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Weaving indigenous agricultural knowledge with formal education to enhance community food security: school competition as a pedagogical space in rural Anchetty, India

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ABSTRACT

Like many socially and economically disadvantaged farming communities around the world, the Anchetty region of Tamil Nadu, India, has been experiencing serious food security challenges mainly due to the loss of traditional foods such as small millets and associated crops (SMAC) and associated indigenous agricultural knowledge (IAK). Drawing on community-based participatory research conducted in Anchetty's Pandurangdoddy village, this paper explores the local understanding of IAK related to SMAC through young learners (school-going students) and their mentors (local farmers and community members), using a case study of school-based competition. Follow-up interviews with participating students, mentors and teachers were organised to explore the potential of a school competition as a pedagogical strategy to promote learning of IAK in formal school settings in order to safeguard the existing and future food security of local communities. There was a general consensus among the teachers, participating students, mentors (community members) and NGOs about the potential for a school competition to create an alternative pedagogical space where IAK and curriculum-based knowledge could be intertwined and exchanged. Pedagogical spaces that weave IAK into schools, however, bring together the different and contested perspectives of the participants to understandings of the potential values of IAK.

KEYWORDS

Indigenous agricultural knowledge; small millets and associated crops; community food security; India; informal learning

Introduction

This food [SMAC] is indigenous to me. I want to preserve it so it gets to the next generation so they too can live like me. (Grade 8 female student, Pandurangdoddy Primary School, Anchetty, India)

In response to the question, 'What do you know about small millets and their associated crops?' this twelve-year-old student in Anchetty, Tamil Nadu, India, stood up and displayed her knowledge to the 60-member class. With energy and eloquence, she recited what she knew about her community's local agriculture and food systems. Her attitude emphasised for the rest of the students the interconnectedness of their local knowledge system with their local food system. After she sat down, beaming with pride, the rest of the class joined her in crossing the divide that separated them from the informal learning activities going on outside their school. Their engagement with one another dramatically heightened as we began the day's lesson around this set of knowledge, which initially seemed inappropriate as a topic of discussion in a formal educational setting. More than just an opening for students

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to show off their knowledge and creativity, this was also an opportunity for them to engage with their cultural and economic milieu, their expertise in ecology and essentially, their identity.

A classroom is a familiar setting to many of us. However, it is not the only space where learning happens, or where knowledge is transmitted that will inform the livelihoods of youth and other members of the community. Outside of the formal classroom, another mode of learning occurs that narrates people's relationship to their surrounding environment, social context and well-being. Informal learning is a space that exists alongside the curricula of formal learning, and can be defined as 'any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria' (Livingston 2001). Informal learning processes are shaped by the community and can occur individually or within a group, without a rigorous or formalised curriculum (Schugurensky 2000). In our study of communities from the remote rural regions of Anchetty, young learners' informal learning experiences often come through their interactions with local agriculture and the environment in which they and their families work and learn. These informal learning experiences are thus an essential part of what are called 'indigenous knowledge systems', a concept variously defined in the literature as traditional knowledge, local knowledge, traditional ecological knowledge, rural people's knowledge and subaltern knowledge (see Kothari 2002). In the specific context of indigenous agricultural knowledge (IAK), and building upon earlier work (Bebbington 1991), we have adopted Warren and Rajasekaran's version of indigenous knowledge, which is defined as 'local knowledge unique to a given culture which has been acquired through the accumulation of experiences, informal experiments, and intimate understanding of the local environment'. In our research, we use the term 'indigenous agricultural knowledges', which we define as a specific sub-set or type of indigenous knowledge system (which equates to peasants' or farmers' knowledge, as originally defined in Bebbington 1991). This knowledge consists of empirical, dynamic and multi-generational knowledge practices and cultural beliefs held by the Anchetty farmers regarding the production, consumption and sharing practices of small millets and associated crops (SMAC).

This definition of IAK thus inherently implies a contrast to Western formal science, which dominates the shaping of school curricula. The dichotomy between indigenous and Western knowledge systems has been thoroughly debated in the literature since the 1990s, both in the field of development (see for instance Waldram 1987; Fairhead 1992; Turnbull 1993; Thompson and Scoones 1994) and that of education (Semali and Kincheloe 1999; Battiste and Youngblood Henderson 2000; Snivery and Corsiglia 2001). The scope of our research is consistent with the move to 'dismantle' the divide (Agrawal 1995) that arises from positioning indigenous agriculture knowledge in opposition to formal schooling, instead seeking to explore convergences between these seemingly polarised knowledge systems. Such an approach is also empirically established by Brodt (1999), suggesting that ideas and materials have historically been exchanged between informal knowledge and formal (science) systems, and therefore a strict separation between the two is not helpful in moving forward to create an alternative pedagogical space where both can complement and enhance overall learning outcomes.

In spite of the often disavowed relationship between informal knowledge and formal schooling (McGregor 2000), several ideas conceptually support the idea of 'third spaces' (Bhabha 1994) or alternative pedagogical spaces that weave together IAK (the 'first space' of informal learning) and Green Revolution agricultural development through Western science (the 'second space' of formal school-based education). Further support for the synthesis of IAK and formal school science can be found in the concepts of culturally relevant pedagogy (Ladson-Billings 1995), cultural border-crossing and culturally sensitive science learning (Aikenhead and Jegede 1999), eco-justice pedagogy (Bowers 2001), culturally responsive science education (Brayboy and Castagan 2008) and, most recently, culturally aligned classroom science (Mpofu, Otulaja, and Mushayikwa 2014). The pedagogical strategies that emanate from these conceptual terms may have some distinct characteristics, but they all share commonalities, including the recognition of place and local culture (language) in learning, the importance of indigenous knowledge systems for learners as an informal learning, and the role of elders (indigenous knowledge experts) in enriching the educational experiences of both indigenous and non-indigenous learners in schools.

In response to the call to bridge informal learning with formal school systems (Eschah 2007), some initiatives have already been launched and documented. For instance, the SHIPS (School Home Investigations in Primary Science) experiment encouraged students (aged 5–10) and parents to use every-day used household items to learn about science through an activity bank selected by teachers, as being suited to local contexts (Solomon 2003). Shukla and Gardner (2006) outlined several other initiatives involving school-based outdoor education programmes in North America that integrate environmental education with formal curricula (Mann, Mccrea, and Medina 1988), such as the Rediscovery programme in Canada (Henley 1996), Foxfire in the United States (Starners 1999) and similar programmes in Europe (CERI 1991) and Asia (Chand and Shukla 2003). These pedagogical initiatives demonstrate how collective and collaborative efforts by teachers, school administrators and local communities can create educational innovations and opportunities for bridging informal learning with formal institutions.

In India, the pedagogical initiatives that interweave spaces for indigenous knowledges within formal schooling have been mostly driven by rural development NGOs (CEE n.d.) and a few isolated community educators. Shukla and Chand (2006) highlighted such initiatives in order to demonstrate the potential of bringing together informal learning (indigenous knowledge systems) and formal schooling to create learning for sustainability (Palmer 2003). Government-supported initiatives have also been recently discussed (Singh and Reyhner 2013), with a focus on developing culturally appropriate education for the children of indigenous communities following the SAARC (South Asian Association for Regional Cooperation) declaration on preserving indigenous knowledges and heritage in South Asia.

For primary school students in Anchetty, the ways in which they experience and engage in learning community-based agricultural knowledge are challenged by school-based formal education. Using a school competition as a pedagogical strategy or integrative space, this paper explores the meaning and characteristics of IAK around SMAC from the perspectives of participating school children and older knowledge holders. A case study is used to examine the potential of school competitions for bringing SMAC-specific IAK into a formal school setting, a strategy that may have positive implications for community food security.

Panurangandoddy village, Anchetty: the socio-educational, agricultural and geographical context

The particular classroom that was the site of our field research was a primary school in Panurangandoddy village, located within the Anchetty, Krishnagiri District, in Tamil Nadu, India. Krishnagiri District is situated within the semi-arid Deccan Plateau and Eastern Ghats, with a population of just under two million (Department of Economics and Statistics 2012). Over three quarters of the population live in rural areas (ICRA Management Consulting Services Limited 2008; Department of Economics and Statistics 2012). Rural indigenous peoples of India are impacted considerably by a lack of food security, as 75% of the Indian population consider agriculture a key livelihood source. Food security in this study is understood as the condition ‘when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and cultural preferences for an active and healthy life’ (FAO 2006).

Families living in Anchetty depend largely on the agro-biodiversity of their region for nutritious, reliable and productive crops. In this setting, SMAC are heritage crops and staple grains that are in current production and consumption, and are deeply embedded in local lifestyles (Bala Ravi 2004). In food security initiatives, however, SMAC are often neglected and underutilised, despite their economic, health, sociocultural and environmental benefits (Frison 2011). SMAC provide hearty food options that are high in protein, calcium, iron, phosphorous, vitamins and amino acids (Chethan and Malleshi 2007; Frison 2011; Devi et al. 2014), rendering them crops with high nutritional and medicinal properties (Rao, Nagasampige, and Ravikiran 2011). SMAC are drought resistant, adaptive and suitable to conditions of sporadic rainfall (highly beneficial in semi-arid zones). They do not require the use of agro-chemicals and generate successful yields, household income and biodiversity conservation (Plaza-Wüthrich 2012).

The importance of small millets extends beyond their health, utility and environmental robustness (Ravi et al. 2010); they are also central to the local culture, economy and autonomy.

The Green Revolution of the mid-twentieth century sought to increase yields and homogenise crops through supporting large-scale, high-input-driven agricultural policies (Harriss-White 1997; FAO 2011). The focus on increasing yields of wheat, rice and certain vegetables meant that little value was placed on traditional crops (such as SMAC) grown and consumed by indigenous peoples and marginal sectors of society. Consequently, the negative outcomes of the Green Revolution have far outweighed the benefits, and monoculture has increased production instability (Shiva 2000). This in turn has increased poverty levels and impacted the general health, well-being and food security of small-scale farmers in the region (Harriss-White 1997; Shiva 2000). Some of these negative impacts of the Green Revolution are also felt in Anchetty, which is experiencing an erosion of SMAC production and consumption along with the related body of knowledge. The shift to imports and external crop production as well as neglected cultivation of SMAC has reduced community access to food security and sustenance, and diminished its overall health.

Lifestyle and livelihood changes in the region, particularly growing rates of out-migration to cities as well as a preference for less laborious and more readily available food preparations, have also led to diminished cultivation and consumption of SMAC. Tamil Nadu has seen rising rates of migration to urban centres, experiencing a 14.3% increase in urbanisation between 1991 and 2011 (Sivakumar 2011). Farmers identify young people as a target population in which a knowledge of SMAC must be revitalised to combat these changes in lifestyle and livelihood. Participants in the Indian Convention of Millet Farmers have called for the transformation of formal educational spaces to include holistic learning about SMAC:

We demand an immediate and urgent pursuit of education on millets in our schools. If the young minds of children can be opened up to the phenomenal advantages of millets as the future of food and farming in India, it will create a new generation of fully informed, food literate millet consumers of the future. (Millet Network of India 2012, 49)

Even before such calls, initiatives for integrating small millets-based learning in India had begun. For instance, the Revalorising Small Millets in the Rain-fed Regions of South Asia (RESMISA) project, under which this research was carried out, was conceived and implemented in 2009 across eight different sites in India, Sri Lanka and Nepal. RESMISA was a large multidisciplinary action-research initiative, with the overall research goal of increasing the production and daily consumption of SMAC in rain-fed regions of South Asia. RESMISA interventions such as school competitions and recipe competitions were designed to increase the production, distribution and consumption of underutilised species such as SMAC, and enhance associated IAK. Of critical importance are the pedagogical approaches to promote the acquisition of IAK about SMAC within schools such as those in Anchetty, where most children are educated to become custodians of their community food security.

Panurangandoddy village, located within the hills and dense forests of the Eastern Ghats, is one of several clusters of villages within Anchetty Panchayat situated among deep and broad valleys, with red soil topography. This is a predominantly rain-fed area relying on monsoons for agriculture. Local cultivation is dependent on household labour, involving practices such as ploughing, sowing, thinning, weeding and the use of bullock-drawn implements to grow SMAC and other rain-fed crops. The main rain-fed crops are finger millet, groundnut, red gram, field bean and gingelly (DHAN Foundation 2011; Manickami and Vijayaraghavan 2012).

Anchetty has the highest percentage of households living below the poverty line in Krishnagiri District (Annual Employment Report Krishnagiri District, 2007–2008). Most households are Hindu, and the majority of the population belong to the Most Backward Caste (MBC). The MBC is an official caste category that refers to 'communities, which were found to be as disadvantaged as the Scheduled Caste (SCs) but could not be declared as Scheduled Castes (SCs), because of the non-existence of untouchability factor' (Department of Backward Classes, Most Backward Classes and Minorities Welfare 2014). All research participants in this study were from the MBC. The literacy rate of Anchetty is 48.3%, which compares very poorly to the literacy rate of the Krishnagiri district (72.4%) and Tamil Nadu (80.03%), and

the average length of schooling is 6.4 years (DHAN Foundation 2013). Primary occupations in Anchetty, particularly among the MBC, include farming, agricultural wage labour and non-agricultural labour. Many of these sources of income require one or more members of the household to work outside of Anchetty. The community is also experiencing high rates of migration to nearby cities. The children of these parents may additionally travel long distances to attend a private school.

Methods

The overall approach taken for this project was a case study of a SMAC school competition organised in the Pandurangdoddy village, a competition designed as part of the larger RESMISA project. All three authors visited the site few times, and the second author stayed in the Anchetty village from June to August 2012. An initial collaboration and dialogue with the local NGO partner, DHAN Foundation, was established prior to field research to ensure that research objectives and methodologies supported local perceptions of food security. The data collection followed a participatory research methodologies approach, which deliberately involved participants in the design, process and dissemination stages (Chambers 2007). As a first step to participatory research activities, a SMAC knowledge test was organised.

A SMAC knowledge competition

The philosophy and methodology of the 'SMAC knowledge competition' was adapted from the 'biodiversity competitions' (Shukla and Gardner 2006; Shukla 2012) which aim at revealing the indigenous knowledges (in this case, IAK) of school children by assessing their performance in a collaboratively designed (with school teachers, local elders or indigenous knowledge experts) school-based competition on the identification and uses of the plants/local foods from their culture (Chand and Shukla 2003).

The competition was held on 3 July 2012, at Pandurangdoddy Government School, located approximately six kilometres from Anchetty. One and a half weeks before the competition, the second author, along with local field assistant Mr. Somu, (who grew up in Pandurangdoddy village), visited the school to provide information for the teachers and headmaster, including the signing of consent forms, the approval of competition design and of marking criteria. The students were informed of the competition exactly one week in advance. They were provided with written information to take home to their parents and given an oral introduction to 'what is IAK', why it is important, as well as a brief review of SMAC. Students were also given examples of potential ways to organise, display and present their information. The research team visited the school every day during the lunch hour and provided material such as chart paper, pencil crayons, glue, tape and so on. The marking criteria (Table 1) were discussed and finalised in consultation with several millet farmers prior to the competition. They all agreed that the criteria were open-ended enough to allow for the documentation of many practices.

A total of 52 participants from grades six to eight voluntarily participated in the competition and collected IAK on SMAC from their 'mentors' – parents, grandparents, neighbours and so on – in the week prior to the competition. Three evaluation panels were set up to assess students in each grade (Grades 6–8); each panel was composed of a DHAN Foundation staff member, a teacher and a small millet farmer. On the day of the competition, students were invited to present their compiled IAK information to a panel of 'millet expert' judges. Students presented their information in posters, pamphlets, art, seed collection, notebooks and folders containing sample plants and information about them, as well as clay models of tools used to cultivate SMAC (Figure 1).

Interviews and discussions with students and mentors

Following the competition, semi-structured interviews were conducted with the four highest and four lowest scoring participants of each grade level; seven students who were not competition participants were also interviewed (30 student participants in total, 15 boys and 15 girls). All the students were

Table 1. Evaluation of Students IAK: SMAC knowledge test used in Anchetty site.

IAK category	Maximum weight	Items included in the category of IAK knowledge
<i>1. IAK content</i>		
Number of varieties collected/ identified	1 pt each	Seed sample, plant sample, drawing, pictures Extra points can be given for students who bring in local varieties of millet
Number of uses identified	1 pt each	Total of each use given, for each varieties identified. For example, a student may identify two varieties. The first one, they would list two uses, and the second variety, they would list seven uses. This would give them a total of nine points
Practices identified	1 pt each	Total of each practice given, for each variety identified. Same applies here as above. If repeated practices are given, only 1 point can be granted
Organisation	0–3 pts	How well the knowledge is organised on the project medium. Could this be a useful educational tool to share with future generations? Was time clearly spent laying out information and knowledge in a comprehensible way?
Clarity	0–3 pts	How understandable is the information? Do you understand the meaning from reading their project, or does it require further explanation?
<i>2. Presentation</i>		
Displays clear understanding of knowledge gathered	0–3 pts	Student does not simply read off their project, but displays understanding of what they are reading
Style and creativity	0–3 pts	Do they communicate information in a way that can easily be remembered? Is the presentation interesting?
<i>3. Creative element</i>		
Creative way in communicating knowledge related to small millets	1 pt each	Song, dance, poem, picture, painting, story, folklore, joke, or something else related to small millet knowledge Does this element accurately depict knowledge related to small millets?

**Figure 1.** Small millets and associated crops knowledge competition in Panurangandoddy village here.

interviewed in their homes. One component of the interview was to identify a mentor whom participants referred to as their source of informal knowledge, for the research team to follow up with a separate interview. (There were 25 mentors in total – 11 men and 14 women – as several were identified by two

student participants.) Student participants identified their fathers, mothers and grandparents as their main sources of SMAC knowledge, ranging between 28 and 70 years of age. Both students and mentors were asked to provide interpretations and a structure of IAK, and comment on the challenges of IAK and ways to facilitate its dissemination within a formal (school classroom) context.

Findings and discussion

Ulloor aarivu: local understandings of IAK

In initial consultations with community members of Panurangandoddy, many respondents explained that they did not carry 'formal knowledge' because they had not received formal schooling. Field researchers clarified that knowledge was much broader and that IAK, as referred to in the study, can also be understood as 'local agriculture knowledge'. In other words, local or indigenous knowledge is related to 'place' and therefore varies across contexts. Translators opted to use the Tamil word for 'local knowledge' in interviews, loosely translated as *ulloor aarivu*, as is it was more widely understood and established the same understanding as 'indigenous agricultural knowledge'.

The concept of place-based learning corresponds to the theoretical discussion around informal learning. Place-based learning provides an avenue of social transformation based on traditional knowledge transmission while remaining cognisant of global educational and economic trends. When applied critically, it is 'a response against educational reform policies and practices that disregard places and that leave assumptions about the relationship between education and the politics of economic development unexamined' (Gruenewald 2003, 3). Such critical, place-based learning pedagogies can therefore be used as political tools to enable people to incorporate their own cultural praxis as a component of well-being in order to counter negative aspects of globalisation. Specifically, place-based learning encourages individuals and institutions at the community level to consider what patterns should be conserved, transformed or disregarded to promote sustainability, thus 'relearning the art of what it takes to live well where they are' (Orr 1994, 130). The majority of mentor respondents defined informal knowledge as 'all knowledge related to agricultural cultivation practices'.

This resonates well with the working definition of IAK that we adapted from Warren and Rajasekaran (1993), and also reveals the influence of practical aspect of IAK around SMAC. This was noted in earlier research by Brodt (2001), wherein practices (primary) intertwined with concepts or knowledge (secondary level) to form composite or hybrid systems in a village-based case study of tree management in Central India. Less common responses from mentors defined informal knowledge as a way of life, a part of their culture and heritage; as intergenerational learning where '... we follow the practices from my grandfather to my generation. That is indigenous knowledge for us' (respondent, 39 years old, father); as language related to place or 'language related to my community' (respondent, 28 years old, mother), including how it is used for agriculture. The less-emphasised importance of local language and place-based skills acquired through intergenerational transmission of IAK has been recognised as an important aspect of indigenous pedagogy (Battiste 2002; Battiste and Youngblood Henderson 2000; Singh and Reyhner 2013).

During interviews, mentors were also specifically asked to reflect on the pedagogical strategies for learning IAK by discussing the qualities of a good student of IAK. The responses, summarised below, did not specifically refer to the youth whom they mentored for the SMAC knowledge competition, but rather to the things that the youth *should* be doing to 'learn well'. Most commonly, mentors stipulated that students must *want* to know about SMAC practices and uses: 'They want to know all the practices about small millets, and also all the sub-practices within these practices' (respondent, 65 years old, grandfather). This means demonstrating interest from a young age, and regular practice. 'If my son concentrates on *ragi* [finger millet], it will not be eroded. A good student is one who wants to use the practices regularly' (respondent, 39 years old father).

A good student must understand and respect the traditional harvesting songs and stories and cultural ways of celebrating the importance of SMAC. This includes recognizing the benefits that cultivating SMAC has on the community and how this relates to cultural identity and community food security (respondent, 41 years old mother)

Mentors identified the livelihoods and practical aspects of knowledge related to SMAC as something that may encourage youth to participate in learning IAK. Several mentors identified a good student as one who has foresight into how this knowledge will be used by the coming generations, specifically related to jobs and income. The preference of SMAC as a main source of food was another critical quality of a good student of informal knowledge that was identified by a small number of mentors. This included the willingness to prepare SMAC as food for consumption. A grandparent noted:

Both his mother and father are working in Hosur town near Bangalore, and he's never liked *kali* [local SMAC variety], so daily I prepare rice just for him. So a good student would eat *kali* daily and help prepare (respondent, 70 years old grandmother).

Respondents generally identified IAK around SMAC as a positive body of knowledge, and were thus supportive of various pedagogical strategies that would encourage its effective transmission among their learners. These strategies, as listed above, describe the qualities of good learners and indicate ways in which IAK can be practised and transmitted. The experiential aspect of IAK of SMAC as reinforced by mentors has also been considered an important pedagogical strategy in the scholarly literature that discusses the role of IAK in local development (Warren and Rajasekaran 1993; Brodt 2001) and education (Semali and Kincheloe 1999; Battiste and Youngblood Henderson 2000; Shukla and Gardner 2006). The importance of learning production-related farming practices for SMAC was regularly viewed by mentors as a practical application of IAK and a viable livelihood option in sustaining the current and future generations by ensuring community food security. Such contextual IAK related to agro-ecology has been discussed by other scholars in India and includes the 'collection and selection of seeds, germination, grafting, cutting, sowing, planting, nursing, soil selection, manuring, pest and disease management, nomenclature and taxonomy' (Sinha 1998, 185).

In addition to production practices of SMAC, mentors also value the cultural dimension of harvesting SMAC and the IAK of SMAC consumption. The IAK of SMAC can be useful in cultural revitalisation with positive health and nutritional benefits that young learners must learn through actual participation in recipe making and cultural harvesting festivals. Sinha (1998) identifies farmers and village elders as repositories of this knowledge who pass on the art of cultivation to future generations through various means such as stories, songs and proverbs. Desmarais (2008) notes that stages of food production, harvesting, cultivation and consumption are embedded in the culture and spirituality of traditional rural farming communities. There is also evidence of a causal relationship between the usage of indigenous knowledges and the health of people, whereby the more access one has to local knowledge, the more access one has to nutrition and health (Kightley et al. 2008).

Mentor respondents recognised that not all young people are interested in SMAC knowledge, and that some would rather learn about modern agricultural technologies and crop improvements programmes inspired by the Green Revolution in India following the 1960s. Of the total respondents – both students and mentors – just over half felt that youth were interested in IAK related to SMAC. Alongside the aftermath of the Green Revolution is the influence of conventional globalised educational policies on IAK practices regarding the production and consumption of SMAC. The dominant education structures neglect IAK and fail to consider its empirical and place-based content and pedagogy, similar to informal learning (Livingston 2001; Gruenewald 2003). Current educational discourse and programming standardises the experiences of young people despite diverse geographical, ecological and cultural identities (Gruenewald 2003). By contrast, the reproduction of IAK through informal learning pedagogies validates cultural intricacies that are intimately connected to local ecology and enhances overall educational experiences in formal educational settings (Barnhardt and Kawagley 2005). The community in Anchetty acknowledges that in order to support students and their families, there is a need for innovative ways to integrate IAK, as an informal and place-based pedagogy, with formal education (schools). A key question therefore is: in what ways can the formalised spaces of knowledge transmission between

teacher and student work in tandem with the positive qualities of informal learning spaces to generate the learning for existing and future community food security through SMAC?

The challenge: weaving IAK into in school settings

One respondent considered the capacity for IAK integration in school to be limited: 'There are no SMAC-oriented teachings in schools because no one can teach them, and no one can think of how to teach them' (mentor/IAK knowledge-holder, mother). This response is critical when looking at the practicality of 'third space' or hybrid learning – an opportunity and space that weaves together school-based science education and informal learning (IAK of SMAC) in the Anchetty community. Systematic and long-term initiatives to integrate this type of informal knowledge into formal schooling are significantly lacking in India, despite the important potential they possess (Shukla and Chand 2006). As previously noted, negative perceptions of informal or indigenous knowledge have led to scepticism and a knowledge divide that presents potential barriers to the success of such integration. While there exists a general interest among youth in learning about local knowledge and agriculture, our case study revealed mixed opinions on whether youth were actually interested in pursuing this knowledge and passing it on to their next generation.

Local teachers and students must first recognise the importance of informal knowledge and then be supported in their efforts to incorporate it into schools. An older farmer and mentor identified an important link between school-based learning and IAK: 'Students must associate their school knowledge with agriculture knowledge to know better about small millets. They should want to know both kinds of knowledges'. This assigns a new role to both formal teachers and community mentors (IAK carriers), as sources of knowledge as well as facilitators in applying this knowledge to other learning contexts. In other words, they need to consider how and which pedagogical strategies or alternative spaces can facilitate the synergistic interactions between IAK and school-based formal learning in order to strengthen existing and future community food security.

Effective methods and achievements of informal learning in schools and in community programmes can be incorporated into formalised learning curricula to nurture local capacity. As already noted, it is difficult to weave IAK (informal learning) into formal learning environments, as the defining characteristics of each inherently contrast with the other. However, formal educational institutions such as schools and teachers can re-orient themselves to accommodate the pedagogies, knowledge carriers (mentors) and place-based practices, including the cultural values of IAK.

The SMAC knowledge competition: a pedagogical space for bringing IAK into school settings

Within the larger RESMISA project, community recipe competitions were run in various project locations including Anchetty in addition to the knowledge competitions described here. Community members were encouraged to submit traditional recipes featuring SMAC, awarding those who brought in the highest variety of the traditional recipes (Shukla 2012). The recipe competition, as originally conceptualised by the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), is a method to document IAK as well as to publically acknowledge IAK holders (SRISTI 1999; Shukla 2009). The findings of the recipe competition revealed a gender component to IAK, as women in particular were given a platform to display their knowledge and skills related to SMAC.

Shukla and Chand (2006) describe knowledge competitions as a tool to encourage informal learning spaces that promote the intergenerational informal knowledge transmission that occurs locally. In the context of biodiversity competitions, formal schooling often does not recognise or celebrate local plant biodiversity knowledge despite its importance to local livelihoods. Knowledge competitions have the potential to re-educate the community and promote awareness among teachers regarding local agro-ecological issues and conservation. In addition, they activate intergenerational learning and validate the knowledge that young people possess through informal learning. As a research tool, the competitions do not impose or hierarchize knowledge and information, but rather leave it up to the

Table 2. School competition as a pedagogical space weaving school-based learning and IAK.

Features	Indigenous agricultural knowledge (SMAC farmers of Anchetty region)	Weaving pedagogical space: school competitions	Formal knowledge (global/Pandurangdoddy school, Anchetty)
Source	Local knowledge experts (father, mother, grandmother, grandfather), especially those who do not work elsewhere	Teacher as cultural brokers, elders as willing knowledge carriers	Teachers, written material, standard curriculum governed by the state
Context	Unpredictable outcomes, various social, environmental and physical prerequisites, as well as value-based and learner-centred	Respectful co-existence, synergistic interactions between IAK and schools	Predictable outcomes (exams), structured access and systematic ladder of progression
Pedagogy	Both practical and cultural aspects stressed, enhancing oral transmission in local language, SMAC cultivation and harvesting ceremonies, folk songs, observation, skill-learning and apprenticeship (guided practice) are continued for longer duration fostering intergenerational interactions, mostly experiential	Elders as guest speakers, land-based experiential learning that uses IAK and science together, Builds on local material and respect community cultural values	Classroom instructions, few practical lessons, questioning often discouraged, little experiential learning
Outcome	Identity rooted place-based community, both functional and cultural knowledge, more cognisant of environment, health and individual/community well-being, ability to connect community issues with occupations, directly contributing to food security by enhancing community food sovereignty	Pedagogy that weaves IAK into schools, Revitalization of IAK Increased Relevance of School curriculum, Community Food security and Sovereignty	Improve employability, build qualifications to reach further stages of higher education, Individualistic, Indirect contributions to family/household food security

Source: Adapted from Shukla and Chand (2006, 68).

informal process to determine which knowledge is transmitted. Shukla and Chand's comprehensive chart shows sites of informal learning in relation to formal learning, looking specifically at the source, context, methods and outcomes of transmission (2006). Findings from the present study can be placed within this framework as a tool to further explore ways in which SMAC knowledge can be enhanced (Table 2).

Over half of the respondents from SMAC knowledge competition were in favour of bridging the divide between formal schooling and informal learning by introducing indigenous knowledge related to SMAC into formal schooling in order to enhance knowledge of SMAC. As formal schools often decontextualize environmentally and socially driven topics based on place, thus centralising knowledge production, respondents saw a need to include the qualities of informal learning, which contextualise and decentralise knowledge (Lave 1997). Students were not formally asked to define IAK; however, during the first information session about the competition, one student responded by saying, 'We are very happy to participate in this programme because this is my parents' work, where their knowledge is oriented'. This comment highlights the student's recognition of the competition as a third or alternative space where both formal knowledge (learned at their school) and informal knowledge (retained by their mentors/IAK carriers, including parents) would be valid.

Many interviews were undertaken with large groups of community members, in which entire families agreed that integrating informal learning methods, processes and topics would be an innovative approach to supporting their cultural and economic identity. Recognising informal knowledge related to SMAC as a valued body of knowledge and bridging it with formal learning would highlight the importance of its cultural and utilitarian practices. Once it becomes a more widely respected and validated body of knowledge and way of life, 'only then is it useful to my son to cultivate' (respondent, mother, 30). In this way, many mentors who were also parents of participating students implied that the alternative, integrative pedagogical space must co-create IAK about SMAC in order to help address contemporary concerns around food and livelihood security.

Some notable suggestions for bringing IAK into the formal classroom were to develop a course on agriculture, or promote activities such as the competition, in which youth are encouraged to investigate indigenous knowledge to the degree to which they desire. The third space of weaving together informal and formal knowledges is thus viewed as practical and livelihood-oriented, building on IAK and

traditional cultural values to meet the food security needs of existing and future generations. Similar views of a third space in the form of follow-up pedagogical interventions are reflected in a study by Turner and Turner (2008, 113), who recommend incorporating indigenous food knowledges into educational institutions, based on their research on traditional foods with indigenous communities from coastal British Columbia. Several follow-up pedagogical interventions were suggested, including using publications and informational videos; incorporating media (where possible); reinstating traditional/threatened foods in ceremonies; serving these foods at feasts; incorporating traditional/threatened foods with contemporary ways of serving them; involving youth in the production and consumption of food; incorporating local food systems and ways of thinking in curricula such as biology, language, communication and career guidance; and offering extra-curricular activities such as science camps and community harvesting outings.

As the literature on similar pedagogical initiatives suggests, the SMAC knowledge competition proved to be useful not just for the students and mentors (Singh and Singh 2013), but for the teachers as well. School teachers and administrators expressed interest in learning more about SMAC varieties from IAK perspectives, especially crops from different regions. Similar competitions that were held in other parts of India are reported to have generated long-term pedagogical outcomes including establishing regular dialogue and interactions between elders and students in the schools, establishing and using local plants in teaching environmental education and the formation of school ecological clubs (Chand and Shukla 2003) as well as reviving local networks of indigenous knowledges (Shukla 2007; Singh and Singh 2013). The Anchetty competition demonstrated good potential to develop pedagogical strategies that would bridge IAK with formal education, by involving local NGOs such as DHAN Foundation.

We are amazed by the enthusiasm of students and teachers in learning about small millets and are willing to work with teachers and students to develop regular follow-up activities in participating schools. (DHAN representative, personal communication)

As a finale to the research study in Pandurangdoddy a celebration was hosted by the research team, staff and students, inviting community members to look over the students' SMAC projects. The event was successful and was attended by roughly 1200 community members from Panurangandoddy and surrounding villages. Students had written plays as well as dances and songs, which they performed before a meal involving two traditional SMAC recipes was served. The SMAC knowledge competition can serve as a model for local organisations (such as the DHAN Foundation) as a tool for recognising and promoting IAK in schools and local communities, and for revitalising the cultural identity of mentors and IAK holders who have been traditional farmers of SMAC for generations. It is critical that young people are included in the process of knowledge gathering and dissemination at community and regional levels.

In general, students and their families regarded the competition and related events as a positive experience in connecting to the IAK of SMAC. Prizes for winning girls and boys gave the students further incentives to use their creativity and problem-solving skills; however, those who did not receive prizes were also excited to showcase their projects (Figure 2).

Reconfiguring the pedagogical space to incorporate IAK

Interviews with project participants – both the students and their mentors – discussed the nature of IAK erosion. The majority of responses identified that while this knowledge has not been lost, there may be a high risk of this happening if certain global trends continue. The research team and various participants identified formal schooling as a potential platform for reviving culture, health and eventually the indigenous food system based on SMAC. For those who did not see a use in preserving this knowledge, the inclusion of IAK in formal schooling could permit students to pursue higher education while also developing an environmental consciousness related to their local identity, which they could carry into the professional aspects of their lives.



Figure 2. Display of models of traditional agricultural implements used in SMAC cultivation, brought and displayed by students during the SMAC knowledge competition at Panurangandoddy village.

Mentors believed this information was important for community health and well-being, but were hesitant to identify its importance for the next generation. Many of them hope for a 'better life' for their children and grandchildren, and therefore prefer to deter youth from acquiring an interest in IAK. Participants were either not sure about the fusion between formal and informal learning, or felt as though youth would benefit from learning about indigenous knowledge and agriculture more broadly, in a formal school setting.

The youth identified their academic and career goals, and almost all participants listed a job that required excessive schooling and settling in urban settings. While there was an identified interest among youth to carry indigenous knowledge, most participating students did not see it as their primary responsibility to retain this knowledge and pursue farming. In asking whose responsibility it was, the common response was that it was for those who were not educated. The young learners in Pandurangdoddy School thus are juxtaposed, by their preferences for modern life choices, with IAK, which is viewed as not useful for meeting their livelihood and food security needs in the modern world.

Formal education has the potential to incorporate both value-based and utilitarian knowledge. Both development organisations in Anchetty and local farmers rely more on acquiring the functional aspects of SMAC knowledge due to government policy influenced by the Green Revolution, which placed the economic benefits of agriculture at the forefront of food security. Non-governmental organisations that promote community-based agricultural development and food security may also perpetuate the notion that IAK is utilitarian by focusing more on the transfer of technology than on localised culture. This type of project has a tendency to concentrate on values such as health and economy rather than on identity and sociocultural preservation. The pedagogical space that weaves together IAK and school-based learning must consider all aspects of the holistic nature of IAK, including its cultural adaptations and resilience, in order to prevent its further degradation and erosion.

The school competition is thus a fuzzy and highly contested pedagogical space: it facilitates the interactions of IAK and formal curricular knowledges, yet the IAK of SMAC is not highly valued by young

or mature holders. Pedagogical programmes that seek to revitalise IAK must meaningfully acknowledge students who demonstrate a wealth of knowledge in these areas. Furthermore, such programmes must promote an environment in which youth not only want to learn about SMAC but also want to engage in its production and consumption. As this study's findings reveal, many students expressed interest in the cultural aspect of IAK, but very few truly committed to actively engage in these processes. In some instances, participants noted that it is up to the youth who are economically disadvantaged to attend school and be carriers of IAK. These so-called economically disadvantaged students represent the families and parents who are small and medium farmers who often derive their livelihoods from SMAC cultivation. This suggests the dichotomous relationship between IAK and formal education: IAK is valued as a necessary function, but is nevertheless highly marginalised and maintains a low priority, particularly among young people. To enhance this body of knowledge means to reconfigure the pedagogical space in which both the functions and cultural aspects of informal knowledge are necessary for livelihood along with the formal school curriculum. In other words, the alternative pedagogical space should empower students to become two-way border-crossers (Giroux 1992) who can respectfully synergize IAK and school-based formal education to develop a synthesised understanding of food security based on the production and consumption of SMAC. This also requires that teachers becomes conscious culture brokers, who have a clear understanding of the metaphorical boundaries between IAK and school and can help students navigate these borders without undermining their cultural capital or IAK (Snivery and Corsiglia 2001; Aikenhead 2006).

Conclusion: cultivating community food security by bringing IAK into school through negotiated pedagogical spaces

When presented with the option of learning about SMAC production and consumption to protect their future livelihood and food security versus acquiring a Western scientific knowledge of modern agriculture, the young and old carriers of IAK in Anchetty were divided in their responses. Almost half of the respondents (both mentors and students) also favoured the use of IAK of SMAC in a formal school setting, and supported the indigenous knowledge-focussed SMAC school competitions in Pandurangdoddy.

Outside of the Panurangandoddy Primary School, IAK occupies a thick and vibrant informal learning space in the surrounding SMAC fields and forests. The *kutch*a mud houses, fields of *samai* millet and dirt roads shape a critical setting that nurtures the intricacies between the production of food, production of knowledge, production of culture and thus production of livelihood. However, the existing and future carriers of IAK in Anchetty – the youth, the teachers and the mentors whom we met – are ambivalent and not hopeful about the current value and future viability of SMAC and associated IAK as an alternative route to livelihood and food security.

The value of school competitions as a third pedagogical space therefore becomes more relevant and urgent to prevent the further marginalisation and devaluation of IAK in school and community. Mentors, students, teachers, local NGOs and all those concerned with educational development for the future of food security can collaborate in such a third space to negotiate and co-create synthesised and robust meanings of IAK alongside formal school education, and nurture strategies for current and future food security. Taylor (2006) notes that the contested negotiations and outcomes of such third spaces are 'of major importance in the positive recognition and growth of local cultural capital including traditional knowledge systems [such as IAK] and languages, recognition of the non-essentialist and mutable nature of all cultures and worldviews (191, 192). If such an alternative space and vision can be created in the schools, teachers can establish connections to IAK (Glasson et al. 2010) and create avenues within the curriculum (e.g. inviting local farmers as guest speakers in classrooms). For instance, the local communities in Anchetty region (Pandurangdoddy, Andevanapalli, Kottaiyur and Athimarathur villages), have traditionally used native varieties of *Ragi* such as Karunketti, Thoddaragi and Pichi, as these varieties are known for their superior nutritional values as well as being able to withstand extreme environmental conditions such as excessive rain and drought. Teachers can teach

the concept of 'sustainable food systems' by inviting farmers to share their experiences of how these varieties have been helping feed them and their families for generations. At a time when livelihoods and food security are in transition, school-based initiatives such as the SMAC knowledge competition and similar pedagogical strategies can help both teachers and students to develop respect towards, and recognition of, the IAK that is central to the lived experiences and culture of local farming communities of Anchetty. The alternative spaces created through the school competition respectfully carved out a niche for the IAK dominated agricultural knowledge – often subjugated by modern science – and responded well to calls for pedagogues to consider new ways of teaching food and nutrition in school (Welch, McMahon, and Wright 2012).

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