# Out-of-school Science Experiences and Interest in Science of Upper Primary School Pupils of Kerala

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**Abstract**

*This study explored out-of-school science experiences and interest in science of upper primary school pupils of Kerala. Data collection made use of Lickert-type scales on topics chosen from the Science curriculum and Science-related experiences that pupils indulge in their daily life. Percentage analysis revealed moderate extent of out-of-school science experiences and relatively high interest in science. Mean difference analysis showed that significant difference existed among pupils in the extent of out-of-school science experiences and interest in science based on gender, locality and type of management of school. The results indicate that in order to reduce disparity among pupils in opportunity to learn teachers need to know about what experiences pupils bring to classroom, monitoring interest should begin from primary classes itself to reduce transitional problems at later stages of study and policy makers and curriculum planners should cater to the special needs of girls as well as rural and aided school pupils.*

Amidst the mounting evidences of decline in the interest of young people in pursuing science (report of ninth meeting of Global Science Forum , 2003) there is similar trend of decline in science interest in India also. National Science Survey (Shukla, 2005) has shown that interest in science as well as satisfaction with the quality of science teaching declined as the age increased. Surveys across the globe suggest that lack of interest in science is mainly due to science being less intrinsically motivating (Global Science Forum, 2003; National Science Survey, Shukla, 2005), nature of science being cut off from real world and its content being overloaded with matters unrelated to the life of students (Hill & Wheeler, 1991; Osborne & Collins, 2001). One way of making science relevant is to base science on experiences pupils are interested in and find applications in real life.

Model of experiential learning (Kolb, 1984) brings out the holistic nature of learning from experience. Experience addresses cognitive, affective and physical aspects of learner. Theory of

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experience (Dewey, 1938) further implies the significance of experience in learning. So knowing the experiences that children bring to classroom is important, as it is upon this base that teacher has to build up education of child.

**Rationale of the Study**

Recent studies on science interest in India demonstrate a shift away from science at the plus two and under-graduate levels (Patil, 2003; Shukla, 2005). As interest in science develops quite early in life (Gardner, 1975), decline in interest in science in later years of life can be tackled to a certain extent by providing all the factors conducive to the development of science interest from quite early years itself.

Exploration in the field of influence of out-of-school science experiences on interest in science is not substantial in India. Present study on out-of-school science experiences and interest in science of upper primary school pupils in Kerala attempts to find out whether the trend of declining interest in science is evident among upper primary pupils of the most literate state in India. Decline in the number of women choosing science (Global Science Forum, 2003), and, lesser number of women opting for scientific careers (Indian National Science Academy, 2004; cited in Bamji, 2004) raises concern about women's interest in science. Locality may be contributing to the difference in interest in science owing to widely differing conditions in quality of life. Hence it is significant to know the effect of gender and locality on out-of-school science experiences and interest in science. This study explores science-related activities that children themselves choose without any external suggestion and the resultant influence these activities have on interest in the topics that they learn in their science classes.

**Objectives of the Study**

The major objective of this study is to find out the extent of out-of-school science experiences and interest in science of upper primary school pupils and the influence of gender and locale on out-of-school science experiences and interest in science. Attempt is made to find out whether there is significant relationship between out-of-school science experiences and interest in science.

**Methodology**

The sample used is 1461 upper primary pupils selected from 14 schools of Kozhikode district in Kerala, using proportionate stratified random sampling technique giving due weightage to gender, locality of the school and type of management of the school. One class each was randomly selected from each of the three grades in the upper primary section.

Two tools–Scale of Out-of-school Science Experiences (SOSSE) and Scale of Interest in Science (SIS) (Gafoor & Smitha, 2008) were used.

SOSSE included 89 out-of-school science experiences with which pupils are familiar. SOSSE is modelled after the tool used in the project 'The Relevance of Science Education' conducted by Schreiner and Sjoberg (2004). The

experiences were chosen after an informal interview with children of the age group 10-14 years, from varying socio-economic and home backgrounds, to ensure that scale did not have items unfamiliar to pupils. Four categories of experiences, viz. Observation, Collection, Activity and Experimentation are included in the scale, with an increase in the level of involvement of children as they move from observation to experimentation. 'Observation' requires the pupil to show merely an inclination to attend carefully to surrounding phenomena while 'Collection' implies a tendency to respond and acquire the objects that have captured their attention. 'Activity' involves taking active participation in an event that satisfies them without being much aware of their implications whereas 'Experimentation' deals with the attempt on the part of the pupil to explore the underlying causes of a phenomenon. SOSSE consisted of items related to all three types of experiences, viz. direct, indirect and vicarious experiences (Kellert, 2002) from three fields of science, viz. Biology, Physics and Chemistry.

SIS included 63 topics selected after a thorough analysis of the contents in the science textbooks of standards III to VII. Topics included in the scale pertained to science and technology, space and the sky, human biology, plant and animal life, light and sound and dangerous aspects of science and technology.

The items in SOSSE and SIS were rated on a three-point Lickert scale indicating the frequency of experience and degree of interest respectively. For SOSSE, total score, scores on experiences in each subject area and scores on categories of experiences, viz. observation, collection, activity and experimentation in each subject area were obtained. For SIS, total scores and scores on each subject area were obtained. All these scores were converted to 2, in order to facilitate comparison among subject areas and categories.

Test-retest coefficient of correlation of SOSSE was 0.78 and that of SIS was 0.70. Split-half coefficients of correlation for the scale and the sub scales were calculated as further evidence of reliability: SOSSE (r=0.88), observation (r=0.75), collection (r=0.68), activity (r=0.70), experimentation (r=0.81), SIS (r=0.70), Interest in Biology (r=0.86), Interest in Physics (r=0.84), and Interest in Chemistry (r=0.86). The internal consistency was established by estimating the Cronbach's alpha coefficient of homogeneity for the scale and sub scales: SOSSE (r=0.93), observation (r=0.80), collection (r=0.73), activity (r=0.82), experimentation (r=0.81), SIS (r=0.95), Interest in Biology (r=0.88), Interest in Physics (r=0.87) and Interest in Chemistry (r=0.87). SIS has substantial positive correlation of 0.56 with the grades that pupils obtained in science. This positive substantial correlation can be taken as an index of concurrent validity of the scale.

## Findings

Out-of-school science experiences was analysed at three levels–(1) total out-of-school science experiences, (2) out-of-school science experiences in the three fields of science, viz. biology, physics and chemistry and (3) four categories of out-

of-school science experiences in each field, viz. Observation, Collection, Activity and Experimentation. Interest in science was analysed in two levels–(1) total interest in science and (2) interest in the three fields of science, viz. biology, physics and chemistry.

### Extent of out-of-school science experiences

Out-of-school science experience of upper primary pupils was found to be moderate in nature (M=1.27; Extent=63%) with pupils deriving comparatively more experience from biology (M=1.38; Extent=69%) than from physics (M=1.24; Extent=62%) and chemistry (M=1.22; Extent=61%). Pupils derived more biology experiences from collection (M=1.51; Extent=76%) and less from observation (M=1.22; Extent=61%). In the case of physics, observation (M=1.29; Extent=65%) contributed more to out-of-school experience and experimentation (M=1.15; Extent=57%) contributed the least. Similarly, in chemistry too pupils conducted more observation (M=1.35; Extent=65%) and less experimentation (M=1.01; Extent=51%).

### Extent of interest in science

Upper primary pupils had relatively high interest in learning various topics in their science curriculum (M=1.50; Extent=75%) with biology (M=1.53; Extent=77%) Physics (M=1.53; Extent=77%) is comparatively more interesting than chemistry (M=1.49; Extent=75%).

### Gender difference in out-of-school science experiences and interest in science

Table 1 presents gender-based comparison of out-of-school science experiences and out-of-school experiences in biology, physics and chemistry.

TABLE 1

**Details of Test of Significance of Difference between Girls and Boys in Mean Scores of out-of-school science (OSSE), biology (OSBE), physics (OSPE) and chemistry (OSCE) related experiences**

| *Variable* | *Girls (N=653)* | | *Boys (N=808)* | | *t* |
|---|---|---|---|---|---|
| | $M_1$ | $SD_1$ | $M_2$ | $SD_2$ | |
| OSSE | 1.27 | 0.25 | 1.30 | 0.25 | -2.99** |
| OSBE | 1.38 | 0.26 | 1.37 | 0.27 | 0.49 |
| OSPE | 1.21 | 0.30 | 1.27 | 0.29 | -5.98** |
| OSCE | 1.23 | 0.33 | 1.22 | 0.34 | 0.58 |

Note: **Significant at 0.01 level

Significant gender difference existed in the extent of out-of-school science experiences (CR = -2.99, p<.01) with boys having more experience than girls did (Table 1). Out-of-school physics experience was more for boys (CR = -5.98, p<.01) while the extent of out-of-school biology experiences (CR = 0.49, p>.05) and out-of-school chemistry experiences (CR = 0.11, p>.05), exhibits no gender difference.

Boys have significantly more experience in biology activity (M boys=1.31; M girls=1.26; % of difference = 2.5; CR = -2.56, p<.05), physics observation (M boys=1.31; M girls=1.26; % of difference = 2.5; CR = -2.67, p<.01), physics activity (M boys=1.30;

M girls=1.17; % of difference = 6.5; CR = -7.86, p<.01), physics experimentation (M boys=1.19; M girls=1.07; % of difference = 6; CR = -6.21, p<.01) and chemistry collection (M boys=1.25; M girls=1.11; % of difference = 7; CR = -4.70, p< 0.01). Girls had higher extent of biology collection (M girls=1.54; M boys=1.49; % of difference = 2.5; CR = 2.41, p<.05), physics collection (M girls=1.33; M boys=1.27; % of difference = 3; CR = 2.05, p<.05), chemistry observation (M girls=1.40; M boys=1.30; % of difference = 5; CR = 5.66, p<.01), and chemistry activity (M girls=1.37; M boys=1.31; % of difference = 3; CR = 2.18, p<.05).

Table 2 presents Gender-based comparison of interest in science in the three fields of science.

TABLE 2

**Details of Test of Significance of Difference in Mean Scores of interest in science (IS), biology (IB), physics (IP) and chemistry (IC) between Girls and Boys**

| *Variable* | *Girls (N=653)* | | *Boys (N=808)* | | *t* |
|---|---|---|---|---|---|
| | $M_1$ | $SD_1$ | $M_2$ | $SD_2$ | |
| IS | 1.53 | 0.30 | 1.51 | 0.30 | 2.00* |
| IB | 1.55 | 0.31 | 1.50 | 0.31 | 3.08** |
| IP | 1.50 | 0.38 | 1.55 | 0.34 | -2.70** |
| IC | 1.53 | 0.36 | 1.46 | 0.37 | 3.34** |

Note: *Significant at .05 level
**Significant at 0.01 level

Girls showed more interest in science than boys did (CR= 2.00, p<.05) (Table 2). Higher interest of girls in science was mainly due to their higher extent of interest in biology (CR = 3.08, p< 0.01) and chemistry (CR= 3.34, p< 0.01) where as in physics boys showed more interest than girls do (CR= -2.70, p<0.01).

**Locality-based difference in out-of-school science experiences and interest in science**

Table 3 presents comparison of out-of-school experiences in biology, physics and chemistry between urban and rural pupils.

TABLE 3

**Details of Test of Significance of Difference between Rural and Urban Pupils in Mean Scores of out-of-school science (OSSE), biology (OSBE), physics (OSPE) and chemistry (OSCE) related experiences**

| *Variable* | *Rural (N=1108)* | | *Urban (N=353)* | | *t* |
|---|---|---|---|---|---|
| | $M_1$ | $SD_1$ | $M_2$ | $SD_2$ | |
| OSSE | 1.27 | 0.24 | 1.33 | 0.28 | -2.98** |
| OSBE | 1.36 | 0.25 | 1.42 | 0.29 | -3.27** |
| OSPE | 1.22 | 0.29 | 1.30 | 0.31 | -3.48** |
| OSCE | 1.21 | 0.32 | 1.26 | 0.36 | -2.35* |

Note: *Significant at 0.05 level
**Significant at 0.01 level

In the extent of out-of-school science experiences, urban pupils had significantly higher score than rural pupils (CR = -2.98, p<.01) (Table 3). Urban pupils excelled rural pupils in the extent of out-of-school biology experiences (CR = -3.27, p<.01), out-of-school physics experiences (CR = -3.48, p<.01) and out-of-school chemistry experiences (CR = -2.35, p<.05).

Urban pupils had higher extent of biology observation (M urban=1.26;M rural=1.20; % of difference= 3; CR = -3.10, p<.01), biology activity (M urban=1.36; M rural=1.27; % of difference= 4.5; CR = -4.44, p<.01), biology experimentation (M urban=1.43; M rural=1.37; % of difference= 3; CR = -2.45, p<.05), physics observation (M urban=1.37;

M rural=1.26; % of difference= 5.5; CR = -5.39, p<.01), physics activity (M urban=1.29; M rural=1.23; % of difference= 3; CR = -3.16, p<.01), physics experimentation (M urban=1.20; M rural=1.12; % of difference= 4; CR = -3.39, p<.01), chemistry collection ( M urban=1.25; M rural=1.17; % of difference= 4; CR= -2.25, p< 0.05) and chemistry experimentation (M urban=1.09; M rural=0.99; % of difference= 5; CR = -4.03, p<.01).

Table 4 presents locality-based comparison of interest in science in the three fields of science.

TABLE 4

**Details of Test of Significance of Difference in Mean Scores of interest in science (IS), biology (IB), physics (IP) and chemistry (IC) between Rural and Urban Pupils**

| *Variable* | *Rural (N=1108)* | | *Urban (N=353)* | | *t* |
|---|---|---|---|---|---|
| | $M_1$ | $SD_1$ | $M_2$ | $SD_2$ | |
| IS | 1.50 | 0.31 | 1.58 | 0.27 | -4.00** |
| IB | 1.51 | 0.32 | 1.58 | 0.28 | -3.82** |
| IP | 1.51 | 0.37 | 1.60 | 0.31 | -4.42** |
| IC | 1.47 | 0.37 | 1.54 | 0.35 | -3.05** |

Note: **Significant at 0.01 level

Urban pupils are more interested in science than rural pupils are (CR= -4.00, p<.01) (Table 4). Urban pupils showed more interest in all the three fields of science viz., biology (CR= -3.82, p<.01), physics (CR= -4.42, p<.01) and chemistry (CR= -3.05, p<.01).

### Correlation between out-of-school science experiences and interest in science

Out-of-school science experience had positive and substantial correlation with interest in science (r =0.46, p<0.01). Positive and substantial correlation is evident between out-of-school biology experiences and interest in biology (r =0.44, p<0.01) while the relationship is positive but low between out-of-school physics experiences and interest in physics (r =0.35, p<0.01) and out-of-school chemistry experience and interest in chemistry (r =0.29, p<0.01). None of the categories of out-of-school science experiences had substantial correlation with interest in science, coefficients of correlation ranging between r = 0.16, p<.05 and r = 0.35, p<.01.

### Discussion

Extent of out-of-school science experiences is moderate with pupils deriving more experience from biology than from chemistry with physics experiences in between. It is quite strange that pupils derived the least biology experience through observation. Theoretically, one can get lot of biological experiences through observation. Nevertheless, active nature of young children may not let them remain satisfied with observation alone, which is a passive process. The least amount of physics experience is from experimentation indicating that children derive more experience from vicarious sources than from direct ones. Boys have more out-of-school experiences in physics and girls in chemistry. This finding is similar to those from other parts of the world (Farenga & Joyce, 1997; Sjoberg, 2000; Christidou, 2006). Generally, boys, compared to girls, indulge more in activity and girls, compared to boys, indulge more in collection. Science is doing; hence, boys

who indulge more in activities will naturally have higher extent of experience in science. Urban pupils excel rural pupils in out-of-school science experiences.

Interest in science is relatively high with biology and physics being more interesting than chemistry. Study conducted abroad (Borrows, 2004) also shows lesser preference for chemistry among pupils. The extent of interest in science is more for girls, owing mainly due to their higher interest in biology and chemistry. Increased interest of girls in biology corroborated by other researches as well (Gardner, 1975; Sjoberg, 2000; Uitto et al, 2006) is related to girls' higher interest in people and life oriented aspects of science (Miller et al, 2006). The finding that boys are more interested in physics has support of previous researches (Tsabari & Yarden, 2005; Christidou, 2006). It may be that abstract concepts of physics appeal girls less (Tsabari & Yarden, 2005) and they have less experience in physics; experience has an influence on interest (Johnson, 1987; Sjoberg, 2000). Urban pupils are more interested in all the three fields of science than rural pupils suggesting societal influence on interest in science. In accordance with earlier studies (Joyce & Farenga, 1999; Uitto et al, 2006, Zoldozoa, 2006) this study reveals that Out-of-school science experiences have positive correlation with interest in science. The influence of experiences on interest is more in biology than in physics and chemistry.

**What the above findings imply for schools?**

One cannot do much to control out-of-school experiences, but knowing about what pupils bring to the classroom will help for providing better education. Knowledge of pupils' out-of-school experiences is invaluable as the present experiences are building blocks of the future experiences. Knowing students' experiences assists in providing those experiences that pupil lack, in choosing experiences that can result in optimum dissonance with existing experiences and in helping pupils to see the meaning and significance of life experience in what they learn at school.

Interest and attitude that one develops in the lower classes influence their future choices (Lloyd & Contreras, 1984). Identifying pupils' diverse interests helps to nurture those interests. Teaching needs to help children realise that chemistry is something that is going on all around and within us will help them see its significance. Pupils need to see that the very essence of biology rests on chemical reactions. This would help them appreciate the significance of chemistry in our lives. Schools cannot ignore the disparity in out-of-school experiences, as substantial positive correlation exists between out-of-school science experiences and interest in science. Girls have to be more accustomed to physics and made aware of the significance of physics, lest they remain behind in the modern techno-savvy world. Disparity between urban and rural schools can do nothing but contribute to the backwardness of rural pupils. Providing more computers and better lab facilities, supplemented with frequent educational excursions to places of scientific interest might be one-step in rural children getting more experience.

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