

Improving Dietary Diversity of School Going Children

(with the Help of WebGIS and Mobile)

Using school online learning and environmental education as opportunity

Background

Malnutrition is a major problem in the country. Poverty is the root of the problem for a very large part of the population. Social discrimination that still prevails cannot be wished away as affecting nutrition patterns. However, from the other causes, one major cause is lack of awareness of the sources of nutrition and food that are often available in local surroundings . In the past these sources were obtained without the mediation of markets. While traditionally many nutritional foods were part of local food, the combination of monetising the economy , trade and destruction of natural environments and shrinking of biodiversity all have led to poor food availability, poor scores of diet-diversity in turn leading to malnutrition. Induction of 'refined' foods, packed junk food and misleading food advertisements have further eroded the quality of nutrition intake.

Due to COVID-19, the school education has taken a big turn towards 'online'. Blending online with the activity, project oriented learning is becoming extremely important. Using some simple activities , using shared devices, mobiles, and the web is a way to reach out to at least those children who have access to devices and networks. But connecting the virtual medium to real life problems will be critical in maintaining the interest and motivation of the children . A web based interface, dialogues and debates , projects with interaction with the community around , and showing off the results will generate a cycle of learning. This learning process will be more effective if it involves students of multiple age groups , some duly trained on higher level techniques . Learning is social. So a social communication medium that consciously overcomes the language barriers by using a multi-lingual medium, will make this knowledge generation process more effective.

Food, nutrition and health are intricately related to sanitation and waste management , the latter being already recognised as necessary components of school education. In general scores of orders from Supreme Courts and High Courts have mandated environmental education in schools and colleges. Would that complex , multidisciplinary learning be possible without an integrating platform like GIS?

A webgis platform, [Communitygis](#) has been designed with this perspective.

A question arises: The process of influencing diets for better nutrition is complex . It amounts to behaviour change on a large scale. Any attempt to use the online resource has to be considered in this context. Indeed the proposed online knowledge content will be curated in a local, lived environment. Can teachers alone do that ? Can a community of experts (nutrition experts, doctors, community leaders), educators, parents, multi-age groups along with adolescent students and peers create social intercourse across the digital media to overcome this limitation?

Given the diversity of India (rural/urban, even with rural tribal, backward, richer areas , even in urban schools, posh locality, middle class, lower middle class, municipal schools etc) no single solution will work. Many things may be common in some , or some may be common in all,) this project proposes to offer a platform for a variety of situations and a variety of agencies.

If one pretends to reach any deeper level in this country in schools, we will have to adopt a multi-lingual approach. Even this concept note should be available in many languages and all other content. The project at IIT Bombay , called Spoken Tutorial is one way of multi-linguality we can adopt. Use of voice medium will also be fruitful.

Introduction

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals (FAO). Although dietary diversity is a proxy for nutrient adequacy, it is not a replacement. A traditional detailed diet recall will be more capable of estimating nutrient intake. We should look at providing an entry point for the participants to enter their existing dietary recall to be calculated for nutrient intake estimation. Recommendations for inclusion and exclusion of food can be given to rectify the current nutritional status. This will also improve their understanding of nutrients and their food sources. Since assessing household food access or individual dietary intake is a time consuming, expensive and cumbersome process requiring a high level of technical skill both in data collection and analysis, monitoring own dietary practice using these techniques becomes difficult. Thus assessing dietary diversity represents a rapid, user-friendly and easily administered low-cost assessment tool. The present concept note has attempted to integrate technology with conventionally used dietary diversity measuring tool in such a way that an individual can assess the diet quality of his/her and set a goal to improve it further. The same could be extended to the community through a conversation across the community . Thus through schools, the community will educate itself about the food diversity, the good practices of past , present, often poor quality thrust by commercials, impact of dietary lifestyles, connection between health, nutrition and education and best use of communication technology for better living. Parents are the food givers. They remain important. But Their ignorance about nutrition could be cause for concern. These are the challenges.

Objective

It is proposed to create a platform, develop prototypes and pilots to demonstrate how digital technology , with spatial data , web and mobile access can be used to create a knowledge engine .

It is proposed that the essence of science be made available to all regions, classes (and castes) , languages for conversations , debates , exchange of notes, creation of the new language to address the issues .

It is proposed to create alternative knowledge channels in contrast to the commercials that not only influence the gullible minds but in fact create monotonic products out of channel-surfing 'consumers'. This alternative cannot be anywhere but through a platform of schools and colleges where critical thinking is at least honored , even if not practiced adequately.

It is proposed to create the stores of anonymized , time series (BIG?) data of regional variations of sources of nutrition , those consumed and those not used, and the trends in the health outcomes in the regions. This will be usable by health authorities for interventions and by the public health researchers for analysis and innovations.

It is proposed to **support the national trend of digitisation of health (seen in contrasting but massive initiatives like NDHB(National Digital Health Blueprint) brought out by Min, of Health and Family Welfare on one hand and NHS (National Health Stack) promoted by NITI Ayog. While both above documents point towards privatisation , there exists a historical massive infrastructure including human resources in public health. The latter needs data as "Data is the new OIL".**

While looking at what junk food does to harm the individual health, sustainability demands looking at the side effects of junk food on the surrounding environments like multi-layer plastics, as non-recyclable permanent nuisance. It is proposed to create a platform to connect the two the individual and environment to expose students to the thought models to promote sustainability.

Encourage school students to set up nutri-gardens (in schools/homes) after understanding how to maintain diet-diversity

Theory

Why digital way : [Seymour Papert](#) has outlined the role of computers in his seminal work [Mindstorms](#) : **Children Computers and Powerful Ideas**. Papert talks of (Ref *Mindstorms* 1980) "ways in which the computer presence could contribute to mental processes not only instrumentally but in more essential, conceptual ways, influencing how people think even when they are far removed from physical contact with a computer (just as the gears shaped my understanding of algebra although they were not physically present in the math class). It is about an end to the culture that makes science and technology alien to the vast majority of people. Many cultural barriers impede children from making scientific knowledge their own. Among these barriers the most visible are the physically brutal effects of deprivation and isolation. Other barriers are more political. Many children who grow up in our cities are surrounded by the artifacts of science but have good reason to see them as belonging to "the others"; in many cases they are perceived as belonging to the social enemy. Still other obstacles are more abstract, though ultimately of the same nature . (objects).....in the form of small computers, will cross these

cultural barriers to enter the private worlds of children everywhere. They will do so not as mere physical objectscomputers can be carriers of powerful ideas and of the seeds of cultural change, ... they can help people form new relationships with knowledge that cut across the traditional lines separating humanities from sciences and knowledge of the self from both of these. It is about using computers to challenge current beliefs about who can understand what and at what age. It is about using computers to question standard assumptions in developmental psychology and in the psychology of aptitudes and attitudes”

Jean Piaget poses a model of children as builders of their own intellectual structures. Children seem to be innately gifted learners, acquiring long before they go to school a vast quantity of knowledge by a process I call "Piagetian learning," or "learning without being taught."

We really look at the "child as builder" . All builders need material. The problem of education may be described as poverty of the building materials that our 'builder' child has to work in. Can digital platform fulfill some of the gaps.

The building materials of the models are the concepts built into activities , conversations , communications and interactions.

To paraphrase Papert¹, we can give to the ..platform..the role of a carrier of cultural "germs" or "seeds" whose intellectual products will not need technological support once they take root in an actively growing mind.

¹ Indeed, the role I give to the computer is that of a carrier of cultural "germs" or "seeds" whose intellectual products will not need technological support once they take root in an actively growing mind.

Methodology

Here we would like to list the proposed guidelines, not exhaustive, for the project.

1. Create a knowledge resource using web based content management system (a web site with text, video content as also forum for discussion)which is easy to operate by non-techies.
2. Build a team of experts (like Nutrition Group of IITB, Faculty in Nutrition departments, Faculty in public health) to handhold , train the senior participants like school teachers and college students
3. Create a multi-disciplinary dialogue consisting of Home science, nutrition specialists, pediatricians and public health researchers and education etc.
4. Create a web interface which allows easy data input (photos upload as part of form filling, offline/online thru mobile) and creates opportunity for fun-learning
5. create learning opportunities for students in analysis of data collected and trends detected
6. an opportunity for students to create their own profile based on projects submitted , some thing they can proudly show off on the web as achievement
7. Create facility to use Food groups² as per Dietary Guidelines for Indians (ICMR 2011)³ .
8. create a multi-age group as learning hub where younger students get to see what older students and adults do , how they think and what tools they use . This as in learning theory is exposure to thought models that create aspiration for learning. It also creates a chain of MKOs([more knowledgeable other](#) or [more knowledgeable other](#))
9. Include occasional exercises for students to study symptoms to identify nutrient deficiency, standards for weight & height to monitor their health. This will connect food , nutrition to the health indicators.
10. Create a webgis platform where different regions are presented with classification(shown in different colors) based on diet diversity scores (average , max/min) so as to encourage a healthy competition. This is not just a display. But also for the school or community to intervene to improve the score. Awards may be instituted for better performances at individual, school and area level
11. Debates, project presentations online or offline, with a pat on the back for good performance, will be used to maintain a temp of activity among students.
12. Connect the diet-diversity to available bio=diversity . If not currently available, by encouraging to restore if destroyed. Thus make affordable and (often found) the diet diversity by leveraging the local traditions.

² Food Groups as per NIN, ICMR 2011: 1.Cereals, millets 2. pulses OR egg/meat/chicken/fish 3. Milk & Milk products 4. Roots & tubers 5. GLV 6. Other vegetables 7. Fruits 8. Sugar 9. Fat

³ Mean serves/day consumption of food groups by Dr Neha Rathi, HSS, IITB

<https://www.google.com/url?q=https://link.springer.com/article/10.1186/s12937-017-0272-3/tables/5&sa=D&ust=1594184993897000&usg=AFQjCNHVQ9T0dBjTdV60PVHbTeBBJ2txTA>

13. Use tutorials (like spoken tutorials of IITB) on types of nutrition, junk food, loss of nutrients in polishing or processing foods etc
14. Create incentives for teachers enabling the student and community interaction as per the Curricular framework.
15. The concept of Self Analysed Goal Establishment (SAGE) will be applied to trigger the positive dietary change among them and young age is the ideal time to establish the healthy dietary pattern for entire life.
16. Study the availability of nutri-gardens and possibility of creating the same in different regions.

Roles and Responsibilities

Roles and Responsibilities (Draft)			
	Student	As we intend to address student thru an insitution, because children are young and cannot take their own responsibility, and because their personal data is involved, they must be shielded. The students will there be de=identified using methods that will be advised by security experts . As such students will be registered in bulk by the institution(regular school or NGO) with a data controller who will be equipped with technical resources to encrypt and decrypt communication with out-side the institution that contains any personal information	students will input their info thru forms which also contain photos. Mentors will conduct activities with students and create reports : focus on trends in diet diversity score and diet knowledge score. The mentors will compute and evaluate these. The conversations that occur among students will be the basis of knowledge score. Students willll be arranged multi-age groups as far as possible. Through such reports created by mentors over a period, student profiles will be created. Self assessment by students on thses scores will be taken into account by mentors while evaluating. The evaluation by mentors will be taught and then supervised by the project or site managers .
	school coordinator	will be the authorised person organising students for the diet-diversity activities, including collaboration with mentors, organising debates and discussion, monitoring activities of the students etc	typically teacher champion
	School data controller	person equipped with technical resources and understanding the tools to encrypt-decrypt and store data safely. The role of data controller may be with the school coordinator id she is technically skilled and has the time to	Typically tech savvy teacher

		carry out these tasks	
	Mentor	contacts students in small groups and individually and conduct activities like sensitizing the students about diet, bring about conversation among students of same age group as well as among different age groups and record the progress of students diet-diversity score, about the progress of their understanding, their expression about diet diversity, the activities about nutri-garden, student's interaction with the community around etc	e.g MSc students
	Site managers	with enroll (register) all the above through the interface on website. More specifically appoint mentors and arrange groups of students to be associated with mentors. Also monitor progress of projects by mentors. Site managers will also encourage experts to add content as knowledge resources and base data. Content includes articles and papers on diet diversity as relevant. Base data includes data on food types, recipes, their food values and norms etc	Typically Post-grad students
	Tech support	Develop the website, take inputs from site managers and other users, and keep improving the interface, also create resources on website through content management system (CMS) and enable all users to keep uploading/updating the content	Typically IIT students, software developers

Web Platform

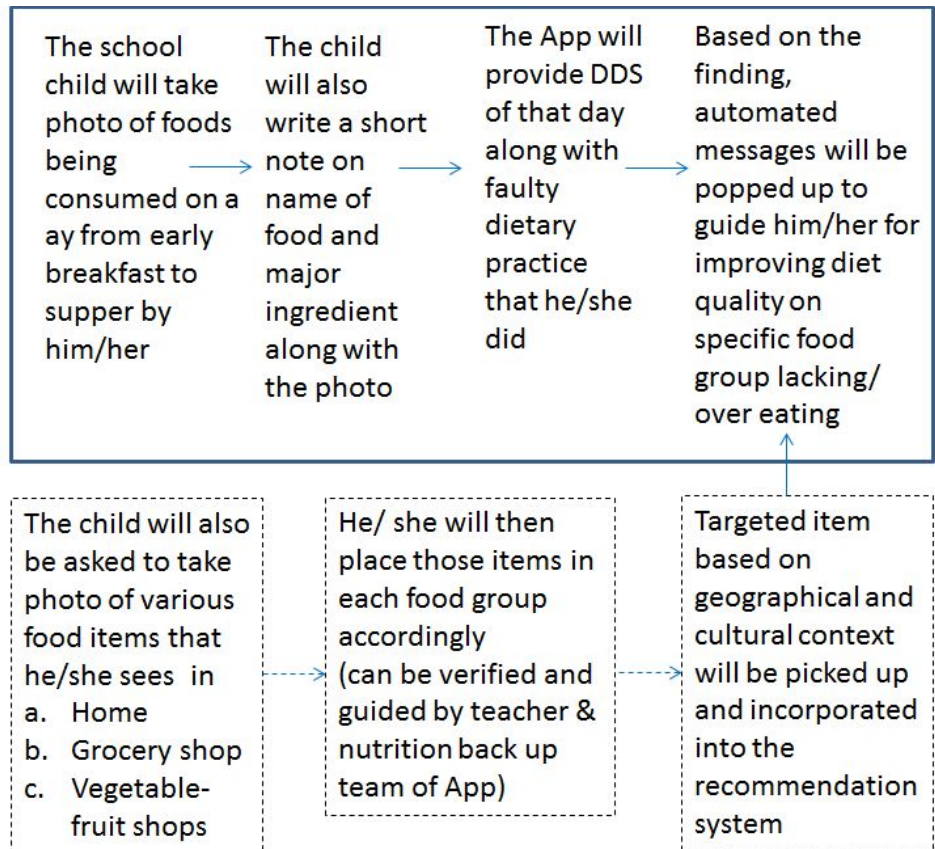
The [CommunityGIS](#) platform will be tweaked to create a theme of diet-diversity Education and community action. for school going children of (say) 12-16 (secondary and higher secondary) years old.

Pilots will be conducted to hammer out protocols of information collection, processing, privacy concerns (anonymisation) ,stigmas, inequalities (poverty not a stigma) , display, communication etc. Food practices in the region will also be recorded as say geo-tagged photos/videos to depict current practices, to record , from elders, traditional practices (may or may not be extinct) and thereby assess diet-diversity scores. Attempts will be made to leverage traditional or local varieties .

The main study will have quasi-experimental design which will assess the changes in the dietary diversity pattern of the school going children (may include their families) through the study period of one academic calendar. The concept of Self Analysed Goal Establishment (SAGE) will be applied to trigger the positive dietary change among them and young age is the ideal time to establish the healthy dietary pattern for entire life.

Targeted messages can be automated and developed based on the individual's record registered time to time in the app. The app will have additional features of showing nutritive value of various regularly consumed food from his/her plate. For this, nutritive values will be tagged from Indian Food Composition Database (ICMR 2017).

The schools or Board authorities may decide to include these as project-based-learning or Science , geography and computer education all in one or simply extra-curricular.



Issues

1. Is this a platform or a project ? If a project who owns it? who funds it?
 - a. (A platform for subject domain specialists to use. Projects will require hand holding till the technology is absorbed)
2. poorer sections of students find it embarrassing to display their poverty. Will they feel this as humiliating to have to display their poverty?
 - a. Good samaritans will have to distill the information and present the same in scientific, non-supercilious manner only if not hurting any feelings)
3. In India, many especially persons branded as lower castes and tribals are discriminated based on their traditional food items...How do we overcome this big hurdle to involve all?
 - a. a scientific temper and compassionate environment is a must to overcome this
4. More than 50% of students do not have access to devices, connectivity , even on shared basis. Do we wish to restrict to the privileged 50% only?
 - a. Admitting that the tragic situation exists, the only way to bridge the digital divide is to pose the problem and show the utility of the digital to all sections of the

community. Possibly there will be stronger aspiration among the deprived community and politics may be shaped by that.

Procedures

1. Students may be asked to discuss what they understand about diet diversity and its relationship to health? How do they see their taste and practice in the light of the knowledge they have. The conversations are recorded on voice. The senior students or Home science students draw some inferences on a group of such conversations.
2. students may be requested to watch a few videos (spoken tutorials etc) and give comments :
 - a. Type 1 and Type 2 nutrients [Type 1 and Type 2 nutrients - English](#)
 - b. Junk food : [Junk food - English](#)
 - c. Reasons for increase in junk food consumption : [Reasons for increase in junk food consumption - English](#)
3. students will be asked to discuss what they feel about diversity and nutrition and document their observation (as benchmark of 'before'⁴ knowledge
4. students may be asked to discuss with grandparents , teachers and peers and parents what they feel about diversity: the terms that indicate their ideas^[5] Understand changes introduced in food practices across generations caused by scientific understanding (good) and commercial(not always scientific) forces and cultural (like urbanisation) influences. See also [What foods did your ancestors love? Aparna Pallavi](#) .

⁴ prior to and after viewing/interactive game or completion a specific task module a knowledge attitude and practices(pre and post) as a score can be obtained

⁵ **Seymour Papert, *Mindstorms*, 1980** " In this book we have considered how mathematics might be learned in settings that resemble the Brazilian samba school, in **settings that are real, socially cohesive, and where experts and novices are all learning.** The samba school, although not 'exportable' to an alien culture, represents a set of attributes a learning environment should and could have".

5. School students may be asked to survey young children 6 months to 5 years in their vicinity and make some observations in a structured form. Asked to discuss nature of health observations and correlate the same with food
6. a student can also be asked to take photos of food served in his/her home, school canteen and Mid-day meal . With access to mobile a form may be filled which includes a photo and location info.
7. He/She can also be asked to click pics of the contents of lunch boxes brought to school .
8. Games will be developed with levels for a student to score and get rewarded. Graded games will be created for students to achieve scores.
9. some older children may be asked to analyse the conversations and distill the knowledge base , 'ontology'^{6, 7} (terminology with meanings, scope) on diet diversity and nutrition
10. Students may be asked to discuss advertisements in media : possible misleading . Debate competitions may be organised .
11. discussions will be held on the diet diversity to be held among multi-age groups and recorded (audio, video). The same may be indexed based on capturing the necessary gaps or on sufficiency of awareness.
12. Regional or school-wise web pages will be created in CMS with links to GIS. Schools and students will have a choice to publish anonymized data . Individual students can maintain private pages to maintain their timelines and their profiles . The same will be public only after double checking with parents and teachers.
13. Older students to present analysis and suggest interventions. The same may be okayed by experts and commented upon, for improvement.
14. Projects may be designed for interventions with impact assessments
15. students may be asked to observe use of pesticides in the agriculture or pest control around them and asked to discuss how that may affect their food.

⁶ [ISO-FOOD ontology: A formal representation of the knowledge within the domain of isotopes for food science](#)

⁷ <https://genesandnutrition.biomedcentral.com/articles/10.1186/s12263-018-0601-y#ref-CR14>

16. Encourage students to sow and harvest the nutritive foods and show the timeline (series of photographs) online
17. standardised reports may be generated for different regions and compared . Methodologies for comparison be developed
18. Infographics to be developed for understanding the data generated.
19. distinguish factors affecting DDS between Urban and Rural children

Expected Outcome

This study will provide

1. Mapping of commonly used cultural and current (including junk) food practices across the nation. This ongoing , anonymized, data bank would be a useful benchmark for researchers.
2. Tracking DDS at individual level, from micro to macro geographical regions
3. Provide feedback to individuals through expert guidance
4. Indexes or grades , on color maps for different areas according to Diet_diversity_scores(DDS) . Could be used to build up a healthy competition among areas to achieve better score.
5. Opportunity to influence DDS by encouraging healthy dietary practices and eliminating faulty ones
6. Sensitization about diverse food intake from very young age to make the practice more sustainable
7. Relate the data collected with height-weight of school-going and younger population
8. Decision support system for nutrition intervention (fortification of food or encouraging community kitchen to make available balanced diet
9. Resource bank for content for education
10. Possible material for applications like AI and ML for better management of food .
11. experiences of cultivating nutri-gardens in different agroclimatic areas, on different scales with and without expert guidance, with and without IOT and such technologies

Technology

1. wishlist
 - a. input data easily and see it consumed on the web
 - b. decide area-of-interest as per school

- c. create separate urban/rural models of admin boundaries and define layers like building locations, clusters, wards/villages, etc
 - d. treemap : with data on trees about types of food they can produce
 - e. vegetation/agriculture
 - f. interface to query : look for trees with fruits caving say zinc or something like that
 - g. sources of food
 - h. create school-wise or area-wise web pages
 - i. create student profiles with complete control on what is published and due respect of privacy.
 - j. Provide tools to maintain privacy of personal data while making available, within limits, aggregatable data for regional analysis.
2. roadmap(priorities)
- a. show how a geotagged photo can be uploaded and the same will appear in the webpage at appropriate location. Can the photo (of course of food, never of the person) also be tagged with food groups as interpreted by students while back up may be maintained identifying the student with the photo, can the photo be anonymised so then onwards only region (at suitable level of granularity) is the only identity
 - b. Assuming that several persons see the photo and determine the score of diversity, create a database of observations . Thus experts can verify if the observations are appropriate .
 - c. Create a CMS linked to GIS with roles such as student, school, area . User management to be implemented for login, passwords and permissions to be controlled by schools or parents. Roles of domain experts to be defined.

Tutorials

1. Food related

- a. Spoken tutorials (available in multiple languages)
 - i. Type 1 and Type 2 nutrients [Type 1 and Type 2 nutrients - English](#)
 - ii. Junk food : [Junk food - English](#)
 - iii. Reasons for increase in junk food consumption : [Reasons for increase in junk food consumption - English](#)
 - iv. What foods did your ancestors love? Aparna Pallavi : [What foods did your ancestors love? Aparna Pallavi](#)
 - v. How to create a nutri-garden : planning given area into different crops. Challenges posed.(national webinar of nutri-gardens)
 - vi. Healthy Food Vs Junk Food Song!
https://www.youtube.com/watch?time_continue=21&v=fE8lezHs19s&feature=emb_logo

- vii. **Classes of food with examples and functions** Read more:
[The basic classes of food with examples, functions and pictures](#)
- viii. https://youtu.be/wsU_O2QbvfM
- ix.

2. Technology related

- a. map making (using mobile, desktop, fieldpapers etc0
- b. editing
- c. styling of maps
- d. map on web
- e. query maps

Pilot

To be conducted in

- 1. some tribal areas (ashram schools)
- 2. some urban schools in poor, middle and rich regions
- 3. some urban schools in posh area
- 4. Some urban NGOs(like [Asha](#))

Scenarios

- 1. students takes photo, geotagged of her own thali and full day coverage
- 2. student talks to grand parents to understand what variety of food they ate and reports in a voice record or video record
- 3. a few students discuss how to determine diversity score and why it is important
- 4. some senior students with training,like Home science PG converse with the above students and ask pointed questions to navigate them to right questions and scientific understanding
- 5. A group of IIT researchers, public health specialists and Home science faculty and students have a bulk of evidence
 - a. of conversations among children, their findings of the food diversity .
 - b. trends of malnutrition in the area
 - c. difference of attitudes across generations
 - d. cooperation or resistance from different segments
 - e. corporate packaged food lobby response and conduct a seminar
- 6. A group of students of colleges with different language background get together and build a dictionary ([wordnet](#)) for food items and diet diversity

Partnerships

Discussions have taken place with possible partners

1. [Niramala Niketan](#) (proposed)
2. SNTD, SVT (proposed),
3. [Asha](#),
4. SCERT (proposed) Maharashtra
5. Govt schools/Tribal schools
6. Schools , Colleges (proposed)
7. NGOs in education like [Eklavya](#) (proposed)
8. Sahayak Trust (Proposed)
9. Baif (nutri-gardens)(Proposed)

References

POISON IN FOOD

Ban pesticides? <http://egazette.nic.in/WriteReadData/2020/219423.pdf>

NUTRITION SCIENCE AND EDUCATION

[Challenges and opportunities for better nutrition science—an essay by Tim Spector and Christopher Gardner](#)

[Effect of an Education Program on Nutrition Knowledge, Attitudes toward Nutrition, Diet Quality, Lifestyle, and Body Composition in Polish Teenagers. The ABC of Healthy Eating Project: Design, Protocol, and Methodology](#)

[Level of nutrition knowledge and its association with fat consumption among college students](#)

[Nutrition Exchange South Asia](#)

[गोटल – महाराष्ट्र जनक कोश प्रकल्पाची सुरुवात](#)

[Let Food Be Thy Medicine](#)

<https://vimeo.com/388559982>

[Ecosystems and human well-being: Health synthesis](#)

ONTOLOGY

<https://wordnet.princeton.edu/> ,

<http://www.cfilt.iitb.ac.in/wordnet/webhwn/>

<http://www.cfilt.iitb.ac.in/wordnet/webmwn/>

<https://genesandnutrition.biomedcentral.com/articles/10.1186/s12263-018-0601-y#ref-CR14>

[ISO-FOOD ontology: A formal representation of the knowledge within the domain of isotopes for food science](#)

CONSTRUCTIONISM

[Papert - Mindstorms 1st ed.pdf](#)

[The Children's Machine](#)

DIGITAL FEUDALISM

[Preventing digital feudalism – Mariana Mazzucato](#)

[Digital Feudalism. How the data ecosystem is becoming... | by Zach Scott](#)

NUTRI-GARDENS

[Nutri_Garden_Docs_Links](#)

Phases Planned

The study will be planned in 3 phases.

Phase I

This phase will involve creation of the database for developing the app. Database will include description of common dishes of habitual diet along with their photos, portions and process technique (boiled, fried, steamed, baked). Variability of pictures and portions of the dishes will be used for customizing the database. Diet survey protocol will be used for this exercise. Major ingredients of the dishes will be taken into consideration to mark the food group.

Phase II

Pilot study involving students from class VI-VII will be conducted in this phase. As part of the curriculum of project based learning, this will be taken up. Students will be asked to capture photos of every food (home food, school tiffin, snacks, canteen stuff) that they are consuming each day from breakfast to dinner. Report of this exercise will be generated after one week after considering average food group intake for 7 days.

Phase III

This includes the implementation phase of the study with quasi-experimental design.

ER-DIAGRAM

