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Exploring Hybrid Spaces through An Informal Science Learning Programme

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Exploring Hybrid Spaces through An Informal Science Learning Programme

Sindhu Mathai



Abstract: *This paper explores the construction of hybrid spaces through the observation of middle school children engaged in short science projects in an informal science learning programme. Hybrid spaces are not just physical structures, but refer to contexts, relationships and knowledges developed by children as their social worlds and identities merge with the normative expectations of school science. Hybrid spaces have been characterised in three different ways: as a convergent space between academic and traditionally marginalised knowledges and discourses; as a navigational space, or a way of crossing and succeeding in different discourse communities; and as a space of cultural, social and epistemological change where competing knowledges and discourses challenge and reshape both academic and everyday knowledges. (Moje et al., 2004; Barton et al., 2008). This paper characterises such hybrid spaces by analysing activities of children working on short projects in the broad area of: 'Trees, plants and insects', during a summer camp held at the Azim Premji University. Children seemed to primarily use the 'third space' to navigate between different funds of knowledge and succeed in science. They developed science artefacts such as scrapbooks and a children's magazine, and negotiated new roles for participating and expressing their developing science identities. They also brought in local knowledge and activities from their home contexts such as gardening, cooking and socialisation with members of their own and wider community. Informal settings help in the negotiation, construction and development of these hybrid spaces, and is particularly meaningful for children who otherwise see science as being alien and outside their everyday lives. Children brought different funds of knowledge into their participation and discussions from both their formal and informal experiences linked to science. Children decided their own trajectory of learning experiences in consultation with the facilitator. This paper also describes various possibilities in informal settings and learning experiences within and outside formal school settings, which help children explore and engage more deeply with their developing interests in science.*

Keywords: *Hybrid Spaces, Informal Settings, Identity Construction in Science, Funds of Knowledge*

Exploring Hybrid Spaces through An Informal Science Learning Programme¹

Sindhu Mathai

1. Rationale and context

This study explored children's construction of hybrid spaces, merging their social worlds with their interests in science through an informal science learning programme. The study took the form of a short summer camp in April 2016. It was conceptualised at the Azim Premji University, Bengaluru by a group of four members, who had experience in science education. The study, spread over a month, included a total of twelve three-hour sessions in the 'Learning Resource Centre' of the University, which was similar to a 'lab' setting. Children came from a school in the vicinity of the University. The choice of using activities with children working on joint projects, drew from literature on situative perspectives on cognition. Meaning-making was studied through interaction of groups of children with activity. Situative perspectives recognise learning as a social process subsumed within communities of practice with children being 'legitimate peripheral participants' in ongoing social practice (Lave, 1991). This is opposed to traditional cognitive perspectives where localised interactions of individual children is emphasised (Megan, 2015). Situative perspectives consider learning to be a process of enculturation and becoming a member in a community of practitioners.

As Lave (1991: 64) describes:

Learning, it seems to me, is neither wholly subjective nor fully encompassed in social interaction, and it is not constituted separately from the social world (with its own structures and meanings) of which it is part. This recommends a decentered view of the locus and meaning of learning, in which learning is recognized as a social phenomenon constituted in the experienced, lived-in

1 Acknowledgements

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world, through legitimate peripheral participation in ongoing social practice; the process of changing knowledgeable skill is subsumed in processes of changing identity in and through membership in a community of practitioners; and mastery is an organizational, relational characteristic of communities of practice.

Lave further goes on to explain why this participation is likely to be peripheral rather than complete or whole because of current practices which separate 'knowledgeable skill' from an individual's developing identities. The difference in situative perspectives is to view cognition itself as an outcome of social processes rather than as an 'internal business' which will need to be reconceptualised in social terms.

This research could be categorised as broadly interpretivist. We attempted to understand how meaning-making is negotiated by children in an informal setting. The multiple identities that children come with into such learning experiences, play important roles in helping them become comfortable with the language of science, develop disciplinary knowledge, and negotiate decisions regarding possible career paths in science.

Some of the questions explored in this study were:

- How do children create new spaces for deeper engagement with science and what do these spaces look like?
- How do informal settings support the development of hybrid spaces?
- What are the different funds of knowledge that children bring from their school and informal learning experiences into science learning?

During the course of this study, I engaged as a participant observer using the following lenses: identity construction in children while engaging with, and learning science (Varelas, 2012); nature of informal spaces in teaching and learning science (Andersen and Ellenbogen, 2012); and hybridity theory conceptualising a 'third space' merging different funds of knowledge brought by students into science learning experiences and settings (Barton, 2008).

2. Perspectives on informal learning spaces and identity construction in science education

Informal learning spaces have been defined in two distinct ways: some researchers use the phrase to refer to learning that occurs across all types of informal learning environments outside formal schooling (Andersen and Ellenbogen, 2012). This includes spaces such as after-school programmes, clubs, museums, parks, zoos, aquariums and other outdoor learning spaces. It also includes learning within the community, in homes, playgrounds, and through informal peer interactions at school. These spaces and opportunities do not have a formal curriculum and are not explicitly designed, though they may be structured to some extent: for example by teachers, in the organisation

of exhibits such as in a museum, or the classification of experiences in a zoo. Another strand of researchers though, prefer to completely exclude all designed spaces (Andersen and Ellenbogen, 2012). In this study, we included the semi-structured, yet participant-centred, outside 'formal' school, science programme, within the category of informal learning. It was conceptualised as a space where students could decide their learning trajectory, within projects which are of interest to them with help from facilitators.

Identity construction within science educational settings is an area of increasing interest and concern among science educators and practitioners. Children and teachers bring with them multiple identities based on different roles assumed in their daily lives as members of a social group, region, gender, class, caste, previous science education experiences within and outside school, etc. These identities are continuously shaped, constructed and re-constructed as children encounter varied experiences in formal and informal educational settings, particularly in the middle school years, or the early adolescent period. The construction of these identities shape how children perceive themselves in relation to science. For instance a child may think that she is not suited to engage with or take up a career in science since the expectation is one of discipline, order, being 'academic', etc. Another child may not see the relevance of engaging with science since the harshness of living under difficult circumstances such as poverty render such experiences meaningless. Also, the absence of role models within the community, may also contribute to a different relationship between a child and science. Studying this 'science identity' and its construction may lead to a deeper understanding of the learner, and develop a relational sense of the teaching and learning of science (Varelas, 2012). Barton (2008) and colleagues' conceptualisation of after-school, informal learning programmes as welcoming learning spaces, ruptures traditional expectations of formal schooling by foregrounding the agency of learners. Gutiérrez and Barton (2015) who worked with students from disadvantaged backgrounds in terms of race and class, describe such an environment created for students for 'tinkering' with different kinds of material, both 'everyday and technical', without using the formal vocabulary of science concepts. For example, they describe how a little girl found a meaningful project in creating a pillow which lights up for her little sister to play with. The project involved working with science concepts while at the same time facilitating conversations beyond science in a context that was relevant for children crossing into borders and sub-cultures seemingly alien to their social worlds and identities.

Similarly, Barton (1997) while describing feminist critiques of science, writes about her discomfort in dealing with science topics such as 'quantum mechanics' in traditional, formal settings which did not value how *she* engaged with the approach to learning. She draws upon the history of science to illustrate how the vocabulary used to understand and communicate science, and a predominantly reductionist approach at work were artefacts of a historical period constructed by the natural philosophers in Europe. Formal educational settings often failed to acknowledge the role of these dominant groups and ideologies in nurturing and shaping science, and the need to enculturate students into the associated language and conventions. She describes how understanding feminist

critiques of science which looked carefully at the gendered language, alternative approaches to choice of organism with which to work (in biology), and greater engagement with the subject of study or a 'feeling for the organism', helped her understand internal conflicts in engaging with science content. *A feeling for the organism* (Keller, 1984) is a book written by Evelyn Fox Keller on the life and work of maize geneticist Barbara McClintock. McClintock used situative approaches to study her plants of interest, quite unlike the distanced, 'objective' approach used by other scientists in the 1930s. She believed that the researcher needed to patiently observe and understand every organism, and know how each was different in order to study it meaningfully. Further, the positionality of teachers and students in mainstream science classrooms, often leads students to view 'science and teachers, not themselves, as the authors of their own experiences'. In this context it is interesting to look at how students make sense of science through different funds of knowledge: as it is interpreted and presented in formal science classrooms, the knowledges and discourses they bring from their homes, communities, popular media, various experiences with links to science as well as to their sense of self (Moje, 2004).

3. Characterisation of hybrid spaces

'Hybrid' or 'third' spaces are created in the science classroom, typically by students, who find social norms and rules imposed in the classroom as being alien to their identities and social worlds (Barton, 2008). The first space may consist of people's homes, communities and peer networks, and the second may comprise the space of formal institutions such as the school, workplace, etc. The third space merges the two. The notion of third space is framed by hybridity theory which states that people in any community draw upon multiple resources or funds to make sense of the world. (Bhabha, 1994). Hybridity theory also examines how being in between several different funds and resources can be both productive as well as constraining to one's continuous identity construction.

The notion of hybridity can thus apply to the integration of competing knowledges and discourses; to the texts one reads and writes; to the spaces, contexts and relationships one encounters; and even to a person's identity enactments and sense of self. Hybridity theory connects in important ways to third space, because third spaces are hybrid spaces that bring together any or all of the constructs given above (Moje et al., 2004: 42).

Educational discourses on identity (Gutiérrez et al., 1999) view the third space as a hybrid construction which serves as a bridge between community and home, while helping students move through or be scaffolded towards a deeper understanding of academic or school-based knowledges.

Postcolonial perspectives on third space imagine the new space as being normal, in terms of people resisting cultural authority through language by challenging notions of fixity. The same signs could be signifiers for divergent and independently valid interpretations. Language in school texts maybe looked at as hegemonic in projecting certain symbols and meanings. Students and teachers while comprehending this text must go through their own internal struggles or ways of navigating around

them or between different discourse communities. Outcomes of such struggles however could be liberating, leading to different constructions of identity and self. At the secondary school level this may include navigating between different disciplinary knowledges and conventions. Pedagogically it involves bringing children's everyday funds of knowledge into the classroom in order to navigate and strengthen conceptual understanding.

Soja (1996) demands looking beyond binary categories of school and community to imagine a new space: of other ways of being and knowing not captured by the first and second spaces. Soja further emphasises the spatial sense in this constructed physical and social space. This may reconceptualise human interactions: in the manner in which technology has percolated into our daily living, our relationships with the environment, and ways of making sense of and intervening in larger issues such as poverty, migration, etc.

In sum, the three discourses on third space include: a convergent space or 'bridge' between academic and traditionally marginalised knowledges and discourses; a 'navigational' space, or a way of crossing borders and succeeding in different discourse communities; and as a space of 'cultural, social and epistemological change' where competing knowledges and discourses challenge and reshape both academic and everyday knowledge (Moje et al., 2004; Barton et al., 2008).

Below is a representation of the conceptual framework described:

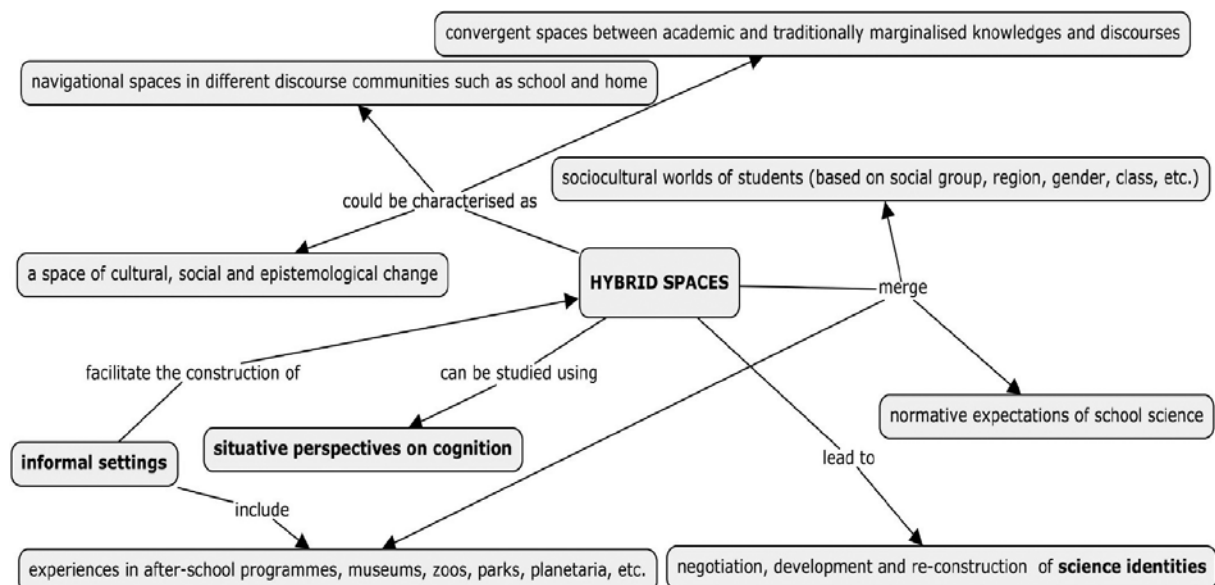


Figure 1: Conceptual framework for the study

4. Context of the school

Children who participated in this study came from a school whose management and teachers shared a good relationship with Azim Premji University. This was because they were our 'practicum' school as well: a school to which graduate students of our M.A. Education programme go to for their weekly practicum experiences associated with coursework. Below is a short description of the school from my field notes:

The road leading to the school is dotted with small shops: outlets selling groceries and stationary, besides tailors, bakeries, etc. However, it seemed quite laid-back and sleepy quite early in the morning, when everywhere else there was peak-hour traffic, noise and overwhelming confusion. From classroom observations, I understood that pedagogic practices emphasised concepts from the textbook. However, from other observations, students seemed to share an amiable relationship with teachers: talking in corridors about events at home, though this was not immediately apparent when classes were in progress. Over several short conversations with the secretary, I came to know that the school catered mostly to students from a lower socio-economic background. Students who were considered to be academically good were given special attention by the management. They were always looking out to see which interested students could be placed in or given opportunities. Considering that the tenth standard board examinations were important for their projected value in the community, they provided special attention and care to students at the school-leaving stage as well. They were welcoming when we first discussed the idea of a summer camp in April, and were also glad to know that this camp was being held only for their students... (Field notes, 5th April 2016)

5. Observations and analyses

In the following sections, I will present my observations and analyses in the form of a narrative with some emergent themes, through the interpretive framework outlined earlier. These will be primarily descriptive, making liberal use of extracts from my field notes as well as students' work through photographs. The choice of narrative is deliberate, in order to bring out the richness of students' engagement.

As a participant observer, I interacted with children in multiple settings: at school, while travelling with them, in the lab and in the Azim Premji University campus. In this process I kept field notes throughout the camp, took photographs, and interviewed children. Hybrid spaces were explored and described by analysing particular events in the course of the summer camp and overlaying this with contextual information, discussing these with three other facilitators involved with other thematic groups, and reflecting about individual students while they were engaged with activities.

In addition, there were other sources: children's journals, observation sheets, scrapbooks, children's interviews, video recordings of some of the sessions, and photographs of children's work. The children maintained a journal throughout the course of the twelve sessions, right from the first day of the camp. They were asked to write down their learnings, thoughts and reflections using some questions as prompts. These were: 'What did I like today? What did I not like about today? What did I learn today? What would I like to do better?' and 'Any further comments and thoughts?' In addition to this, students also used the journal to record their observations as part of their chosen projects. Three months after the camp, students were once again interviewed on their thoughts about going back to school, topics they had engaged with, memories of their camp, and their own identities in relation to their engagement with science.

Every morning of the twelve-session long summer camp, I walked up to school from the adjacent main road near the school, to pick up children and bring them to Azim Premji University in a bus. I was often the first to reach school. It was vacation time, but a lot of activity was going on. Teachers regularly came in to complete various responsibilities. In the first week of April 2016 (at the start of the camp), it was to get the annual examination results in place and announce it quite prominently on a decorated notice board. After this, it was time for the end-of-term parent-teacher meetings. The children were also enthusiastically involved in organising their student 'files' for these meetings. They seemed quite used to this ritual of having their results announced publicly. All of them seemed confident of doing well, and did not seem particularly perturbed or anxious on the day of the results. Their non-competitiveness was a pleasant surprise to me. The group of twenty children (who participated in the camp), shared a spirit of openness, and were conversing happily in Kannada. All of them seemed to have a shared culture even though they came from different South Indian states. There were of course clear lines drawn by the school management: groups were often all girls or all boys, and often of the same age. This segregation seemed to be perceived as an unwritten rule to be followed at school. Otherwise, girls and boys were quite open to talking to each other. There were some differences in discussion as well, that were quite apparent. The boys typically discussed cricket matches, 'aliens', etc. The girls, on the other hand, were often heard playfully teasing each other about happenings at home, discussing hair styles, festivals, trips outside, movies watched, and puberty. Kannada movies on TV and popular Hollywood films were a topic of common interest for girls and boys.

6. Structure of learning experiences in the informal spaces

On the first two days of the camp, the facilitators asked children to articulate their interests in science and choose broad areas. The areas were largely those they had encountered in school and in their textbooks. We made a final list of groups based on which students would work with concerned facilitators. The four groups which finally emerged were: 'Human body', 'Trees, plants and insects', 'Space Research' and 'Chemical reactions'. One facilitator attended primarily to each group, based on his / her familiarity with the topic.

In this paper I will be focusing primarily on the interactions and activities taken up with five children, all girls, who had chosen the topic 'Trees, plants and insects'. I was the primary facilitator of their learning experiences. In some cases, observations of children from the entire group will be mentioned. Facilitators for the other groups, discussed and shared notes on their experiences and also provided suggestions during weekly meetings. Towards the end of this paper, I will describe some themes on informal learning spaces which emerged from observations across the four different groups.

In the initial days of the camp, children in the 'Trees...' group explored trees, plants and insects in the Azim Premji University campus. I supervised them while they made forays into several unexplored areas on campus and observed a variety of trees, plants and insects (Figure 5). By the third day, I

divided them into two smaller groups: 'Insects' and 'Trees', based on their interests. I also handed each group two separate worksheets for making observations on specific insects and trees. The tree observation sheet was adapted from the structure of expected observations in the 'SeasonWatch' programme (SeasonWatch, 2016). Children had to make observations on the different parts of the tree (leaves, flowers and fruits), note the developmental stage of each (leaves: fresh / mature; flowers: bud open; fruits: ripe / unripe, etc.) as well as any animals (insects, birds, etc.) on the tree showing any particular behaviour (feeding, walking, etc.). They noted down the number of leaves, flowers, etc. using broad qualitative phrases and words such as: none, few, many, etc. Terms such as simple and compound leaves, arrangement of leaves on a stem / branch, different developmental stages, etc. was explained to the children. They also made some collections from their explorations such as seeds, leaves, flowers and dead insects (though they were told to collect only dead insects, some of them brought back live insects too), which they put into little boxes and took to the lab.

On the fifth day, I helped tabulate the overall observations of students on the board and documented the diversity, richness and some qualitative characteristics of insects and trees that they had observed. We were able to identify some of them, and tried to look up others using available books and material from the internet. We plotted a few graphs based on the observations made (Figure 2). A couple of students who had just completed Grade Six, were new to understanding and making graphs, and took help from their older peers. We drew graphs to depict insect diversity on campus as well as different developmental stages of trees and plants. We tried to understand insect diversity by noting down the types and numbers of insects under each taxonomic Order. Children were curious to understand the differences between different Orders and correlate this information with their observations. Often it was struggle to make an exact correspondence between the description of the Order and observations, because of difficulty in recording observations of moving insects. Some collected insects (for e.g. honeybee), were easier to observe and identify.

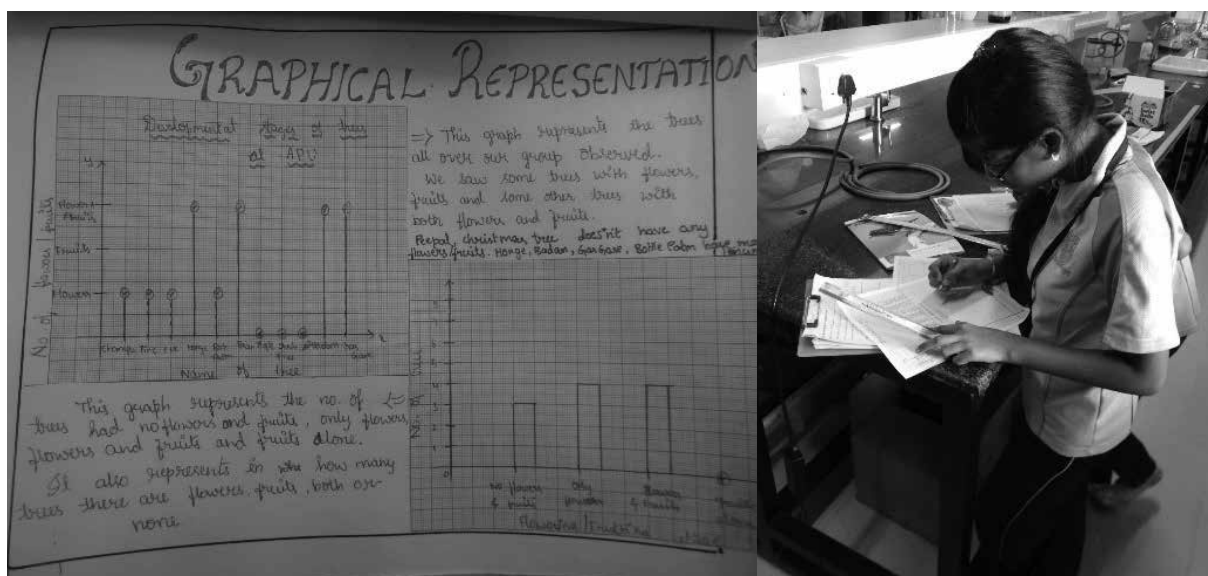


Figure 2: Left: Graphical representation made by a student and used in her scrap book; Right: Another student diligently making graphs.

Children had brought along some chart paper from home, which they used for making a 'scrap book'. I asked them to write up their observations too from their worksheets, and stick any sample leaves, flowers, fruits and dead insects that they had managed to collect. They worked on their scrap books after putting together as much information about their identified trees and plants as they could, and decided to complete any remaining at home over the following weekend (Figure 3).

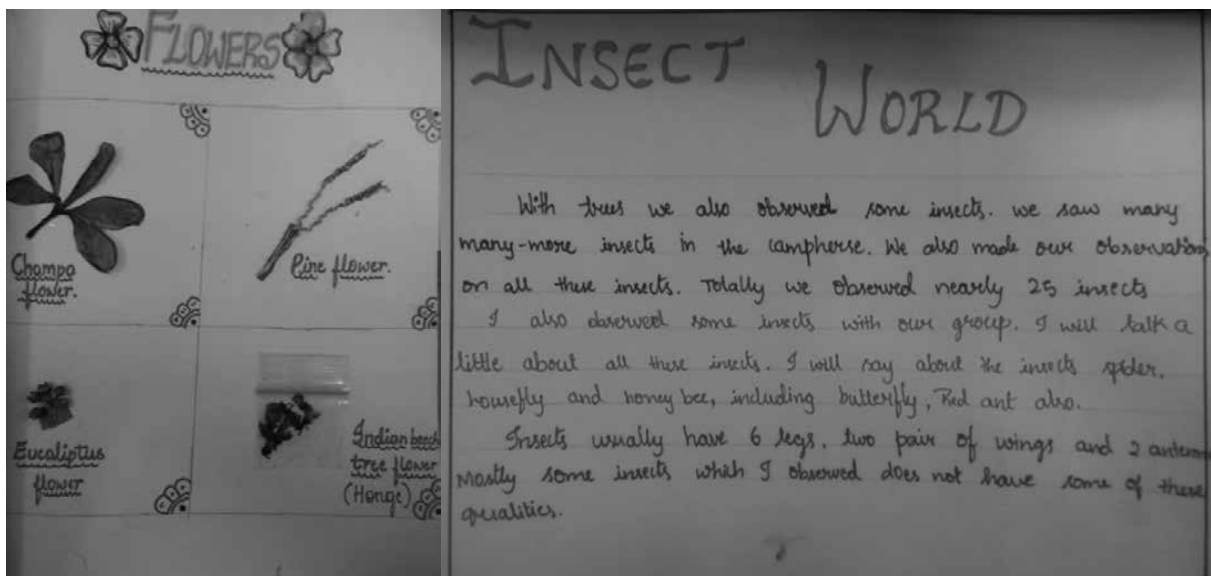


Figure 3: Scrap book representations and descriptions of flowers and insects by two different children.

We also read the popular children's book 'A Very Hungry Caterpillar' by Eric Carle (1969), which brought out different stages in the life cycle of a butterfly through a simple story. After this, children reviewed what had been done so far in the camp. One of them suggested that we sow some seeds and watch them germinate and grow. They wanted to bring some seeds from home, grow them in little containers and document their growth. Accordingly, I brought some compost and a few seeds from home along with little containers for growing. I asked each of them to make observations about the seeds they were growing using a gardening observation sheet. They made these observations in the lab. We settled down to discuss the kinds of seeds we were growing. (Figure 4).



Figure 4: Left: Seeds brought and grown by children; Right: germination of bean seeds.

I had also suggested that they ask questions to their parents, grandparents, neighbours and friends on the food plants they were growing. Since there is quite a diversity in faculty and staff members at Azim Premji University with representation from different Indian states, I suggested that children also interview those who were present on the day of our discussion. I took them around the building and cubicles, and they interviewed a few people representing different states of the country. Children were happy to see differences in the way seeds and associated food preparations were used across different states, and we tabulated these observations.



Figure 5: Children engaging with plants, trees and insects in multiple ways on the Azim Premji University campus.

By the ninth day of the camp we were wondering if we could come up with a 'Children's Magazine' as a way of documenting their learnings different from the scrap book. They were surprised when I suggested that they could include little stories, anecdotes, jokes, puzzles, art work and whatever they found interesting and relevant for the magazine. The next day they came back from home carrying a lot of art work with them. They were happy to talk about them and also share it with their friends. The previous week they had observed M.A. Education students at Azim Premji University engaging with an 'art mela' on campus, and had seen them making vegetable prints on paper. They too wanted to do some art work related to vegetable prints for the Children's Magazine. So I brought some vegetables from home, such as lady's finger and potato, and they cut them and made prints on different kinds of drawn outlines such as pots and flowers. We also wanted to get a sense of the interviews each of them had done with faculty and staff at Azim Premji University regarding the food plants. So three of the girls wrote up two interviews in detail that we then put into the children's magazine. They also documented other aspects / work done in this project, such as their gardening observations. I took photographs of their artwork and put them together for the Children's Magazine (Figure 6).

Creative Corner!



We had fun expressing ourselves, doing craft, writing stories and making vegetable prints to complete our four week engagement!

Figure 6: Extract from the Children's magazine depicting artwork done by children

On the last day, all children across groups made presentations of their work to their peers and other facilitators. A couple of them volunteered to make 'ragi mudhe': a traditional dish that was relatively easy to make considering the ingredients and time taken. One other facilitator and I brought the required ingredients from home: ragi flour, sambar, induction cooker and vessels. Of course the glassware in the lab came in handy for serving and scraping!

In the following short sections, I will be drawing from previous literature characterising hybrid spaces (Moje et al., 2004), as well as categories of examples outlined in Barton et al. (2008), which described urban middle school girls engaged with science practices at school. There is further discussion of these practices in Section 8.2.

7. Characterising hybrid spaces

7.1. A convergent space between academic and traditionally marginalised knowledges and discourses

The topic of 'Trees, Plants and Insects' along with children's investigation on the Azim Premji University campus, lent itself well to the project. Children brought in their local knowledge into



Figure 7: Observations on the Gasa Gase tree in a child's scrapbook

observations and discussions to build connections between different developmental stages, arrangement of leaves on the stem that they observed, and categories used for classification. While making observations and identifying trees and plants on campus, all of them recalled names and attributes of local trees such as Honge (*Pongamia pinnata*, Indian beech tree) and Gasa (*Muntungia calabura*, Singapore cherry; Figure 7). Children kept talking

together and repeatedly interrupting to offer what they knew. They told me that the fruits of the Gasa Gase tree were edible, and spoke of the visual characteristics which signified that the fruits were ready to be picked. When I tried to eat a greenish, unripe fruit, they stopped me, and asked me to eat the ripe, red one instead, describing its mild sweet taste after ripening. They also recounted games played with these fruits in their neighbourhood. When the characteristics of trees and scientific names were discussed and written about in the scrap book, they were happy to include these observations as well as to highlight the local, familiar name.

They brought multiple events happening at the time in Bengaluru into the classroom (such as garment workers' protests and striking work over a Government notification related to monetary benefits). While waiting at the school on one of the mornings, we found a dead python in a nearby drain, beaten to death recently perhaps with a bottle (Figure 8). While spotting the snake was interesting for all children, identifying the python and connecting its appearance to the popular movie-inspired snake, Anaconda, seemed to be a 'scientific' objective, consonant with the theme of the summer camp.



Figure 8: The dead python in a drain

7.2. Navigational space, or a way of crossing and succeeding in different discourse communities

Children were constantly grappling with terms encountered in biological classification as well as their own interests in collecting samples of flowers, leaves and dead insects. They looked at collecting insects as a fun-filled process, describing watching insects “like following small children” referring to the difficulty in observing moving insects compared to making observations of trees and plants. Other descriptions in worksheets included “the ragi plant is grown very beautifully in one corner”; “One branch of dry leaves are fallen down”, “ants are walking,” “we can see the roots...”, “the tree looks very nice”, etc.

7.2.1. Creating science artefacts

Such personal descriptions and characterisations were part of observations recorded in the

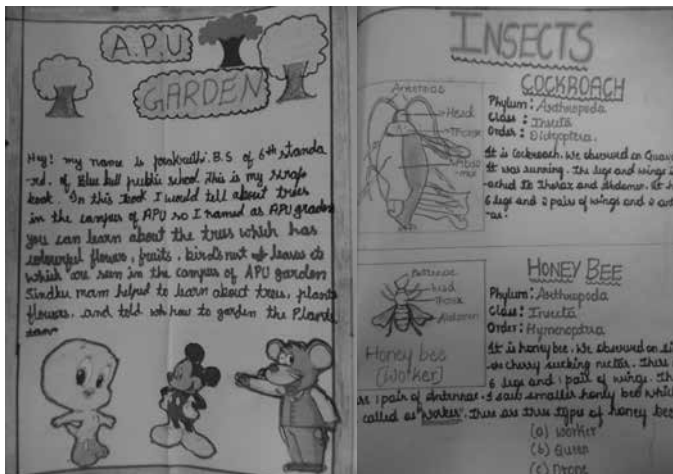


Figure 9: Extracts from children's scrap books

‘science artefacts’ they made: scrapbooks and the various contributions for the ‘Children’s Magazine’. These artefacts merged their interests in making / crafting objects both at school and for recreation. On the first day of camp, they had shared craft-making as an interest, when asked to describe their interests other than science.

Scrapbooks: Scrapbooks were titled, described and styled in multiple ways,

with one student describing it as a ‘wondering book’, and another titling it ‘Azim Premji University garden’ with use of popular cartoon characters to introduce content (Figure 9 (left)).

Children’s magazine: Putting together a children’s magazine allowed them to engage with craft, art-work and poems, which they were unsure about including in ‘science’. Some of them guardedly asked if art-work which involved vegetable prints, paintings featuring plants and trees, as well as recipes involving the food plants they had grown would count as ‘science’. When assured that it

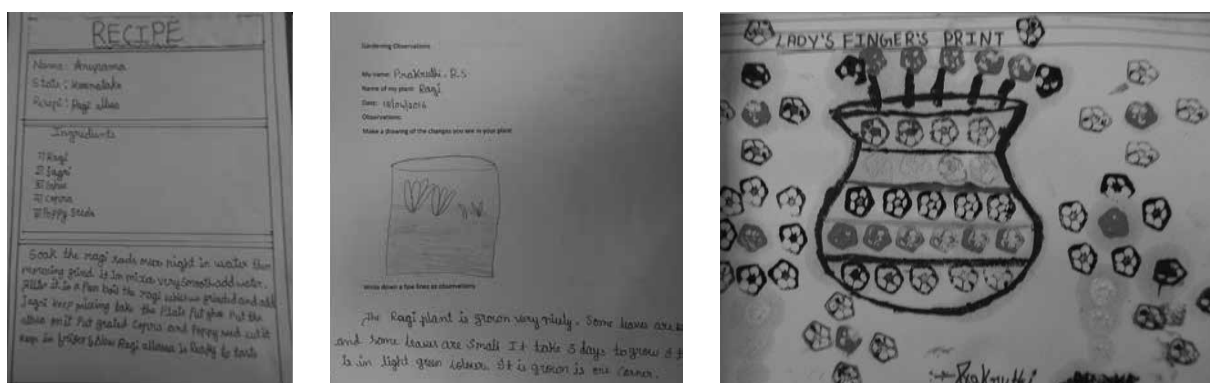


Figure 10: Extracts from children's contributions to the children's magazine

would count, they put together various paintings and craft (which were photographed and used), as well as tabulations and descriptions conveying a sense of the work they had done through the camp (Figure 10). While including these under 'science' could have involved a detailed discussion, the moment, as well as children's enthusiasm seemed to take away from the need to justify inclusion of this work. On later reflection, I felt that there was an opportunity to include this discussion on the nature of science, also to see how receptive they were and to listen to their views. Perhaps this could be taken up when there is another such programme!

7.2.1. Playing with different science identities

Outdoor explorations: While the typical 'good' science student is often portrayed as conformist, and the school classroom space as one that constrains movement, the children were clear about wanting to explore the Azim Premji University campus from the first day. They saw this "freedom to move" both within the lab and outside on campus, as a clear departure from their school science experiences. They repeatedly expressed satisfaction in being able to "discover new things", while also indicating unhappiness when asked to "sit in a place" to tabulate observations. The charm of the outdoors was an important criterion for some of them to choose this group. They looked at the informal space as a place that would be enriching in ways quite different from the classroom. This had perhaps been indicated by the school management as well, in their conversations with the students prior to the camp.

7.2.2. Negotiating new roles for participation

Collecting insects: Negotiating new roles was evident particularly in the cases of Ramya and Shambhavi². They were clear about what they expected and demanded it to the extent they could. While they were in the same grade, and were also good friends, they were constantly negotiating roles for themselves in the context of work to be done. Ramya who seemed quite worried about being outdone by Shambhavi, made it clear that she liked following insects and observing them, unlike Shambhavi who expressed her displeasure with insects from the outset. Ramya enjoyed observing and documenting the insects taking meticulous care with the drawings as she observed them. This seemed to help her negotiate a new space in the classroom with her friends. Shambhavi however preferred to draw diagrams which were similar to those in the textbook. While Shambhavi had failed to take care of her germinating plant, Ramya lovingly nurtured her bean plant and watched its dramatic dicot germination.

Below are extracts from my field notes at the end of the camp on these two students while describing how they went about what they were interested in:

2 All children's names used in the body of the paper are pseudonyms. There are possibilities that identities may become apparent in a few photographs. However attempts have been made to depict these pictures as meaningful exemplars rather than portray them in a negative manner.

Shambhavi was a strong support to the group: having stayed through the entire camp from the beginning, not missing a single day, and also supporting her friends with help as well as questions whenever required. Being one of the older students of the group (moving from Class 8 to 9), only seemed to help further. She was also very sure about what she wanted to do, made sure there was tangible personal progress on each day of the camp, was quick to comply as well as to make her dissatisfaction felt, and was always the first to volunteer for any activity. She saw herself as being different from the group, in her quickness with answers; making sure the interviews she did with members at Azim Premji University were thorough and engaged; and ensuring she had questions up her sleeve always both for herself as well as for her friends. While she was passionate about the work she did, she also vividly shared personal experiences each day. She recounted the birth of her baby cousin a few days after the camp began, and how she visited her aunt's house (in the same area) every day to spend time with the baby. She was quick to complete her scrap-book requirement and did it remarkably well; checking details such as anatomical features of insects with her sister who was doing her Pre-University course with Zoology as a subject. Shambhavi's contribution to the children's magazine was substantial. She was clear that she enjoyed new experiences such as interviewing people, and making observations. At the same time she was not happy when I interrupted a co-facilitator in one of the sharing sessions, and about collecting dead insects. She refrained from sticking any actual specimens of insects in her scrapbook, though she more than made it up with her detailed observations and drawings. In the interview done towards the end of the camp, she indicated that she would like to explore other areas in science. She was already trying to learn as much as possible during the camp, by moving over to others' groups and observing and asking the facilitators questions. She was also the first to kick-start the presentations on the last day of the camp when there was a shy silence from the group. She was not happy making observations on her gardening plants, finding it relatively boring and tedious work. Her week-end trips outside home to see her little cousin, meant that the plants were not well-cared for, and hence died rather quickly. She was however keen to follow the discussions on germination and the differences between monocots and dicots, interested in the terminology and possible links to what may follow later at school.

Ramya had a clear sense of self and expressed it. She was happy to be quiet in a group, and not participate in Antakshari (a musical game which involved selecting and singing appropriate film songs based on phonetics) on the way back home from the camp. "I don't like this sound" she used to say, and kept wondering about how she could bring a 'personal' element into a scrapbook on plants, the way I had been exhorting them to. She was initially very quiet, happy to make a few observations without too much detail, and happy to catch insects, following them and trapping them through maze-like paths. What came out quite uniquely about her scrapbook was her close attention to insect collection and her careful method of packaging them in neat little zip locks and plastic containers. None of the other students had paid this much careful attention to collecting insects. Mid-way through the camp, Ramya, who was also one of the senior children

in the group, moving from 8th to 9th Std., was challenging Shambhavi, her classmate. She tried to correct Shambhavi's mistakes, and made sure her voice was heard, when Shambhavi couldn't be stopped from working and volunteering. Ramya also made some interesting observations and remarks on the food grains we were growing. She maintained her interest in the bean plant that she was growing, which made a spectacular germination even in the small container in which it was being grown. She made careful observations and did not express unhappiness with making repeated observations unlike the other children. Towards the end of the camp, when I had asked for contributions to the magazine, Ramya tried to come up with puzzles: different from the artwork brought by others. She was also happy to document class discussions on the germinating seeds for the magazine. Ramya's parents have lived in Bangalore for several years, having originally come from Wayanad in Kerala. She was however reluctant to reveal this to her friends (her friends expressed surprise when she told me she came from Kerala) (Field notes, 28th April 2016).

Keeping the herbarium samples fresh: While making the scrap book demanded that leaves and flowers were dried before pasting, Sudha* was eager to stick the samples fresh: making sure she replaced her dried samples on the day of presentation with fresh green leaves and bright white Champa flowers. The other children quickly followed. While there were conventions that children followed regarding tabulation of observations and making drawings, this was one convention that they saw as being pointless disrupting the colours they had observed and documented. The entire group followed this modified practice, though they did not overtly discuss it. There was a subtle expectation that the facilitator would not dismiss it or ask for it to be re-done.

7.3. Reshaping of academic and everyday knowledges through traditionally marginalised knowledges and discourses

Engaging with Gardening: The entire group decided to take up gardening and make meticulous observations of the growing plants. While thinking of appropriate seeds to use for gardening, children brought in their carefully chosen seeds from their home kitchens, after having discussed with their parents which ones would germinate “surely” and “quickly”. The seeds which were finally grown are indicated in the table below (Figure 11).

The excitement of watching seeds grow was coupled with the seemingly tedious, mundane routine of making descriptions, drawings, tables and graphs, to document observations. Though all children saw this process as being cumbersome, it helped them navigate through and succeed using science practices and conventions.

Engaging with Cooking: While growing these plants, and recording its uses seemed to be ‘science’ enough, two children from the ‘Chemistry’ group, took the initiative to make *ragi mudhe* on the last day of the camp. Others also became involved in the activity. (Figure 12). The children were surprised to know that the four facilitators had never eaten this dish, which most of them ate every day for dinner. There was camaraderie among the children while cooking. For the facilitators,

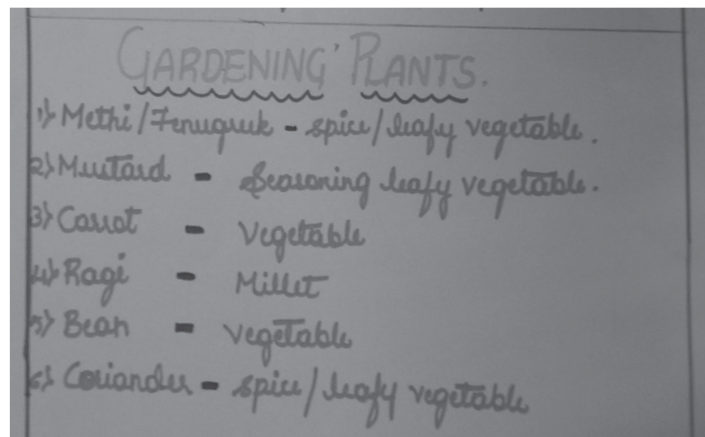


Figure 11: Categorisation of seeds grown by children

eating it was a novelty. Ragi mudhe is traditional cuisine that the facilitators struggled to eat the right way. It has to be swallowed after gentle rolling using the tongue alone without the use of teeth: something that perhaps we were not successful in doing.



Figure 12: Left: The ragi plant growing in the lab; Right: Ragi mudhe cooked and served by the children on the last day of the camp.

Interviewing the immediate and wider community:

While children tabulated their observations of plants and insects, and also looked at a few reference books to compile their scrapbooks, they were also excited about interviewing their parents, relatives and staff at Azim Premji University, on the plants they had grown.

They came up with questions which probed traditional uses of the plant (Figure 13), food preparations in different states, and medicinal properties, all of which contributed to their knowledge of these plants. They were surprised to find that ragi was not commonly used in the Northern states or even in Southern states other than Karnataka. Meanwhile other interesting observations included plants such as mustard having different uses in different regions, and the use of its particular parts.

INTERVIEW QUESTIONS		Mustard	Carrot	Ragi	Lohandeh	Beans
1) How is this vegetable/spice/millet used in your home? (in making food, religious/cultural purposes, etc) 2) Was it used differently when your parents/grandparents were children? 3) Does it have any medicinal properties?	State Usage	Not used much in Kerala	Commonly used in all states of the country	Commonly used in all states of the country	Not used in West Bengal, Bihar, Assam, Odisha and Uttar Pradesh	Commonly used in all states of the country
	Medicinal Properties	Stomach pain For cooling Body Blood Pressure Head Ache For Vitamin A Dandruff After child birth, it is given to mother	Mustard oil good for skin Digestion Fur and Joint pain	Eye sight Vitamin A It has fibre Good for digestion	It has iron and fibre control Bowel food (milk) Gives strength With hunger	It used for cough in case of cough & cold cough cough cough

Figure 13: Left: Questions arrived at for conducting interviews; Right: Tabulation of findings from interviews, later included in the 'Children's magazine'

8. Discussion: Construction and development of hybrid spaces and science identities in informal settings.

8.1. Funds of knowledge brought by students

As discussed in Section 7, the development of hybrid spaces helped craft new forms of participation for children. It also brought in different students into interesting engagements with science. The topic of interest for this group of children 'Trees, plants and insects', naturally lent itself to bringing in different funds of knowledge into the discussion on science concepts. It also allowed for place based pedagogies, enabling meaningful links between available resources and the structure of learning experiences. Children were able to bring in traditional knowledge of different food plants through interviews with parents, grandparents and members of Azim Premji University from different parts of the country, adding to the richness of content.

The different funds of knowledge brought in by students and described in the previous sections especially in the context of the content areas discussed here, are summarised through the concept map below:

It is apparent through this diagram that knowledge acquired and learnt from school (which includes knowledge of science concepts as well as normative expectations from a 'science student') is quite different from knowledge through informal learning. Informal knowledge includes a wide variety of experiences within the home (discussions with siblings and elders, traditional practices, etc.), and through other informal settings providing science experiences. These experiences being part of the child's 'everyday' (or certain social and cultural events), are linked to the child's identity or developing sense of self. Science experiences embedded in these are meaningful to a child beyond the constructed world of the curriculum and school.

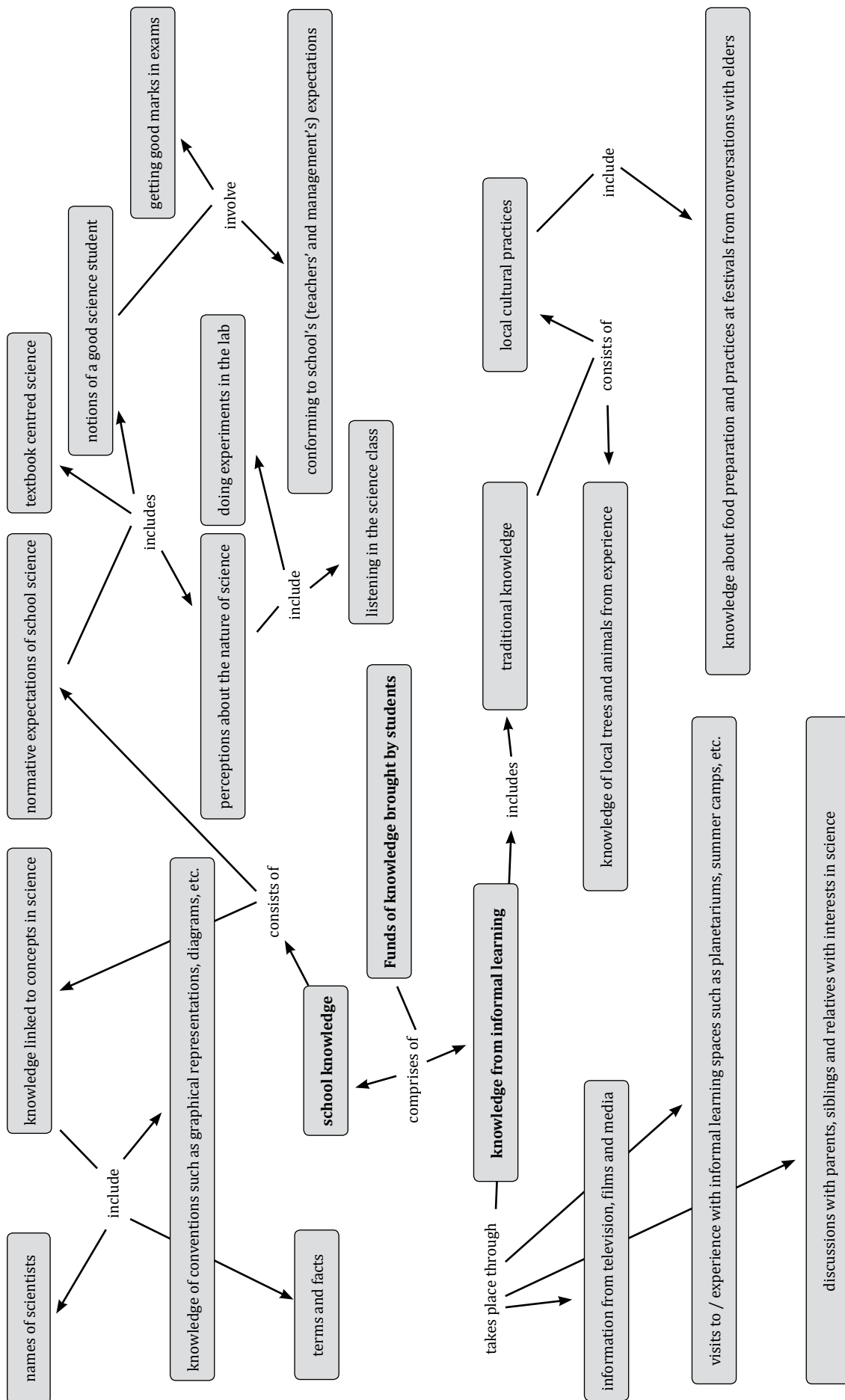


Figure 14: Funds of knowledge brought by students

8.2. *Characterising hybrid spaces*

As discussed, in this study, the framework used by Moje et al. (2004) drawing from the work of other researchers such as Bhabha (1994), and Gutiérrez et al. (1999) was used to characterise the third space using three different ways (described in Section 7). Moje et al use the three ways to illustrate how students develop and use hybrid spaces as a 'scaffold' in the context of 'privileged' literacy practices in upper level classrooms. They also point out that such spaces help students enculturate into the texts and practices that may seem different from their everyday worlds. They also have a larger emancipatory vision when they state: '... our ultimate goal is to work toward third space that brings the text framed by everyday Discourses and knowledges into classrooms in ways that challenge, destabilise, and ultimately, expand the literacy practices that are typically valued in school and in the everyday world.' (Moje, 2004: 44). While the study described here cannot claim to have challenged the dominant Discourse, the nature of the selected theme and the setting expanded the content and contexts of science learning.

In their study, Barton et al. (2008) describe three practices which children engaged with meaningfully in the course of science learning experiences in the school classroom. These practices included the creation of 'signature science artefacts', 'playing with identities', and 'negotiating roles through strategic participation'. Creating a science artefact here referred to students' initiative in conceptualising and developing it, and was not a requirement from the science teacher or curriculum. A girl in this study composed a song on the skeletal system and set it to the tune of a popular song. Another made a 'rabbit magnet' as part of a project on animals, which was not only a beautiful trinket but was also used as an interesting tool when she presented her project to the group. These artefacts were similar in nature to the scrapbooks as well as the magazine put together by children. Again, 'playing with identities' involved taking up positions of authority in the classroom: positions which they were not expected to have in the science class. Barton describes the case of a student who brought in her real life experiences on the street related to smoking, to call attention to its dangers during the proceedings of a science class. Similarly, children in our study saw the "freedom to move" around on campus as being central to their summer camp experiences in contrast to their school science experiences. 'Negotiating roles' was also analogous to the cases of Ramya and Shambhavi described above. In Barton's study, girls who saw the rules imposed by the science teacher as being constraining, crafted new rules and roles for themselves, retaining elements they perceived as non-negotiable. They were able to participate in this manner and also received encouragement to do so by the teacher and their peers.

Barton et al. analyse and discuss urban middle school girls' experiences with science in high poverty schools. They describe the criticality of the middle-school years in forming girls' science identities using evidence from other studies in the American context. It is also clear from studies such as Archer et al. (2010), how a developing interest in science among ten year old girls and boys may change by age fourteen because of their life-experiences. Children may decide to not take up science further as a career or even be engaged with it because of these experiences. In

our study too, while children seemed to celebrate engagement with informal spaces, most did not see themselves in careers requiring science. The reasons they gave were that it would be “hard”, required sustained “interest in a topic”, and that scientists were not people they could relate to. The last reason, especially for many of the girls came from the fact that they hardly had any role models among family and friends. This brings out the need for longer, continuous and rigorous engagements through such informal programmes.

8.3. Characterising informal settings

Informal learning experiences are meaningful for children to explore interests outside the constraints of the often assessment-driven school curriculum. Children were quick to point out the difference between their regular science classes and the ‘lab’ setting in multiple ways. Here are statements made by four children:

“That is theory; this is practical; that ma’am will say we have to listen, but here we can experiment and see the difference.”

“In science lab they teach and do experiment; but in science class they do not do any experiment, only teach.”

“Science class is nothing but studying of chapters. There we study, here we can experiment.”

“In science class we can understand, but if we can’t understand, that means we can learn in science lab... if we don’t see we cannot understand.”

The last statement above indicates that the objective of the “science lab” for them, was to understand better what they learnt in school. The children also seemed to think that the reason why they could not do experiments in school was because there was not enough time. It is important to note that children did not report their science classes in a negative manner or with such connotations; they merely thought of it as natural or as expected. In their minds “school science” and “lab science” were simply different. They perceived them as separate yet connected entities where the science lab became their space to “understand” the concepts that they learnt in school. Understanding through experiments or science that was “extra-curricular” was not something that could be expected from school science which was clearly just a “subject”.

What then are possibilities for students in informal learning settings? Studies with children across cultural contexts have emphasised the value of informal learning settings such as summer camps, after school programs, hobby clubs, museums, planetariums and aquariums, to foster conversations about science and careers in science. The informal context provides greater motivation, engagement and interaction with peers and teachers. It presents several challenges and possibilities for negotiations. Here I would like to bring in emergent themes pertaining to informal learning settings from across the four groups of children working on different science topics and themes in the course of this described study.

Selection of topics based on possible interests: In the first couple of sessions, children were forced to grapple with what ‘their interests’ meant, drawing from school knowledge, information from the media, as well as other children. Facilitators had to work with children’s interests in mind. Preparedness of children in terms of prior understanding as well as what was possible to be taken up given the constraints, were challenges. It took some time for children to understand for themselves that there were certain topics they liked and could explore; and others that they could not work on, given the space and time constraints that we had. There were still other topics which children realised during discussion that they would rather not work on. This was after taking into consideration their interests, materials required, connect with school science, and interest in the physical or biological sciences. Often engagement with a topic and the laborious related processes changed children’s interests. However the structure which indicated that they were free to choose based on interests allowed them to be aware of these inclinations and express them along with their frustrations.

Multiple educational sites: Across topics and groups in the camp, children wanted to be engaged with hands-on work which took different forms. Children who had taken up Chemistry worked in the lab, and developed familiarity with glassware, chemicals and other associated paraphernalia. The ‘Trees, plants and insects’ group decided to move outdoors to explore insects and plants on campus. There were old pots and containers which moved between the lab and children’s homes in which they grew seeds brought from home. One of the groups exploring the human body made a trip to the doctor on campus to understand the human heart beat, and the library to explore relevant books. Across groups there were different kinds of educational activities that students undertook such as collecting leaves, flowers and insects, recording observations, tabulating, graph-making, organising a scrap-book, cooking, making models, manipulating glassware, etc.

Discomfort and satisfaction while working: While moving around the campus in the summer heat presented a difficulty for many students, they were also excited about this change from their routine and were eventually appreciative of it. For the facilitators, it meant moving beyond the conventional lab to explore other possibilities around campus. Children found themselves challenged: in forming mixed groups, disrupting conventional groupings according to gender, grade and familiar friends. Initially, they were rather uncomfortable with the informal environment that allowed them to ask questions and discuss openly with facilitators, but found it meaningful later. Younger children took help from their older friends in engaging with graph-making, and understanding terms and conventions. Engaging with glassware in the Chemistry laboratory was a new experience, and helped them connect with abstract textbook content presented at school. Children in the ‘Trees...’ group had some familiarity with vegetation from their home environments, which led to some exhilaration in being able to identify and engage with familiar plants. It also led

to some anxiety about not being able to identify unfamiliar, new plants, and repeated requests to facilitators to help them do so. Their contributions to the 'Children's Magazine', took the form of stories, poems, drawings and craft, besides 'science' content. While they welcomed the freedom to express themselves and include content not required to be 'science', they also made sure that some 'science' content was written up from the work that they had undertaken in the lab.

Fluid learning: For the facilitators therefore, the informal learning experiences that emerged were fluid. There was no certainty in terms of structure or the broad division of time for various activities within the sessions. Looking at previous literature on the concept of time, Brandt (2007) insightfully describes the enculturation of Deborah, a middle-aged American Indian woman into the construction of time and space in a molecular biology laboratory. The author writes 'In our interviews together, Deborah emphasised this new concept of time imposed by the laboratory, and keeping up with the harried pace of homework, exams, and research, often clashed with her family's sense of time. She often felt as if the demands of time came at the expense of participating in ceremonies at home, or spending time with her children.' This sense of time seemed to restrict Deborah's identity from her native upbringing and culture. For young children such a harried sense of time and space is perhaps even more suffocating. For teachers too it is worrisome. In this context, what transpired during the summer camp required serious preparation for facilitators each day. There were certain expectations of structure in the science lab, which were done away with as the sessions progressed, because of new ideas generated by students and the need to accommodate them. Planning prior to the camp in terms of getting the laboratory ready, helped largely with logistical requirements. However the content and structure of what was discussed and learnt changed every day, depending on each facilitator's familiarity with the content and students' requests and participation. We looked at multiple ways of representing children's understanding, which they engaged with happily. There was a fluid sense of time, space and learning.

In conclusion, informal learning settings, such as the ones described, developed exciting possibilities for students and facilitators to engage with in shared inquiry beyond fixed curricular expectations. The negotiation and development of hybrid spaces allowed for deeper exploration, helping children navigate, merge, as well as reshape their cultural, social and science worlds.

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About Azim Premji University

Azim Premji University was established in Karnataka by the Azim Premji University Act 2010 as a not-for-profit University and is recognized by The University Grants Commission (UGC) under Section 22F. The University has a clearly stated social purpose. As an institution, it exists to make significant contributions through education towards the building of a just, equitable, humane and sustainable society. This is an explicit commitment to the idea that education contributes to social change. The beginnings of the University are in the learning and experience of a decade of work in school education by the Azim Premji Foundation. The University is a part of the Foundation and integral to its vision. The University currently offers Postgraduate Programmes in Education, Development and Public Policy and Governance, Undergraduate Programmes in Sciences, Social Sciences and Humanities, and a range of Continuing Education Programmes.



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