearly indicated the attainment of basic computer literacy by groups of young children in the age groups of 7–14 years. This learning takes place due to the emergence and development of group social processes, an aspect crucial for achieving basic computing skills. The paper describes the process of socially shared understanding and learning as being crucial to individual learning. It is to be noted that this approach of socially shared learning does not challenge the analysis of the individual level of processing; it maintains that individual learning is vital in any learning context, but insufficient to build the psychology of learning. MIE research is of the view that young children learn through interaction with others, particularly peers as it provides an important context for social and cognitive learning. For it is in this way that children make sense of their own experience and environment. Hence, schools are not the only privileged sites of learning.

Introduction

The pursuit of capturing the nuances of the learning process has been a continuous endeavour. What is learning and how it occurs in humans has taken a new meaning in the learning environment. Today, learning is no longer viewed as an internal or individualistic activity; rather, it has emerged as a social process incorporating multiple but distinguishable phases (Lave & Wenger, 1991; Levine & Moreland, 1991). Significantly, cognitive and social processes cannot be understood in isolation; rather, it is the essential aspects of one another that help determine any learning. Thus, Mead's (1934) observation that social experience shapes a person's interpretive processes, Dewey's (1959) emphasis that learning is a collaborative reconstruction of experience and Vygotsky's (1978) emphasis upon the mediational role of socially meaningful activity call attention to the cognitions *about* and *in* social phenomena. Further, research by

Minsky (1986), Rogoff (1990), Schrage (1990) and Resnick, Levine & Teasley (1991) focus our attention towards groups/communities of minds in interaction.

Such pioneering and innovative works have value in today's contemporary educational system where there is a shift in the learning paradigm. Traditional teacher-centred models are now being replaced by alternative models of instruction, such as learner-centred, constructivist, collaborative and the like. Here, the emphasis is upon supporting children as they learn in a particular context (Brown & Mankowski, 1993; Brown, Collins & Duguid, 1989; Cobb 1995; Pea, 1993). The present paper highlights the varied learning strategies employed by children while attaining basic computer literacy. The emergent discernible pattern of learning strategies adopted by groups of children is indicative of socially shared cognition. The interplay of the two salient aspects in learning processes are: (1) Cognitive inputs from the environment, and (2) social networking/collaboration.

These two aspects have come to form the core concern of Minimally Invasive Education Learning Stations (MIE LS) paradigm, and have become the basis of learning and attaining basic computing skills. Even though the basic methodology of learning computing skills remains through social networking, the current paper highlights the emergent different learning patterns used by children while working in groups as opposed to working on their own. Emphasis is drawn towards the salience of the dual role of the group and individual efforts in attaining computer literacy.

Background

The Hole-in-the-wall experiment consists of providing computers to children in safe, public, locations such as a school playground. The computers were placed outdoors, usually mounted on walls and, hence, often referred to as "hole-in-the-wall." The goal of these experiments is to try and establish a model of education that can reach the hundreds of millions of economically disadvantaged children in rural and urban settings (Mitra, 2003). MIE could be relevant for spreading universal literacy, e-literacy and education.

The first experiment was conducted in 1999, when one PC was embedded in a wall facing a slum in New Delhi. This computer was easily accessible to the children living nearby. Further research (Mitra, 2000) indicated that "groups of children, when provided appropriate resources will attain computer literacy with minimum intervention." MIE LS produce other changes in children's social and educational achievements (Inamdar, 2004). Research findings at MIE LS report learning processes as located in the social context, that is, as peer-mediated instruction (Mitra & Rana, 2001). MIE has clearly established that, irrespective of background, children organise themselves into groups and are able to attain basic computer literacy (Dangwal *et al.*, 2005; Inamdar, 2004; Mitra, 2003, 2004).

Background of present study

Experiments conducted over the last five years have established that children working at MIE LS are able to achieve basic computing skills (Mitra, 2003). "MIE is defined as a

pedagogic method that uses the learning environment to generate an adequate level of motivation to induce learning in groups of children, with minimal, or no, intervention by a teacher.” (Mitra *et al*, 2005).

MIE research has indicated the learning of basic computing by groups of children. This learning is located and positioned in the appearance and development of social group processes. The emergence of MIE groups of children is of salience because it has been noted that the group functions by imparting not only the impetus for learning but also provides the necessary structure in laying the foundation of ongoing learning. This collaborative effort of children has been termed as “social networking” (Mitra *et al*, 2005).

Social networking is the process of linking, that is, the way a child connects with another to create, construct a network or social group that she or he can then come to depend upon in order to obtain or acquire information, as and when she or he needs it. Research into the prevalent group dynamics of children working at MIE LS (research in progress) has revealed that children often approach either peers, younger and/or older brothers and/or sisters, acquaintances, anyone working on the computer at that given point in time, or at times, even a knowledgeable person—one who has some knowledge about computers. With time, the child working at the computer develops some rudimentary or a fairly structured network to ascertain information to learn computing skills. Thus, two salient aspects emerge:

- A group of children organise themselves, such that the child learns and benefits from the group and the group also benefits from each child working at the LS.
- Social networking then describes the process of connecting individuals via peers, friends, relatives, strangers and acquaintances. It goes on to become a person’s “personal network.” Thus, each child draws, as and when necessary, upon anyone from his or her social network to progress ahead in learning computing skills.

The abovementioned processes are of importance as they aid each child in attaining basic computing literacy. Continuous interaction among the group of children is the basis of MIE learning. The basic strategies adopted by these groups of children while working in groups in comparison to while working alone at the computer reveals different learning methods. This validates Vygotsky’s (1978) contention that in order to understand the individual’s psychological development, one must study the system of social relations in which the person grows and develops. The significance and implications of the concept of the zone of proximal development as socially shared cognition is clearly visible at the MIE LS.

Present study

Objective

Having understood that groups of children learn basic computing skills by organising themselves into groups, the next step was to enquire about the learning strategies adopted by these children. The query was “how does knowledge get transmitted, shared

and/or acquired?" The present paper seeks to identify and study the composition and patterns of learning strategies engaged in by children while achieving computer literacy at MIE LS.

Research site

MIE experiments are located in urban slum and rural India. The findings of the present study are based on data collected over a 9-month research period from 17 sites across eight states in the country (Table 1). These learning stations range from the Himalayas to the tip of the Indian peninsula (North to South) and from the Rajasthan deserts to the Ganges Delta (West to East).

Table 1: Zone-wise break up

<i>Zone (no. of states)</i>	<i>State/s</i>
South (2)	Karnataka and Tamil Nadu
North (3)	Uttaranchal, Jammu and Kashmir, and Uttar Pradesh
East (1)	West Bengal
West (2)	Rajasthan and Maharashtra

A total number of 250 children (boys and girls) were selected for the study. The spread between the genders is more or less equal. In others words, the number of boys and girls in the study is more or less the same. These children are regular users of the learning stations. Their age ranges from 6 to 14 years; the average age being 10–11 years. A majority of these children study at the elementary school level (below grade 8). They come from diverse ethnic and cultural backgrounds. They are typically Hindus, Muslims and Christians.

The background of the parents is equally diverse, from daily wage labour to farmers, shop owners, auto-rickshaw drivers, working in cottage industries or in a government organisation, etc. Men are found to be more educated (eighth grade), while the women are mostly illiterate. (Mitra *et al*, 2005).

Data source

As part of the ongoing International Finance Corporation (IFC)-sponsored research, children at MIE LS underwent assessments on varied domains. A research consultant (RC) was appointed at each of the MIE LS sites. The RC's task was to interact with the children visiting the kiosk, and hence, develop a working relationship with the children, and enabled assessments of such groups of children.

The RC was hired 1 month prior to the opening of the MIE LS. The purpose was twofold: (1) to enable the RC to familiarise himself or herself with the village, and (2) most importantly, to build a rapport with the children such that they would accept the RC in their area of space.

Table 2: Sample daily observation report

Names of children	Application	Time spent/ application	Remarks
Boys	WordPad	30 minutes	Lokesha went to Start + Program + Accessories + Word pad + Enter key. He opened WordPad. First he went to font and clicked over it and selected 36 size. He then typed his name and selected it by dragging over it. Next he went to bold option and clicked it. He told me that he clicked over B to get his name in bold, and that he has learned this by himself. Then he went to Italic and told me that he pressed over I to get his name in slanted letters. He pressed backspace to delete his name. Again he typed his address. This time changed font and color as well. He selected red color for his name. Then he typed his friend's name and used different colors. He pressed enter key to start a new paragraph and space bar to maintain the gap between the words. After that he went to file option and saved the file in the name of Lokesh. Then he closed the word pad by pressing over close option.
Kiran			
Umesha			
Lokesha			
Arun			
Girls			
Rajani			
Babitha			

Note. Location is Kalludevanahalli, Machine No. 01; Time: 1a.m.

One assessment given to the RC was the maintenance of a *Daily Diary*. Such an attempt allowed the RC to map the daily activities of the children visiting the MIE LS. The RC was required to be present at the MIE LS everyday for about 4 hours a day, 5 days a week. The period of data collection was spread over 9 months, resulting in a detailed account of the activities at MIE LS. The close interaction between RC and children helped understand and study the varied features involved in the learning process. Based upon the daily observations and interaction with the children, the RC filed the Daily Report on the following issues—number of children at the LS, their names and gender, nature of the children's interaction, which children were working together in a group, or was a given child working on his or her own. Further, the RC also periodically asked the children details of the activity or activities they did on that day, what new aspect they had learnt during the course of their visit to the LS, how did they perform that activity, from whom they had learnt it and to whom did they teach it to. Data for the current paper is based upon the *Daily Diary* maintained by the RC, a sample of which is given below. Typically, the RC was at the LS from the time it was opened to the time it was closed (Table 2).

Methodology

The contents of the Daily Diary were examined to identify the following two aspects:

- Identification of learning methods adopted by the children at the LS when *working in groups* in comparison to while *working independently* at the LS.

- To map the course of development of computer literacy for each child, as leader or follower of the group, and the spread of information and learning from one child to another. It would help in the identification of leaders and members present in a group. Such an exercise would enable the evaluation of flow of information within the group and between groups, and provide an estimate of the number of children who stand to gain from any one group or leader.

The daily observation was analysed to provide inputs for each month, that is, from August to April, 2002–2003. Kindly note that for the month of February and March, data availability was sporadic; hence, the raw frequencies for each month were corrected to account for the differences in the number of data points available per month.

Analysis of data

Data from the Daily Diary was scrutinised for the various learning methods adopted by the MIE LS users. These methods were mapped with various learning theories as propounded by Skinner (1968), Bandura (1986), Lave (1991) and others. These are presented below with explanations.

Methods of learning (Figures 1 and 2)

Trial and error

The child performs certain actions at random. These could be random pressing of keys, opening and closing windows, opening and closing several applications at random. Something happens on the computer as a result of these actions. However, the child does not make any connection between his action and what happens on the computer.

Rehearsal

There is an initial element of randomness where “something happens” accidentally on the computer. The next element is that of awareness, in which the child makes the

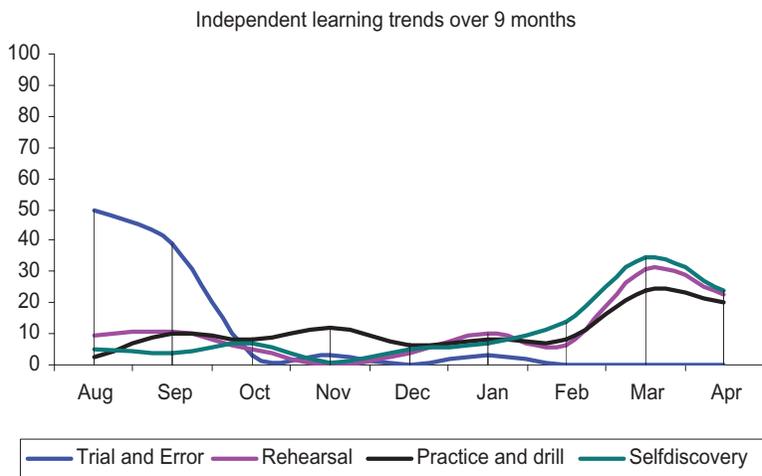


Figure 1: Types of methods adopted by children over a 9-month period

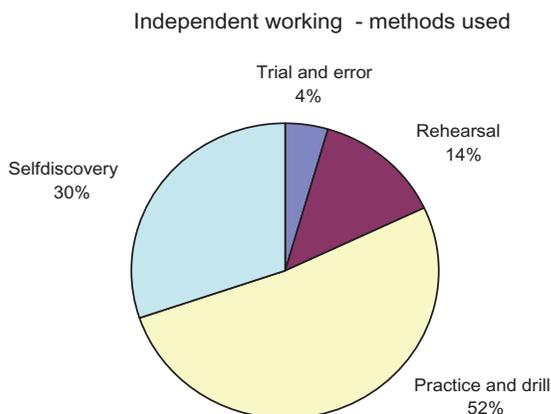


Figure 2: Percentage of methods used over a 9-month period

connection between what he did and what appeared on the screen. The child repeats the action deliberately, either immediately or after a time lag to get the same outcome. The child learns something through practice. Here, the child begins from a state of no awareness or comprehension; when the task is not well-defined in his mind and then improves his awareness and comprehension through practice. The child is aware of his goal and he persists in reaching it through successive trials.

Self-discovery

As in the case of rehearsal, there is accidental discovery. The child then explores further to learn more. So there is progression from a state of “I do not know” to “I know something” to “I want to learn more.” There is a gradual crystallization of learning.

The three categories described above are not discrete, but interrelated, in the sense that very often, trial and error [with no awareness] leads to rehearsal, which is followed by self-discovery.

Demonstration

One child shows the other how to operate, that is, there is hands-on teaching.

Verbal inputs

One child tells another, that is, gives the other child verbal instructions on how to operate.

Observation

Children observe others and learn.

Practice and drill

What is evident from the daily observation reports is that children reach a stage when they know exactly what they want to do and how to go about it, that is, they have

acquired the capability to perform certain tasks on the computer. This involves navigation, using different keys, using different icons and working on various applications (games, paint, word and Internet). This may be taken as an indicator of the functional knowledge acquired. Children then rehearse what they have learnt, that is, they get back to the same task or application again and again. This drilling leads to assimilation and consolidation of functional knowledge. This parameter reflects the capability acquired by the children.

Findings and discussion

The present section is divided into two parts. The first details the learning methods used for each of the 9 months when children work independently in comparison to when they work in groups, thus, identifying the pattern of different learning strategies used by children in these two contexts. The second section provides insight into the group dynamics operating at the MIE LS. It investigates the role played by leaders and members in imparting relevant information to each other. The complex interplay of group dynamics is examined in learning processes.

No difference is observed in the behaviour pattern of boys versus girls, whether they were working independently or in groups, or using various learning strategies. Interestingly, at the end of the 9-month period, nearly all children have used all the learning strategies. Also, the presence of an RC does not seem to affect children's behaviour at the MIE LS. The similarity in the daily diaries of all the RCs is indicative of such an observation.

Section I: Independent working at LS

Children draw from others, but when a child finally starts to work at the MIE LS on an independent level, then the following methods emerge as the predominant learning strategies.

Trial and error

Table 1 shows the percentage of methods adopted over the period of 9 months. It reveals that in the month of August, when the MIE LS was installed, the predominant method was "trial and error," which continued to be the prominent method in the month of September. The children are making little connections between his or her activity and the result, if any. It must be noted that although the children may not make the necessary connection between his action and result, trial and error is a clear indication of the need of the child to explore, search and investigate objects in his or her environment. This activity serves as an indication of the inquisitive nature of young children. Trial and error is a fundamental initial method of learning, especially when there is no other source of receiving or obtaining information. This method tapers by the third month (October).

This further gets confirmed in Figure 2, where it shows the overall percentage usage of all the strategies used by the children over the 9-month period. The figure clearly shows that the usage of trial and error was least used (4%), when compared with other

strategies; however, it also suggests that the role of trial and error is critical only in the initial phases of learning.

Role of rehearsal in learning

This initial method of trial and error gives rise to where “something happens” unintentionally and inadvertently on the computer. Now, the child reports making a connection between what he did and what appears on the computer screen. A purposeful and conscious repetition is made to get the same outcome. This leads to persistent and repeated practice on the part of the child. *Role of rehearsal in learning*, which has a component of trial and error, plays a consistent role throughout the learning period of 9 months. Hence, this particular method appears as a combination of various aspects, each playing its critical role in learning computing skills: trial and error + conscious awareness of activity + consistent repeated practice of this activity.

Figure 1 indicates that children, to begin with, use this strategy by only 10%, but its use, although a little erratic, increases to nearly 30%. Hence, the child, while working independently at the MIE LS, employs this method constantly over the period of 9 months. The contribution of this method in comparison to the other methods is 14%.

A common learning technique is rehearsal and this applies to skill acquisition. Thorndike (1906) postulated that *selection and connection* was the guiding principle no matter how simple or complex the form of learning was taking place. The *Law of Exercise* or *Law of Use* reflected that learning took place through the strengthening of bond between situations and actions. This type of maintenance rehearsal refers to repeating information and there is a direct link between the number of rehearsals and the quality and speed of retention. The mastery of knowledge and skills by rehearsal is also empowering for young children. Gaining automaticity is crucial, if one is going to use a particular skill a lot.

Practice and drill

Once the child is exactly aware of the activity involved in achieving computing skills, she or he then adopts a rigorous regime of continuous practice. The daily observation reports indicate a distinct phase where the following characteristics emerge:

- Children are exactly aware of what they want to do, for example, *Arun told that he is going to open word pad and also told that through word pad he can create a file and also he can save it. He has learnt this by himself and also likes it very much. When the file opened he went to font size and selected 26 size and went to colour option and selected purple. He told me that he has changed the size and also the colour. He pressed caps lock and told me that he has pressed caps lock to type his name capital. He learned this by himself. He pressed backspace to delete the wrong writing. He pressed space bar to keep the distance between the words. Then he went to file option and saved his file.*
- They are also aware of the exact nature of activities required to perform certain tasks on the computer. For example, how to navigate, the use of different keys, use of various icons and working on various applications, like Games, Paint, Word and Internet.

- Hence, children indicate knowledge about the functional aspects of computer applications.
- Children reveal the need to repeat these necessary actions again and again. It seems likely that this particular activity is necessary for assimilation and consolidation of functional knowledge of computers.

Figure 1 indicates the gradual increase of the use of this strategy—from 3% to 25% over a period of 9 months. The contribution of this method in terms of its comparison to other methods is the highest at 52%, indicating the importance of practise and drill in learning contexts. This drill of repeating the actions helps in combining the necessary activities and goes a long way in strengthening the newly acquired computing skills. The following inputs from the daily observation reports reveal the role of practice and drill. For example, *Loksha told that other than this he knows 3D Pinball, Virtual lab, and typing. He learnt all these by observing others when they were playing. He also told that daily he is practicing minimum two hrs on computers; this enabled him to learn more about computer.*

Self-discovery

While using this method, children report that there is an element of trial and error, which helps them in the accidental discovery of some aspect of how a given application is to be used. Trial and error is one way of how the child explores the varied possibilities present in the context; it allows him or her to discover on their own and learn the resultant outcome. The basic characteristic present in this method is presented in the following sequence of events:

- In the initial months the child often reports “I do not know.”
- It starts changing to “I know some aspects of computer activities with the help of others—friends, experts, peers or any other child at the LS.
- It then takes the form of “I want to learn more.”
- To finally, “I have learnt this on my own.” In fact this aspect remains a constant input from each child that she or he has learnt computing skills on his or her own.

The contribution of Self-discovery as a method of learning is 30% as compared with other methods (Figure 2) over the 9-month period. If we study the trend (Figure 1), in the initial months it is negligible but gradually towards the end (March onwards), there is a sudden increase in its usage.

Stepwise examples include:

- *At 1:28 pm, another boy grabbed the mouse and opened windows media player. Within few seconds he again closed it. Oh I couldn't go to games, where is it, he shouts.*
- *At 12.47 pm Ravi opened notepad and began to type his name and his friend's name (Somesha). I ask him—What is this? His answer—This is page, we can write over it. Who told you? Some days back I have learnt it from my friend. His name is Gangadhara. He is studying in Nagamangala. Ravi is finding it difficult to locate the buttons. Some of his friends are helping him.*
- *5:32 pm all have quit the place only Punith Raj is standing. When asked why he says that I like computer and love to learn more and more. He opens 3D Pinball.*

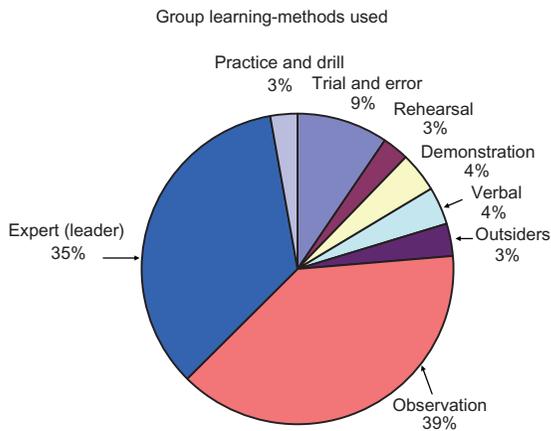


Figure 3: Overall percentage of methods used over a 9-month period

- Nandeesh used the red joystick to select the parts and drag it to appropriate place by using green joystick. He told that he had to press the red joystick while dragging and simultaneously pressing the button. He has learnt it by himself.

Section II: Group learning methods at LS

Analysis of Daily Observation Diary delineated the following learning methods when the children were working in groups: Trial and Error, Rehearsal, Demonstration, Verbal Inputs, Outsider Help, Observation, Inputs from Peer Leader, and Practice and Drill (Figures 3 and 4).

Trial and error

Once again, we note that for the initial month, groups of children adopt trial and error as the primary method of learning. Figure 4a clearly indicates that in the month of August, children only used this method. This method then drops off completely in the subsequent months. But when compared with other methods, it only contributes 9% to the overall methods (Figure 3).

Rehearsal

Rehearsal continues to be an important method in the initial months (Figure 4b), it drops off completely in the middle for the next 3 months and then we find some usage in the later months. The total contribution of this method is 3% when compared with other methods.

Demonstration

If we study Figure 4c, we find that throughout the 9 months, the usage of this method is erratic though continuous. In the beginning month, ie, in the month of August, there is heavy usage followed by a drop in the next month followed by a rise again. This

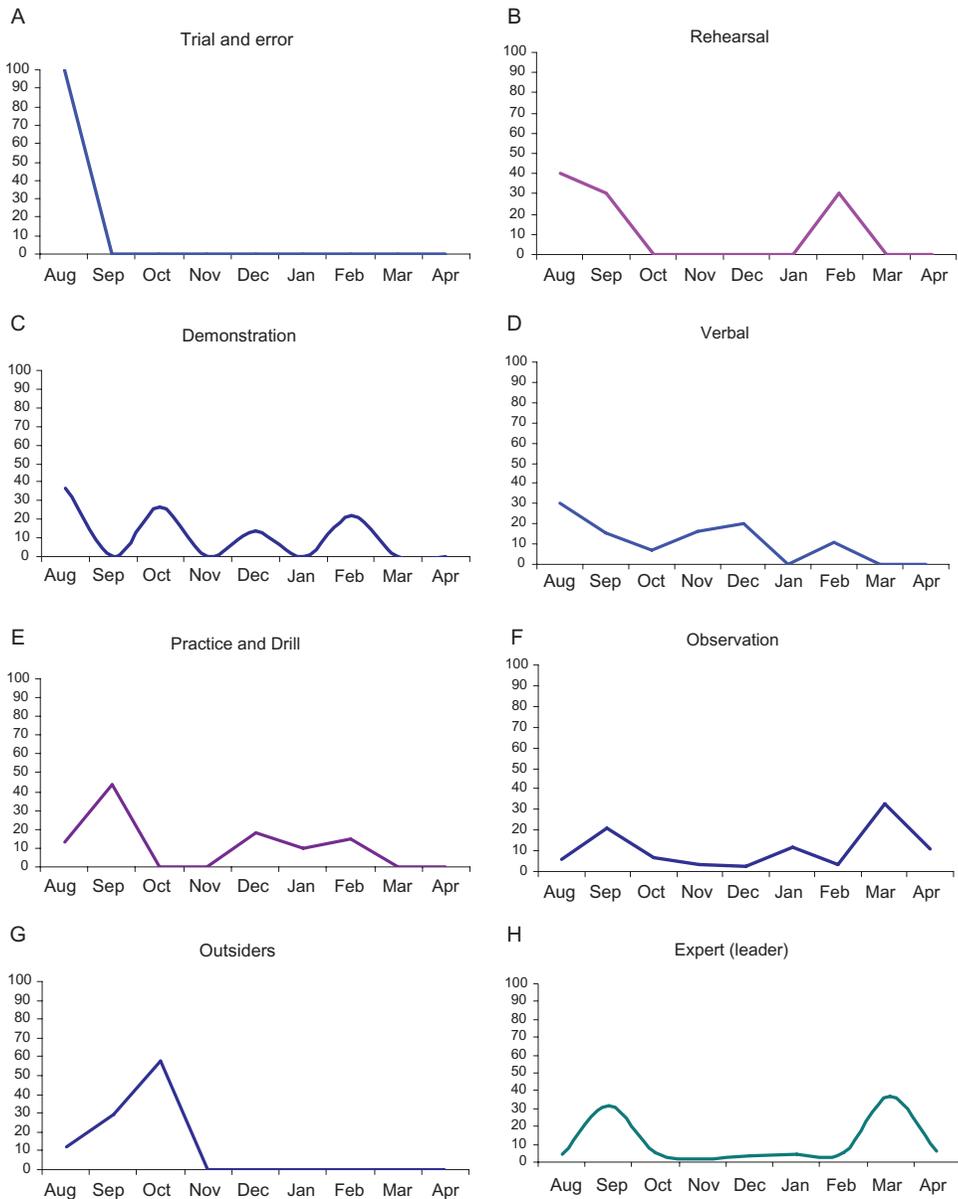


Figure 4: Illustration of the type of methods adopted by children over a 9-month research period

pattern is observed across the 9 months. The demonstration of one child to the other leads to imitation. Imitation represents an act that one person copies from another. It is an educative step the child could not have attained on his own. Cognition derives from social realities that surround the child. Modelling by significant others has a special

impact on young children. Over time, imitation becomes more accurate because experiences become more organised and exerts a corrective influence on what the child extracts from new modelling situations.

How does imitation take place? Bandura (1971) laid the foundation for this learning process. First, there is attention towards the MIE LS in the form of orienting and perceptual activities when the child registers the overt activities. When the child observes and imitates the other children's activities, the recognition that his or her response matches with that observed by the child strengthens the child's desire to imitate. It also takes on the form that if he is teaching other children, there is an awareness that he must learn not only for his own self, but also in order to teach his group of collaborators. Ultimately, he will not need a model to imitate, the child imitates from memory.

Verbal inputs

Like *rehearsal*, we find that children are in continuous dialogue with each other. This activity is sporadic yet continuous across the 9 months. In the initial month, there is an increase followed by a dip and then an increase again. The contribution that *verbal inputs* has is 4% as compared with other methods. Scaffolding is the support given to children as they carry out a task (Collins, Brown & Newman, 1989; Palincsar & Brown, 1984).

If we examine the contribution of other methods, we find nearly a similar pattern whether for *outsiders*, *observation*, *experts* and finally, *practice and drill*.

Interestingly, for *outsiders*, the pattern is a heavy usage in the beginning with a sudden drop around the fourth month. *Observation* is a slow curve that has an increase and a decrease at nearly the same pace across the ninth month research period. *Practice and drill* follows a similar trend; there is a heavy usage in the beginning with a drop around the middle, and again, an increase in the end month. For *experts*, the pattern is heavy usage in the beginning, a dip in the middle followed by heavy usage in the end months.

Maximum contribution of the learning methodology is initiated by *observation* (39%), followed by *experts* (35%).

Further, results indicate towards the fact that other knowledgeable individuals, namely peers, serve to impart the required information; yet the children actively select relevant inputs in the form of varied learning methods from others that is mainly peers, to achieve basic computer literacy. The two major learning methods adopted by children when they seek help of others are *observation* and enquiring about information from peers (*experts-leaders*) who have more knowledge about computer usage.

Observation remains the primary method throughout the learning period, indicating the power of observation as a principal method of human learning, particularly for young children in the age group of 7–14 years. But the children, while working inde-

pendently at the MIE station, indicate another pattern and set of learning strategies. Initially, the children make use of trial and error as the primary method, along with some practice, in terms of repeating responses at the MIE station. It is followed by a burst of practice activity where the children report that they are aware of exactly what to do and how to operate a given programme. Finally, children report self-discovery, that is, having established the initial learning period with help from these methods and vital information from others (*experts*), they are on the path to self-learning. During the later stages of learning, awareness of what to do at the computer and self-discovery are the prominent methods adopted by the children. Rosenthal and Zimmerman (1978) examine Bandura's work of social modelling that children can learn without overt practice or direct incentives and that learning gains persist over time. Vicarious learning as it has come to be termed refers to the mere observation of events and its imitation in due course of time. Observation is a commonly witnessed method used by both children and adults.

Learning at MIE LS indicates the social aspect of situatedness (Lave, 1991). The above discussion helps delineate two strands in learning—the *cognitive* as characterised by a triggering context which has novelty and interest, leading to the form of exploration and exchange of ideas and information, showing the path to connections and associations, rehearsal and “stamping in” of the relevant responses and integration of learning. The second strand is the *social processes* of communication, emotional expression, loose group formations, experience of the others in the environment and encouraging enhancement of sharing space with others. It is when the learner's personal and social world are connected that learning takes place (Lave, 1991; Resnick, Levine & Teasley, 1991; Wertsch 1991). Collaboration emerges as a core aspect of cognitive development and cannot be divorced from the social context.

Typically, educational settings adopt a single pedagogical method, that is, the drill and practice. When a single teaching method is used, a sizeable percentage of these children are likely to fail. Agreeably, it is difficult to encourage a multi-method approach, given the diversity of school-going children. Yet, the results obtained at the MIE LS indicate that young children are open to a variety of learning methods. Each learning method has its significant role in the entire process of learning computer skills. It is assumed that a similar template will emerge in other learning situations also. Further research in different contexts will help validate such an assumption.

MIE learning provides a context within which information is given by peers, siblings and friends. This reveals an important feature. The child gets information that is just sufficient in order to learn computing skills. The child imbibes this information and then goes on to take more relevant information; in this way, the cyclical process continues. The availability of peers or others enables each child to draw upon the required information. In traditional setting, adult caregivers normally regulate the dialogue with children; in MIE learning, we note how peer group learning takes place. A key phenomenon of such interactions is that children maintain the dialogue between each other. Jerome Bruner and his colleagues called this scaffolding. Bruner's metaphorical term

“scaffolding” refers to the gradual withdrawal of adult support as a function of children’s increasing mastery of a given task. This mastery takes place within the child’s zone of proximal development (ZPD) as propounded by Vygotsky (1978). Children gradually develop the ability to do certain tasks without help or assistance. This difference, between what the child can do with help and what she or he can do without guidance, is the ZPD. In the MIE setting, we find that the children’s new capacities are being developed in the ZPD through collaboration in actual, concrete, situated activities with the help of more capable peers.

Thus, concepts like zone of proximal development, scaffolding and dialogue are especially useful for shared learning in public places.

An important aspect that needs to be noted is that when children work in groups at the MIE LS, synergy is generated in collaborative contexts. This synergy provides a significant platform that produces or creates a learning environment.

- *First*, it provides motivation to each child to learn computing skills. In this setting, the activity at the MIE LS keeps providing each child with the needed enthusiasm and driving force to repeatedly come and work at the LS.
- *Second*, children in collaborative settings learn from one another. Each learner has more helping hands to depend upon. The child draws upon this common source of pooled knowledge, as and when required, yet, also keeps working on it independently to finally stand on his or her two feet. That is, achieve basic computing literacy. This is in sharp contrast to structured learning situation, for example, formal school settings where isolated learning is encouraged. Interestingly, the nature and setting of the MIE LS encourages positive outcomes such as sharing, collaborative learning, etc. There is no room for negative behaviours like bullying, or seeking control or dominance. Children realise that it is only through sharing and helping each other that they can achieve their goal.
- *Third*, interacting with one another produces cognitive, as well as social fallouts. Ongoing research at Hole-in-the-wall Education Ltd. suggests that children frequenting MIE LS indicate some positive behavioural changes, such as helping their friends to solve a problem,” “working together,” “learning not to shout when a teacher asks a question, but to raise their hands and wait for the teachers sign to answer” and “organizing themselves at the learning station” (Mitra *et al*, 2005). Hence, group activity creates more activity and leads to learning from peers.

Results confirm that young children learn basic computing skills when they interact with peers. In this way, they make sense of their own experience and the environment. Interaction that arises in the course of such activities provides a context for social and cognitive learning (Brownell & Carriger, 1991; Resnick, 1991). MIE research confirms the view that young children learn most efficiently when they are engaged in interaction, rather than in merely receptive or passive activities, as has been observed in formal schooling practices.

Learning in the MIE setting establishes that shared cognition is both within and between individuals; and although the individual needs significant others to learn and

shape each others' knowledge and reasoning processes, we must not lose sight of the learning strategies used on the individual level to consolidate the learned information, namely the processing of information—cognition. That is, in order to convert information the individual needs and draws from significant others into knowledge, the child requires independent time to unite or merge and strengthen the gleaned or assembled information. The data on learning suggests that children require an approach in which children interact in small groups. It will allow them to observe, experiment, inquire and examine aspects of their environment. In this way, they make sense of their own experience and the world around them.

The above results indicate that human activity and learning occurs on two levels, namely, individual and social. In order to understand the individual, it is necessary to understand the individual in relation to the social relations in which he exists. Groups of children at MIE LS are learning at the social and individual level. *The power of MIE lies in the social network and of the interrelationships that exists among them.* Each child learns on two levels or planes. First, it appears on the social plane—between people as an *inter-psychological* category—where drawing upon the experience of others is necessary. Also, on the individual plane, namely, within the child as an *intra-psychological* category—where working on one's own is necessary to consolidate that very learning—is the basis of learning. One of the main themes of Vygotsky's work was on how human activity operates on two levels, the social and the individual.

Summary and future direction

We can summarise by stating that in MIE LS, the salience of group activity is of paramount importance. These social groups are observed to be more than the sum of its parts. This leads us to enquire into the possibility of other skills that children can acquire at the MIE LS. Questions such as: (1) does participation at MIE LS increase positive feelings towards one another, (2) does it build relationships, (3) does it encourage cooperating and sharing, and (4) does it provide affirmative views about other children, particularly because computing skills are achieved due to social networking. Further, does MIE activity increase self-esteem through not only increased learning, but also due to the feeling of being “wanted and respected” by other children? These are some of the queries that future MIE learning needs to answer and provides research agenda for the future.

It is recommended that young children should be encouraged to interact with others; they should be investigating and observing aspects of their environment worth learning about, and recording their findings and observations. Interaction that arises in the course of such activities provides a context for much social and cognitive learning. Spontaneous play is not the only alternative to early academic instruction. The data on children's learning suggests that primary school children's experiences require an approach in which children interact in small groups as they work together on projects, which help them make sense of their own experience. These projects would strengthen their dispositions to observe, experiment, inquire and examine more closely the worthwhile aspects of their environment.

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