Public computing, computer literacy and educational outcome: Children and computers in rural India

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Abstract

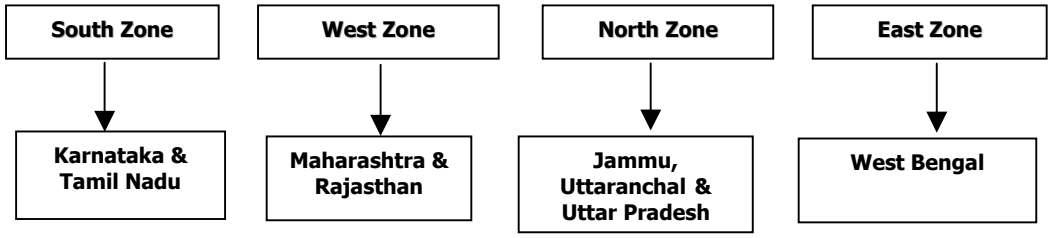
This paper reports the research findings from a national research program conducted in rural India. In this research, children were provided unconditional access to public, outdoor computer. Evaluation was conducted on the children's ability to learn to operate the computer and the effect of such playground computing on educational outcome. The results suggest that playground computers might have an important role to play in improving the outcomes of elementary education and in imparting critical life skills.
Keywords: Evaluation, education, outcomes, computer, rural

Introduction: The Education for All movement took off in 1990 at the World Conference on Education for All. Since then, governments, non-governmental organizations, civil society, bilateral and multilateral donor agencies and the media have taken up the cause of providing basic education for all children, youth and adults. Around 83 countries are on track to achieve Education For All (EFA) by 2015. However, according to the 2002 Report, 28 countries, accounting for over 26 percent of the world's population, may not achieve any of the three measurable Dakar goals i.e. universal primary education (UPE), gender equality and the halving of illiteracy rates. Two-thirds of these countries are in Sub-Saharan Africa and Asia, which includes India as well.
India has the highest number and greatest diversity of grassroots Information and Communication Technology (ICT) initiatives in the developing world. There are a huge number of ICT projects and community centers in rural India for development purposes. And over half of the world's ICT kiosk initiatives are located in India (Sood, 2003). Not only that but India is ahead of other developing regions when it comes to ICT initiatives in rural areas. One of the most pioneering works in this area is a research experiment on "Minimally Invasive Education" (MIE) or "Hole in the Wall project" initiated by Dr. Sugata Mitra, Chief Scientist, CRCS, NIIT Ltd. (Mitra 2000, 2003; Mitra and Rana, 2001).

The Hole in the Wall project: The first experiment was conducted in 1999, when one PC was embedded in a wall facing a slum in New Delhi to observe what children would do with it. Mitra (1999; 2000, 2001, 2003) hypothesized that "groups of children when provided appropriate resources will attain computer literacy with minimum intervention".

The three-year nation wide research program in India proved that groups of children can learn to operate computers with no adult intervention.
Observations, anecdotes from community members indicated that a lot was happening as a result of the nature of the MIE learning stations. Teachers and Principals commented that children were performing better in schools and they attributed it to the learning stations. An MIE learning station has been designed such that computers are accessible from outside through holes in the wall. The present paper is about Zonal findings in India wherein MIE learning stations have been installed. It is also worth investigating findings at the National level (though not covered in the current paper but analysis is in progress).

Research Design: The current design covers 4 Zones: South, North, East and West Zone:



There are 17 sites where these MIE learning stations are operational. Out of the 17 sites, some sites have Internet connectivity while others have offline content. Offline content are freeware educational and fun games (science/ english/math/puzzles/quizzes etc).

Sample: Sample size of experimental group = 250 and control group = 119 children. Experimental group consist of children in the age range 8-14 years (boys and girls), going to Government schools and are exposed to the MIE learning stations. While, control group consists of children falling in the same age range; belonging to the same socio-economic strata as the experimental group. The only difference being that they are not exposed to MIE learning stations. In this study, the dependent variable is the MIE Learning Station hence, any significant change in the performance of the experimental group can largely be attributed to the impact of MIE learning stations.

Tools used

a) **Computer literacy:** Icon Association Inventory (IAI) is used to assess the level of computing skills that children have achieved.
b) **Intellectual Maturity**: The Draw a Man test has been used to assess the child's intellectual maturity.
c) **School Academic performance*:*** The school academic performance is measured by the aggregate percentage marks obtained by the experimental and control group children in their school examination.
d) **HiWEL English and Math test**: These are two standardized tests developed in-house for English and Math.

Results: The results are based on nine-month research period at each zone. And is in the following sequence: Performance in icon test & the learning curve [measure of computer literacy] followed by results on intellectual maturity and academic results, respectively. Graphical representations is only shown for sites where the experimental & control group

are at par with each other at the beginning i.e. baseline. Any difference in the post phase can then be attributed to the MIE learning stations. However, there are cases where the experimental & control group differ significantly from the beginning and hence, have not been reported in this paper. I have also not reported those cases wherein, no significant difference is observed in the beginning and on the 9th month (end of the research period) for experimental and control group. Zone-wise comparison between experimental & control group for each test has been studied. Again, only those cases have been touched upon where both experimental & control group were similar in the beginning. I will take this opportunity to state that in cases where they is significant difference between the two groups to start with (baseline), I could have discussed the relative changes, however this requires a different statistical technique and hence is not currently reported. The study is still in progress and would be reported in the forthcoming papers.

- Performance in icon test

Fig 1.0: Performance in icon test [North Zone]

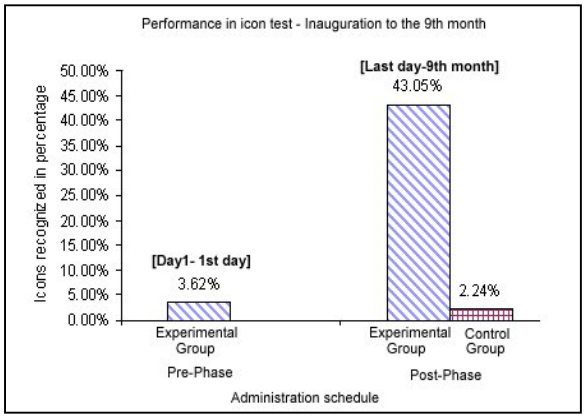


Fig 2.0: Performance in icon test [East Zone]

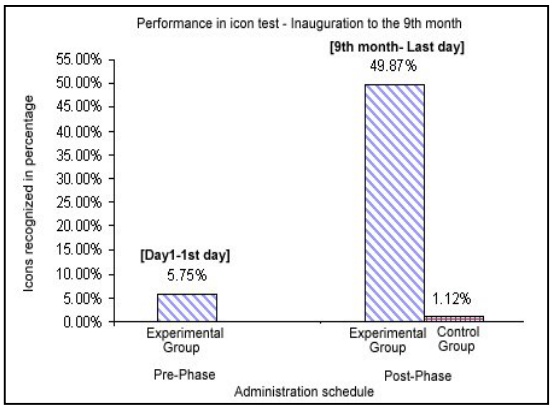


Fig 3.0: Performance in icon test [South Zone]

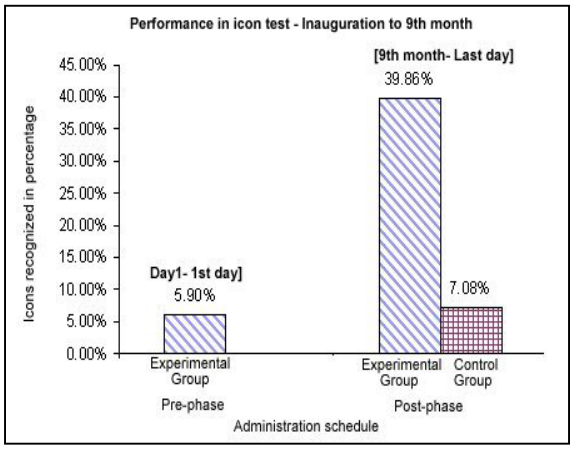
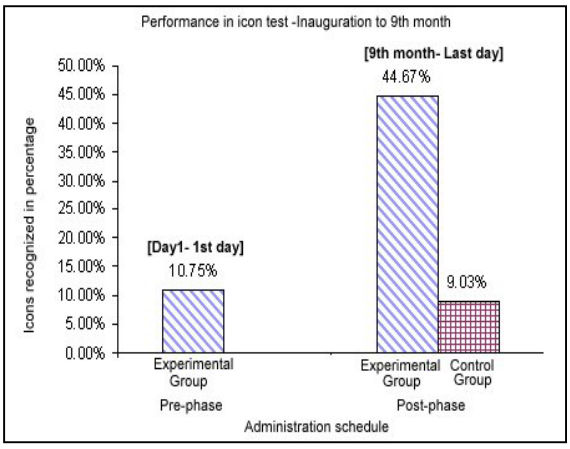


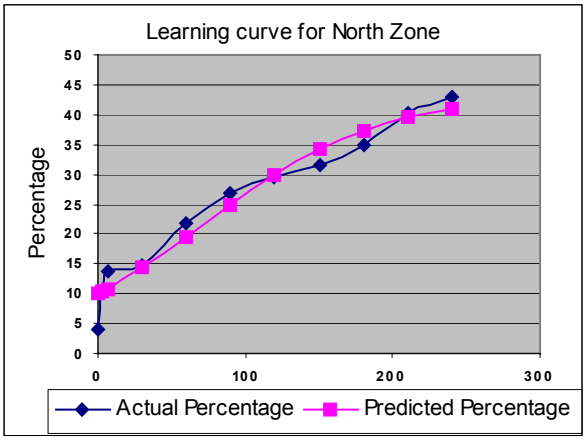
Fig 4.0: Performance in icon test [West Zone]



In all the above figures, it is noted that there is a significant difference in the performance of experimental group on first day (i.e. inauguration day) and on 9th month (p= 0.000). Similarly, there is a significant difference between experimental group and control group on 9th month (p=0.000).

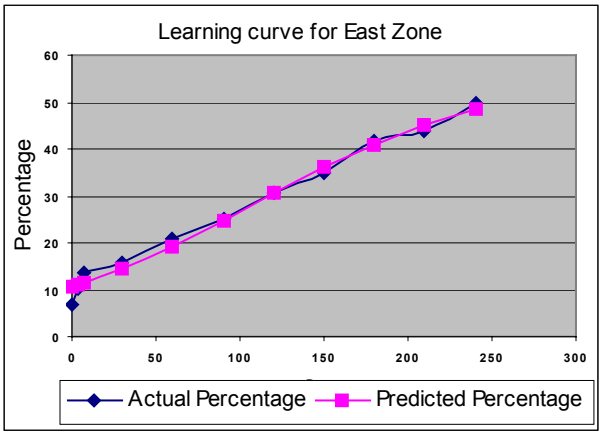
- Learning Curves (icon test): A logistic model is used to study the behavior of performance over a period of time. They describe: a) carrying capacity of the curve, b) growth rate in that particular site, c) initial knowledge of the focus group children, d) knowledge achieved on the 9th month, e) any scope of further learning (by the children themselves), f) the "goodness of fit" of the model [R^2 and MSE].

Fig 5.0: Learning curve -North Zone



Children started with an initial knowledge of 8.928% (i.e. 3.62% of the icons recognized); after nine months with a growth rate of 1.6% they achieved 98.73% of their potential. In other words, they recognized 43.05% of the icons. After the point of inflation i.e. 43.435% intervention will be required to enhance their icon recognition. R^2 is 0.956, which shows a good fit with M.S.E=8.751

Fig 6.0: Learning curve –East Zone



Children started with an initial knowledge of 1.47% (i.e.5.75% of the icons recognized); and after nine months with a growth rate of 1.33% they achieved more than 87.22% of their potential. In other words, they recognized 49.87% of the icons. After the point of inflation i.e. 57.176% of icon recognition intervention will be required to enhance their recognition. R^2 is 0.986, which shows a good fit with M.S.E = 3.658.

Fig 7.0: Learning curve South Zone

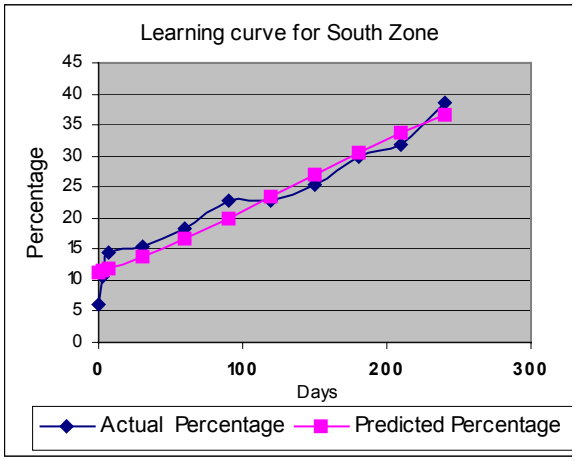
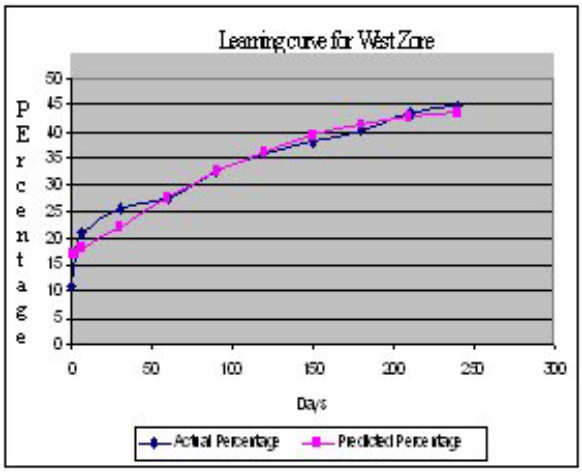


Fig 8.0: Learning curve West Zone



Children started with an initial knowledge of 11.91% (i.e. they recognized 5.90% of icons) with a growth rate of 0.92%, they achieved 75.96% of their potential on the 9th month. In other words, they have recognized 39.86% of icons. Their point of inflation is found to be 50.63%, which means after this point, intervention will be required to enhance their performance (icon recognition). The fit of the curve is good [R^2=0.939] with an M.S.E= 7.1438

All graphical representations (figures) given below - ***Intellectual Maturity***, ***Academic Performance, HiWEL Math*** and ***HiWEL English*** suggest that to begin with the experimental and control group were similar but after nine-months of exposure to the MIE Learning Stations, the experimental group has performed significantly better than the control group.

Intellectual Maturity [IQ]

Fig 9.0: IQ between the two groups [North Zone]

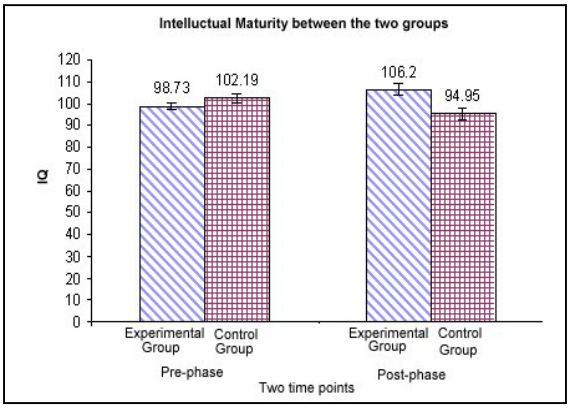
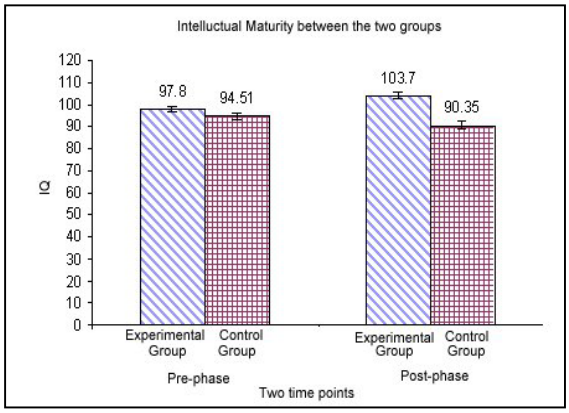


Fig 10.0: IQ between the two groups [South Zone]



- Academic performance

Fig 11.0: Academic performance [North Zone]

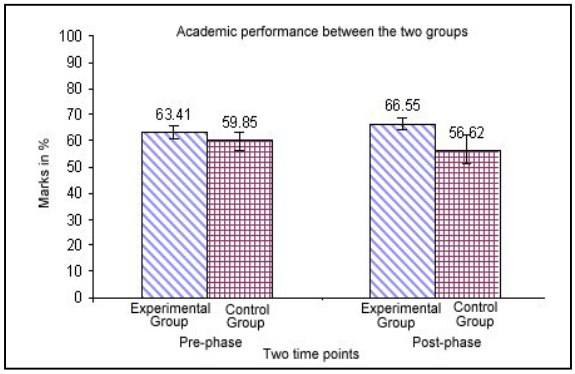
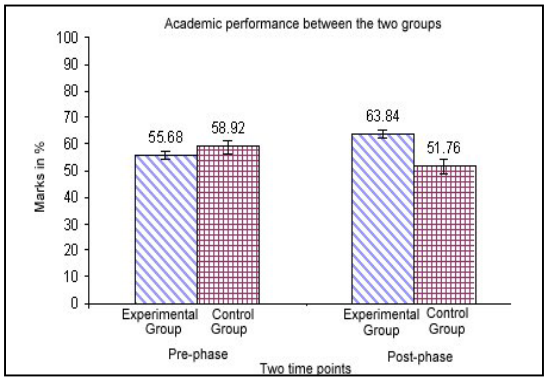


Fig.12.0: Academic performance [South Zone]



- HiWEL Math

Fig13.0:Performance in HiWEL Math [South Zone]

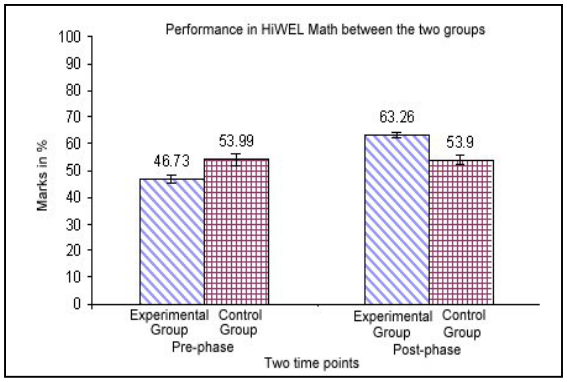
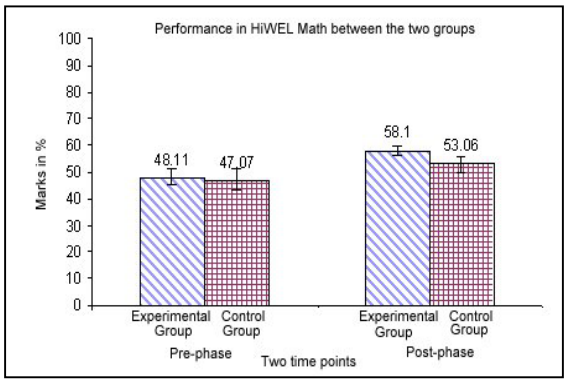
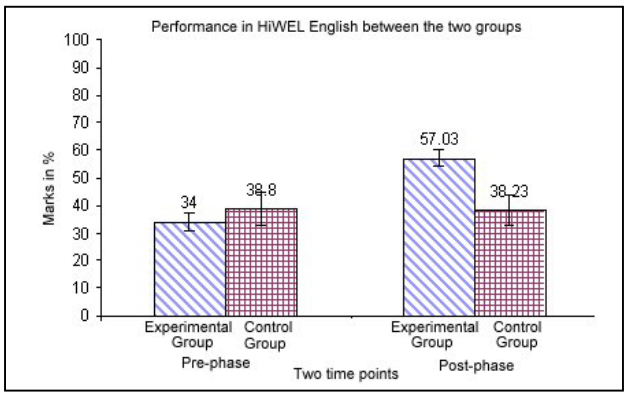


Fig.14.0 Performance in HiWEL Math [West Zone]



- HiWEL English

Fig 15.0: Performance in HiWEL English [West Zone]



Interpretation: The above data suggests that there is a lot of zonal variation that is affecting the performance of experimental and control group. Zonal variation refers to the diversity within each site/location in terms of language, dialect, culture, geographic location, socio-economic factors, etc. Let us understand what I mean by the term "geographic" location. There is a site, in the North Zone named "Hawalbagh" where children come to the MIE learning station from as far as 25 km; whereas, there is yet another site in West Zone in Rajasthan, where covering a radius of more than 5 km becomes an alien territory for a child. Another type of geographic location is the proximity of the site to the city or main town, which also can be possibly causing a difference in the performance across zones. It is true that though the experimental and control group are matched but still differences have been observed in their performance prior to the installation of MIE learning stations. These could be attributed to many extraneous variables, which need to be investigated, separately.

Interestingly, the findings are not consistent across zones for example on one parameter, there is no difference between experimental & control in the pre -phase, while for another zone, the same parameter shows difference between the two groups. As mentioned earlier, in the current paper, we have not discussed cases where the experimental and control group are not at par with each other when tested for baseline [pre-test]. In such cases, it is observed that the performance of experimental group is lower than the control group. But in the post-phase testing, the experimental group has performed better than the control group, though the difference is not significant, hence has not been reported in the present study.

Let us examine each parameter individually: Before I share the findings on computer literacy, I will like to mention that while the experimental group is tested at various time points, the control group is tested only on the 9th month. The reason why control group is

not given similar treatment is to ensure firstly, no familiarity with the test. And secondly, that the difference in performance of experimental group is due to exposure to MIE learning stations. It can be observed from the graphs (fig 1.0, 2.0, 3.0 & 4.0) that the percentage of icons recognized by experimental group on 1st day and control group on 9th month is similar. In effect, any difference in the performance of experimental group is attributed to the learning stations. One can with confidence arrive at this statement because; over the nine-month research period the environment of these children has been relatively consistent (to begin and end with).

Performance on Computer literacy: Children who have been exposed to MIE learning stations have gained computer literacy (as measured by IAI) over the nine months as against children who have had no exposure to MIE learning stations. In other words, MIE learning stations has led to computer literacy. However, computer literacy is not the same across zones for example, south zone recognized 39.86% of the icons, whereas, east zone recognized 49.87% of the icons on the 9th month.

Learning curve clearly indicates that greater the exposure to MIE learning stations better is the computer literacy. It also suggests that in each zone there is still further scope of picking up computer literacy though this capacity varies across zones. For example, in east zone, children have acquired 49.87% of icons recognition and there is still further scope of recognizing 50.63% of icons. Whereas, in west zone, the children have already reached 98.35% of their potential (using the logistic model), leaving relatively little scope for further learning.

Another interesting feature that can be observed in the learning curve is the S-shape. At all locations, the learning has been with multiple s-shapes. In other words, some learning takes place, followed by a plateau, after which again there is an increase in learning followed by a plateau. The plateau stage could be an indication that the child is crystallizing & assimilating his/her thoughts and then is ready to learn again.

Intellectual Maturity: In the North & South zone, experimental & control group matched in their Intellectual maturity in the pre-phase. On the 9th month, the experimental group gained significantly more than the control group. This huge gain in the intellectual maturity of the child can be largely attributed to the MIE learning station, which acts as a catalyst in enhancing the cognitive growth of the child. Marked shifts in intelligence test scores suggest that environmental factors and personality characteristics may have significant effects on performance in the test {Paul H. Mussen, John J. Conger, Jerome, Kagan 1974). In our study, the learning stations provided an enriching environment for the child.

Academic performance: It is observed that academic performance has increased significantly in two zones: North zone and South zone. The results are encouraging, as out of 17 sites, in 11 sites, children have benefited academically from the MIE learning stations. Everything else being constant between the two groups, the experimental group has gained from using the learning station. Interestingly, literature suggests that high intelligence may be expected to correlate significantly with educational achievement. The experimental group in the North & South zone has gained significantly in intellectual maturity and also in their academic performance.

HiWEL Math & English: In the West zone, children have improved significantly in HiWEL Math & English over the nine-month period. While, in South zone, children have

gained significantly in HiWEL Math. One of the possible reasons could be the content that the children were exposed to. For example in West zone, in one of the sites, they had Internet connectivity as well as offline content. Similarly, in South Zone (2 sites) children were provided with Internet connectivity as well as offline content.

Conclusion: MIE learning stations have impacted children in more than one ways. Despite the huge regional, linguistic, cultural variations among & across sites, there has been some common observations & findings. Most of the children have picked up computer literacy on their own, increased significantly in intellectual maturity, improved in school performance & in tests developed in-house. There is no doubt that family and school are critical institutions that influence the growing of a child, but it is also a preadolescent to early adolescent age for the child. During this time, family relationships are important, yet at the same time peer group relations take high priority compounded by the nature of the learning station. The design of these learning stations and the methodology of none or minimal intervention from adults creates an environment of flexibility and promotes maximum interaction among friends. Here, the child is an active "maker of meanings" in such a fluid and non-formal learning environment. It is in this context, that MIE learning stations have a huge potential and can be used as an alternative to formal schooling.

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