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Impact on Learning Spaces by *K-10* School Education Pedagogy

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Abstract

Pedagogy is a technique of teaching. Various teaching activities require various types of settings. In school education (K-10) wide range of age group is involved so a wide range of pedagogies is observed as a psychological need of respective age group. The learning background of current decade school students is different than the students of previous decades due to continual change in syllabus and exposure to technology at a very early stage in schools and homes. There is a great diversity in school infrastructure with their own pedagogical culture. Today few government schools with minimum infrastructure are more productive and gaining popularity and some private schools with high infrastructure are not those productive but still popular with flashy activities? So in this view above study was conducted for the overall learning environment of schools from K-10. Schools ranging from private international to rural municipal studied with a defined set of parameters. Various school environment assessment tools were studied and the tool by the Organization of Economic Co-operation and Development (OECD) is found relevant to follow. Time space analysis was used to categorize places in maximum use and their timings so as to derive some design briefs. It is found that pedagogies for different age groups vary and had a strong impact on the physical design of spaces. Practical education, use of technology in learning is now becoming main focus from global to rural level of India, so physical forms and the design of learning spaces are changing. The conclusions of this study may be useful for educationists and architects, in reference with innovative pedagogies and design of learning spaces for them. Gender specific study and differently-able children study is not scope of this study.

Keywords: Teaching and Learning (T&L), learning spaces, pedagogy, K-10, school survey, time space analysis

1. INTRODUCTION

Education was one of the primary activities from ancient period either it was skill education like hunting, pottery or farming. Later it was transited to formal education system [1]. Indian education system had transformed from Gurukuls to Pathshalas and Madarsas, to modern schools [2]. Today lots of changes are seen in education system. Pedagogy and related various new activities are observed in the middle years (K-10) of school education such as change is syllabus, use of technology etc which impacted learning[3]. This change has been observed from generation to generation, country to country and even school to school in the same region [4]. Generally it is observed that there is an impact of built or un built learning spaces, on pedagogy and activities related to it such as reading, writing, memorizing etc. These spaces either support, do not support or neutral in character in response to various learning activities. The age group is one of the important factors when teaching and learning is considered [5]. Various age groups have different psychologies for learning so the spaces. But commonly in today's education system it is found that very few schools are in harmony of age appropriate Teaching and Learning (T&L) methods, appropriate learning spaces in the middle year school education[6]. Perhaps the consciousness to develop the schools in such harmony is considerably increased and most of the schools in the world are in transition phase to adapt new changes suggested by experts [7]. This adaptation and transformation is faster and worldwide due to advanced information and communication technologies (ICT).

From religious literature it is clear that knowledge is transformed from consecutive generations through the Guru-Shishya Parampara (Teacher- Student Relationship) [8]. Earlier most schools were in line with of religious campuses or thoughts namely Pathshalas, Madarsas and Gurukuls. The very purpose of education was to initiate spiritual attainment and use it as a tool in day to day life [9]. Extensive education system were found in ancient India which includes Brahmin (Hindu) education, Muhammadian (Islamic) education and Buddhist education. Later, elementary education was introduced which includes reading, writing and calculations mostly for trading. The spaces used for such education were tree shed, verandahs or temple shed [10].

In British Era in order to train Indians, for administrative use [11] of the British Empire, a specific curriculum was designed and learning spaces according to them were proposed by Macaulay. Britishers wanted upper economic class Indians to be Britishers in taste, opinions and morals so as to be a part of support system to their administration. So they created education system under the *"downward filtration theory* [12]. Strong discipline and limited education were taught to become passive obedient learner to become clerk for them. Students were exposed to limited sphere and multidimensional growth of students was never the motive [10]. Perhaps it is seen that Guru- Shishya Paramapra (Teacher- Student Tradition) is continued in arts field to some extent till today.

It is observed that the current education system which is mainly cognitive and to some extent social based [13], does not cover overall multidimensional development of students [14]. A vast heterogeneity is observed in T&L methods and infrastructure of schools. Some schools with minimal infrastructure had one of the best T&L environments and some school with high infrastructure had not good T&L environment. So there is a need to study the overall teaching-

learning process and various learning spaces to enhance effective learning environment for students. This paper focuses on the middle year general school education, i.e. from K-10. Gender specific study and study of differently able children is not included.

According to famous American educational psychologist Robert Gagne [15], learning means, a permanent change in capability of a human that is continual and referable in growth. Education means a process of experiences for inner growth regarding skills or development regardless of age according to Dewey [16], Pedagogy is an important tool to transfer knowledge. According to Gage [17], pedagogy is a science of teaching effectively continuously developed by academic experimenters and novel teachers. Pedagogy decides types of activities to be performed and so the space for them can be designed accordingly. In order to avail this education an appropriate physiological and psychological conditions are required, known as learning environment. According to Newmann, Marks and Gamoran [18], the true learning environment is an approach of constructive pedagogy that allows mimicking real life situations for students to own that experience and gain knowledge through quality and variability, student connection and equity etc.

So in order to design spaces for such effective learning environment it is required to observe and study them in great detail. While in this study it is observed that pedagogy is one of the very important aspects which influence learning directly and vice versa. Moreover, it is also observed that because of rigid learning spaces there are limitations on pedagogy which ultimately hampered the very purpose of education.

In this consent three schools were selected with different pedagogical approaches. For two schools, it took one complete day in school to study various spaces and their impact on user by physical experience and observation. Qualitative survey was performed with the help of standard questionnaire prepared by OECD school survey. Analysis of spaces was done with two aspects; one was on the architectural aspect and other the user's experiences about the spaces. Thus various relationships amongst learning spaces, pedagogies and student outcome were observed. One school is studied by detail report and websites available. Further literature review is done to reinforce the aspects of the study further and to derive parameters of learning spaces. Various standard assessment tools for learning environment were studied.

2. LITERATURE REVIEW

2.1 Relation between learning spaces in schools and student learning outcomes:

The Department of Education and Early Childhood Development, East Melbourne, Australia carried a research to find the relation between learning spaces in schools and student learning outcomes in 2011. It covered planning and design of educational facilities and their effect on student learning outcomes. Learning outcome was measured on the basis of cognitive, physical, social and affective changes in children. It covered attainment, pedagogical effects, perceptions of teacher and student about space, wellbeing in the form of comfort, health and safety [19]. The spatial qualities in the research inscribed at the design, implementation, occupancy and sustainability phase. Learning outcomes are quantified by the attainment in class, teacher observation, pedagogical effects, improved social behavior etc. Another study on relation between learning spaces and learning outcome was done by Jill Blackmore [19] for Deakin University Australia. The main idea of study was that learning spaces should to be flexible to accommodate pedagogy physically. Furniture design and classroom setting should have mobility and flexibility of desks and chairs, location of computer tables, display boards etc. thus it was concluded that the 'learning spaces and people' both should be considered in combination and not only 'spaces' for the students outcome in learning. Although architects and designers so far pay attention on the space design, 'the place' which is in reference with location decides the interactive behavior of user to a maximum extent and not 'the space' which is only enclosure. E.g. study desk in a classroom and study desk at home give total different feeling to the same user. The attachment to the space of a user can be produced by appropriate nice design of a space according to the designated use of it. So there is impact of space on the user and vice versa. The new learning spaces with appropriate pedagogy can improve student learning outcomes. Recent studies of noble learning environments show that there is an association amongst spatial design and school environment and student learning [20]. Evidences suggest that well designed classrooms and other learning spaces, facilities integrated with Information & Communication Technologies (ICT) can be an accelerator for new pedagogies and effective learning. Such spaces extend more options for learning through flexibility, adaptability and connectivity.

2.2 Relation between pedagogy and learning space:

Alana Harper [21] used auto ethnographic approach to use the available physical settings in a personified manner. She found that small adaptations in the existing physical settings can lead to great comfort for personal pedagogical approach. That leads to comfort for teacher so the issues like delivering lectures, student management and good conversation with them are resolved to a considerable level. In the study by Vincent J. Granito and Mary E. Santana, [22], considered environmental factors of classroom (such as overall space, lighting condition, acoustics, furniture and board flexibility and technology used) with learning outcomes (such as concentration, engagement, attendance and grades.) along with user perspectives and it is found that poor environmental conditions of learning space distracted teacher and student specially with weak mental state or with some disabilities. So considering the best practices in pedagogy [23], such as collaborative, team-based and problem-based learning methods, class rooms were designed with higher use of ICT, including multiple display screens, flexible seating arrangement, with no podium or dais for teacher. Technology provided active Learning, active interaction, engagement, transformation, at various universities in USA. The classrooms were specifically designed for the suggested

pedagogy. The studies of these spaces have shown significant results such as more interaction between teacher and student and amongst students, better grades compared to conventional classrooms. A study by Barrett et.al. [24], included around 750 school students of primary and middle school and it is found that environmental factors such as thermal comfort, colors, lighting, and acoustics were important factors to increase productivity by 25% of school going children. In a paper published by Dennis Pierce [20], there are various types of furniture in a classroom like normal stools, desk benches, couches to choose comfortable seating posture or change the classroom in a discussion room, small pods groups etc. to suit the pedagogy. Redesigning classrooms resulted in making the students more engaged and inviting and they showed 25% better outcome.

2.3 Relation between pedagogy and student's outcome

A study on effective pedagogy in primary schools by Iram Siraj et.al. [17], showed that many background factors other than school learning environment such as parent's socioeconomic status, their qualification, and home environment relate to the children's outcomes. A good teacher relationship is the base for understanding what has been taught. So pedagogy is directly related to student outcome. Peter Hudson et.al. [25] concluded that Pedagogical practices align well with student's outcome in terms of knowledge, understanding, and demonstration of skills, values and attitudes. One type of pedagogy cannot suit all as there are various types of learners [26] Pedagogy changes from country to various local communities with the change in social and resources available. The seven principles of impactful pedagogy includes mutual respect between teacher and students, their attainment, healthy interactions, relevance of syllabus, skill development and attitude to gain knowledge as well as evaluation base [27].

2.4 Innovative pedagogies for present day and future education, based on technology and psychology of learning to create children centered learning environment

In the research article [28], few unconventional teaching techniques are discussed such as using ICT which appeals the students, mind maps which uses keywords and images to explain the concepts and they are memorized very quickly, teaching with humor, which strengthen the student teacher relationship and teaching can be remembered later, Z TO A approach which explains application first and concept last, implicative words to find the main conceptual word, role play and analytical learning where children are exposed to a certain set of situation to solve the problem which found fruitful.

2.4.1 Novel pedagogy for primary school education

The age group of 3-8 bears dynamic cognitive, physical and psychological developments that require many types of pedagogies of early education [29]; play-based early learning activities should be planned. Provision for a variety of activities like running, jumping, climbing, cycling, sand and water play, gardening, Spaces are needed for active motor senses, health and well being, social and emotional development as well as to develop skills such as literacy, communication and logical thinking [29]. Siddharth [30], mentioned a few techniques and creative tools such as charts, stencils, models by teachers; real world examples; role play; storey board teaching; stimulating the classroom environment by taking classes in a different place etc. Child-centered, interactive and imitative methodologies are preferred. Mix-grade teaching improves learning by peer learning method. Multidisciplinary teaching is encouraged [31].

2.4.2 Nobel pedagogy for middle school education

The age group of 9-12 showed dynamic changes in cognitive than physical state. They are emotionally stable than 6-9 year and have strong logical base with factual imagination [26]. Silent sitting, Role plays, Stories, Anecdotes, Group singing, Group activities, Questioning, Discussion, Value clarification, real world experiences are some of the pedagogies suggested by 'education for values- A Framework' by NCERT.

2.4.3 Nobel pedagogy for secondary school and onwards education

The age group of 13 year onwards leads to the adolescence phase possessing strong emotions, greater cognitive levels, creativity, and imagination of theories in classroom and urge of proving themselves [26]. Following are some of the authentic learning environments according to Lombardi [32], for middle years and secondary school students. Simulation based learning, Student created media, Inquiry based learning, and Peer- based learning, group work etc. Apart from this a ICT presentation of the main theoretical concepts, case studies, classroom assignments, field work, role play, deriving the summery, discussions with professionals and experts are some more pedagogies suggested[33].

2.4.4 Components of an effective learning environment

Learning environment is created by physical infrastructure, environmental factors, and student-teacher interaction in total. It broadly depends upon the characteristics of learners, goals of teaching and learning, supporting activities for T&L and the culture of the school [34].

According to Mirja Lievonen [35], the ideal learning space is measured in four parameters. They are spatial- deals with the space; sensory- relates with environmental factors; social-population of student; pedagogy; interaction and instrumental-teaching learning aids ,tools and ergonomic considerations. The study on connections between people and learning spaces [19], which includes architectural design, planning, student interaction, teacher interaction, technology used, the time space matrix of the spacious, well being of user etc. are studied. According to its findings most of the principles are followed in the design phase, but at execution phase and occupancy phase the indicators are less followed. It is observed that focus is on quality of the space rather than educational practices which is to be improved. The research on the impact of school facilities on students and teachers [36], gives us a considerable proof of relation with outcomes to learning space. Indoor environment which includes thermal comfort, lighting, ventilation, acoustics and visual qualities such as colors, aesthetics and safety are the variables that

affect on academic outcomes. Apart from this flexibility, feel of ownership through attachment of space, type of social mix population in the class affects the overall learning environment. Transitional spaces, structural factors, sustainability etc. factors also are the components of learning spaces.

2.4.5 Standard assessment Tools for learning environments

1. Sannoff's Assessment Tool- This tool was developed by Henry Sannoff [37] in 2001, based on six key elements which are massing, context, interface, way finding, social space and comfort. First impression of a visitor was considered. Architectural features such as physical features, various spaces, circulation, safety, security etc. were considered.
2. 2.BREAMM Building Evaluation Assessment Method – It has been developed by Building Research Establishment (BRE) [38] in 1990, England, UK a computer generated post 360 degree post occupancy response based on sustainability indices such as health and well being, water, land use, transport, materials, pollution etc. It focuses more on the establishment of new project associated with sustainability and health and not the outcomes or pedagogy.
3. The School Environments Assessment Tool (SEAT): It is developed to obtain information of existing conditions of schools in accordance with child friendly infrastructure school model. This version is developed by Humanitarian Schools in Rwanda in Central Africa in2010 mainly for government school [43].
4. The *OECD School User Survey: It is developed by* OECD Learning Environments Evaluation Program (LEEP). It is collective effort of the Group of National Experts on Effective Learning Environments (GNEELE) and various international experts. It focuses on design of physical learning environment for 21st century skills with effective pedagogies, curriculum, assessment and organizational form extract students' capacities [40].
5. Here OECD school survey is followed for the study as it was focused on design of physical spaces along with pedagogies and curriculum

3. METHODOLOGY

In order to study the relation between pedagogy and its impact on learning spaces, from global level to rural level in India, three schools were chosen to study on the scale of Private International, Private National and Municipal Rural. The Private International school (Green School, Bali, Indonesia) was studied through a detail report prepared by architect Marian Hazzard and Ed Hazzard, with Sheryl Erickson and internet data; later two i.e. Private National School (Sahyadri School, Maharashtra, India) and Municipal Rural school (Navanadisar Prathmic Shala, Gujarat, India) were studied through personal visit by spending whole working day there, with standard questionnaire. A detail time table study of all schools with each school section such as primary, elementary and secondary is done for time space analysis. Around fifty various architectural parameters of each learning space, derived from various literature studies were considered. Comparative analysis of all three schools was done to find conclusions. Apart from this 'time space analysis' is done through activity charts to understand the net time spent in a space in a whole working day to derive the preferences (long time use or short time use) of spaces as a guideline for design. Finally conclusions were drawn on the basis of both criteria.

4. ANALYSIS AND FINDINGS AND DISCUSSION

Analysis was done majorly on following areas.

4.1 Overall learning environment- it included *infrastructure quality* defining its flexibility, social environment and culture, psychology of learning, active learning methods, use of technology, sustainability etc.

It was found that even though the size and quality of infrastructure varied from global level to rural level amenities provided are almost same.

Infrastructural facilities were designed according to pedagogy at global level and national level whereas in contrast at rural level pedagogy was adapted with the available infrastructure very positively in terms of student engagement and teachers comfort while delivering lecture.

In total from global to rural level there was very less artificial soundproofing treatment in class rooms but classrooms were audible up to satisfactory level.

All schools were found in natural setting with lots of plantation.

Aesthetics and ambience was created by the use of natural construction materials such as exposed bricks, locally available stone, mud, wood, bamboo etc. soothing natural colors such as brown, yellow ochre, shades of green, etc. on the background of lush green campus.

At all levels local culture is deliberately taught in the form of language, art and celebrating local festivals. In Green School (Private International) Indonesian Art and Balinese language is taught; in Sahyadri School (Private International) Marathi Language, local farming, is taught; in Navanadisar Prathmic Shala (Municipal, Rural) it is obvious.

Child psychology was considered at every level, but it was dealt excellently at rural level school. Active learning was the core of all schools.

Use of Information and communication technology is almost similar at all levels. Internet, Audio-visual devices is commonly used with guidance.

Awareness and best practices about environment are higher on global level school and decreases consequently up to rural level.

Thus student centered learning environment where children are privileged on physiological and psychological was found at all levels.

4.2 Activity chart- Time table study was done to derive 'short time use' and 'long time use'. Time spent at various place in school is analyzed to find the priority used space so that they can be considered for design according to local sun path.

In rural school with minimal infrastructure multiple and optimum use of spaces is found. E.g. multipurpose hall was used as dining hall, class rooms were used for various activities, outdoor spaces were used as study spaces etc. The reason behind it was the innovative flexible pedagogy which suggests that T & L can be anywhere in spite of designated use. Availability of restricted built and unbuilt spaces further reinforced it.

In private national school multiple uses of spaces was not much encouraged. Spaces were given designated use such as classrooms, labs, dining hall, outdoor spaces for casual interaction etc. The reason behind it was a typical pedagogy of mid 90s which suggests more formal classroom teaching than student centered teaching in unconventional format. Ample of built and unbuilt spaces supported it further. But the same infrastructure can be better to be used for nonconventional innovative pedagogy.

In private international school again multiple uses of spaces was not much encouraged. But children centric spaces were designed to facilitate the T&L such as curvilinear architectural forms, use of levels, lots of open spaces, local and natural construction materials made it more interesting for children. The reason behind it was modern pedagogy which suggests more practical T & L than formal teaching in classrooms. Filed work is given more importance. Lots of practical fields were created such as local farming, art and craft, various updated labs for science, mathematics, languages, geography etc. were supporting the pedagogy.

Table 1: Time Space Analysis Comparison of Spaces Used in Whole Working Day Percentage wise

Space	Primary School			Middle School			High School		
	N	S	G	N	S	G	N	S	G
CLASSROOM	30	-	23	30	36	23	-	33	24
LABORATORY	30	-	17	30	30	17	-	32	18
OUTSIDE SPACES	30	-	35	30	9	35	-	12	36
DINING HALL	3.5	-	8	3.5	12	8	-	12	9
GROUND	3	-	5	3	9	5	-	8	-
ASSEMBLY SPACE	3.5	-	12	3.5	4	12	-	3	13
TOTAL	100%		100%	100%	100%	100%		100%	100%

N-Navanadisar Prathmic shala(Rural); S- Sahyadri School (National); G- Green School (International)

4.3 Learning spaces- Six major types of spaces are found in all types of school. They are class rooms; laboratories; transition spaces such as corridors, verandahs, terraces; outside open spaces; gardens, play grounds; dining hall and assembly spaces such as grounds or halls. These spaces were designed used differently according to the pedagogies of the schools.

Classrooms- In rural school floor sitting was preferred, in national school formal sitting was preferred where as in international school casual sitting was preferred.

Laboratories- In rural school labs were with minimal resources but teaching models were designed locally by teachers. In national school standard equipments and set up was found. In international school most updated facilities and equipments were found.

Transition spaces- In rural school transition spaces were vibrant colored with lots of graphics related to the nearest activities of room. In national school fewer graphic were painted on walls. In international school very less graphics on walls was found. The reason behind it shows the pedagogical culture of the school.

Outside open spaces- In rural school outside open spaces were smaller in scale but various characters were given to them such as no disturbance reading area, playing area, medicinal garden, kitchen garden, open tree classroom etc. In national school outside open spaces were larger in scale and treated with casual sitting areas, beautiful landscapes, formal playground set ups etc. In international school outside open spaces were treated with natural landscapes, sitting areas, formal playground set ups sustainable features such as solar lamps, hydro power stations, mud land to play etc.

Dining hall- In rural school dining hall was semi open and used as multipurpose hall or covered play area. In national school dining hall was a built space and no multiple use is suggested. In international school dining hall was semi open and used for single use i.e. dining.

Assembly spaces- In rural school playground were used as assembly space. In national school a designated assembly spaces or sports hall was used as assembly space. In international school designated assembly hall or ground was used as assembly spaces.

It is found that the learning spaces were supporting the pedagogy. But they have more potential to be used innovatively by teachers. Any space can turn into a great reformation by adding graphics and use for it. Also it is found that these spaces can be flexible and utilized on the basis of Building as Learning Aid (BaLA) [41].

5. SUMMERY AND CONCLUSION

At all levels ranging from global to Indian rural, though infrastructure varies, amenities on campus are same. Pedagogy varies widely in complex irregular pattern and use of learning spaces change accordingly (Table1). Practical education, creativity, social and emotional development are preferred on all levels in respective geographical context. The respective administrators told that students as products of such schools are different in attitude towards life and prominent in society than conventional cognitive based schools students.

- In conclusion the school community is on the urge of 'children centered learning' and 'active learning' is practiced not only at global level but also at rural level of India.
- Due to use of technology new global concepts in T&L are percolated faster up to rural level. It is

accepted worldwide even in rural areas that learning is not only cognitive learning, but it has various aspects than curriculum.

- Awareness of sustainability is increasing and environmental friendliness taught in schools practically from globally to rurally to be citizens of Eco friendly world ahead.
- The form of learning spaces is becoming more important to support new pedagogy.
- Buildings and their surroundings are becoming learning aids.
- Fieldwork and practical learning is demanding certain type of infrastructures in enclosed as well as open spaces.
- Thus, learning spaces need to be designed as case specific by studying the mission, curriculum, type of pedagogy followed in the school.

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