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STUDENTS' ENGAGEMENT WITH A CHAPTER ON 'FOOD PRESERVATION'

Rohini Karandikar and Rupali Shinde
Homi Bhabha Centre for Science Education, TIFR, Mumbai
rohini@hbcse.tifr.res.in, rupali@hbcse.tifr.res.in

The present study is part of a longitudinal project titled School Science Research and Development- Participatory Action Research. The study aimed to understand grade 5 students' ideas and experiences in relation to food preservation. In 6 sessions of regular school time, we found that a game, an activity and a worksheet on the topic made it possible for students to bring their daily experiences into the classroom. The discussions brought to the surface some misconceptions of students and also highlighted the language difficulties that students face with technical terms. The students' responses on the sub-topics showed a high level of student engagement and awareness of the ill-effects of food preservatives on health.

INTRODUCTION

The Indian school education system has undergone a major overhaul with emphasis on child-centred teaching-learning process. The National Curriculum Framework (NCF, 2005) recommends that "teaching of science should enable children to examine and analyze everyday experiences"(page ix). With reference to everyday experiences 'food and nutrition' is certainly a suitable theme for classroom science considering that natural, social, cultural and environmental aspects are associated with it.

Food and nutrition education is at the intersection of different fields of scientific and traditional knowledge and includes life experiences, cultural knowledge and practical experiences according to Rangel, Nunn, Dysarz, Silva & Fonseca, (2014), with reference to Brazilian schools. In the Indian context, very little scientific research or training programmes are conducted in the context of public health and nutrition (Khandelwal & Kurpad, 2014) which could contribute to the malnutrition and poor health of Indian adults and children. While there are larger social dimensions to the existence of malnutrition in Indian society (Sahu et al., 2015), nutrition education is important in the school setting. Studies in nutrition education discuss the need to design educational strategies considering students' prior knowledge, abilities and cultural relevance (Pérez-Rodrigo & Aranceta, 2003). Additionally, educational strategies should be engaging, creative and inexpensive. Implementing such strategies requires time as well as sustained interaction. According to Dixey et al.,(1999) school-based nutrition education should go beyond providing information to developing skills in the areas of food preparation, preservation and storage.

Textbooks at the elementary school level provide scope for including a wide range of topics related to food e.g., 'Food for all', 'Constituents of Food' and 'Methods of Preserving Food' (Grade 5, EVS textbook,

Maharashtra State Board). The focus of this paper is on 'Methods of Preserving Food', as this topic emphasises both the science and the technology involved in food preservation. It also opens up possibilities for engaging students in discussions of local practices and diverse methods of food preservation.

We are a part of a Participatory Action Research project (PAR) in a low-income, Marathi medium school near our centre. In PAR, the focus is on the development of communities rather than the academic interest of the researchers (Cohen, Manion & Morrison, 2011). The current project is a longitudinal study with the objectives of improving the quality of science and environmental science (EVS) education in a nearby school and preparing of instructional material that can be shared with teachers. This project has already completed four years of collaboration between members of our centre and teachers of grades 3, 4, 5 and 6 while following one batch of students from grade 3 onwards. Some details of the objectives, experiences and learning of the first two years of the project have been reported earlier (Deshmukh, Bhide, Sonawane, Chunawala, & Ramdas, 2018).

OBJECTIVES OF THE PRESENT STUDY

This study focused on grade 5 students' knowledge and ideas informed by their experiences of the topic 'food preservation' and their attempts at making connections with food preservation methods and the related terminologies introduced in school.

METHODOLOGY

As part of the PAR project, we interact with the school teachers on a regular basis and help plan out the sequence of activities to be carried out in completing the topics in the textbook of Environmental studies. The project members of our centre develop these sequences and share the details with the teacher for her inputs. Typically, we get about a week (5 days) to complete a topic. The topic "Methods of Preserving Food" covered sub-topics which included need for storage of food, food spoilage and micro-organisms, and methods of food preservation (drying, cooling, boiling, placing in airtight cans, and others). Other than these topics mentioned in the textbook, we decided on 1) a game of arranging picture cards consisting of food items, 2) classroom interaction (based on concepts in the textbook) 3) activity of exploring empty food packets and finally, 4) a worksheet on methods and forms of preserving certain foods. For the game and the task on exploring empty food packets, students worked in groups. Worksheets were solved in teams of two students each.

Research Design

The study was planned as an exploratory research with a focus on gaining insights about students' ideas about the topic as well as connections of the topic to their daily experiences.

Participants

The study was carried out on the same class of grade 5 students who are a part of the PAR project. There were totally 70 students (30 girls, 40 boys) in this classroom, who had varied socio-economic and cultural

backgrounds. The school overall caters to the lower socio-economic classes. Although the project is of participatory action research, when we conducted the current study, the teacher was unavailable due to some personal circumstances. Hence, one of the authors designed the activities and also taught in the classroom while the other author observed and took detailed notes of the classroom sessions.

INTERVENTION

To elicit students' ideas on shelf life of foods, the lesson began with a game (Day 1) in which students were required to arrange picture cards of 5 food items in increasing order of shelf life, i.e., in the order of food item getting spoilt first to food item staying fresh for the longest duration. The picture cards were of banana, milk, *chapati*, garlic and turmeric. For milk and turmeric, pictures of the packets containing the respective food were depicted to avoid any confusion. Students were divided into groups of 6 each. The question asked was; *if all of these items are kept at room temperature at the same time, in what order would they spoil?* Students were asked to provide reasons for the sequencing of their picture cards.

On days 2 and 3, students were engaged in classroom interaction about the concepts in the chapter as mentioned in 'Methodology'. On day 4, students were given empty packets of food items to engage with information on expiry date or 'best before' date and instructions on storage. On day 5, students were provided with a worksheet. Worksheets can be used as a mode to construct knowledge (Che-Di Lee, 2014), can support students' thought (Reid, 1984) and can be used by teachers to understand students' previous knowledge (Krombab & Harms, 2008). Through a worksheet, we can also involve every child in the learning-teaching process and can identify and address student misconceptions and facilitate learning for understanding (Griffin & Symington, 1997). The objective of the current worksheet was to understand students' learning and knowledge on food preservation and appropriate use of terms/diagrams to depict the same. The worksheet consisted of two questions. The first question required the students to suggest *ways* in which foods like mango, coconut, *amla* (Indian gooseberry), milk, and fish could be preserved and the *forms* in which they could be preserved. Students also could 'draw' the process or the product. In the second question, students were asked to write their favourite preserved food and its benefits, disadvantages and healthy alternatives for the same.

DATA COLLECTION AND ANALYSIS

The outcome of the game on picture-card arrangement was documented in the form of photographs. Worksheets solved by students and observation logs of classroom interactions served as data sources. Data was analysed qualitatively, wherein we have identified themes from students' responses and then analysed them.

The game (Day1)

The game was aimed at engaging the students and giving them some insight into what they would learn in the next sessions. Students worked in groups, discussed and collaborated on the appropriate arrangement of the picture cards of food items. A representative response from a group is shown in Figure 1.

Figure 1: Representative arrangement of picture cards depicting various food items.

The graph (Figure 2) indicates responses from various groups on the positioning of the food items. According to the graph, most groups indicated banana at the 1st position, suggesting that it can spoil first among the given items.

From Figure 2, it can be seen that most of the students reported the shortest shelf life for milk and banana. In the next position, again, milk, banana or chapati were mentioned. However, since more students stated that banana would spoil before milk, we probed this response. Students argued that "*the banana has already developed blackish spots, hence would spoil even before milk*". Their reasoning could be attributed to the fact that the banana in the picture card was a ripe one. For this game, it would be worth looking at students' responses to a picture card with a fresh and completely yellow banana. The longest shelf life was mentioned by students for turmeric, garlic and *chapati*. Picture cards of turmeric and garlic remained mostly at the last place indicating that students did understand that these items have a longer shelf life. These picture cards can be used as a resource for engaging students before discussions on topics related to food preservation.

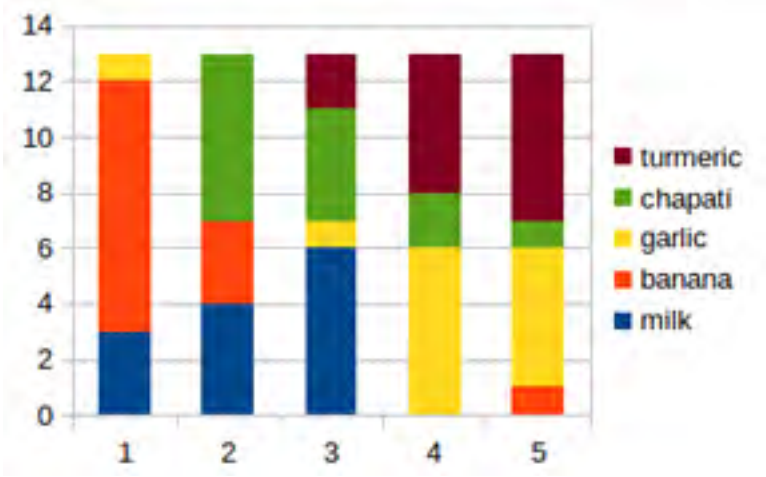

Figure 2: Graph representing students' responses in arranging picture cards. X-axis: position of food card with reference to their shelf life, indicating least shelf life to longest shelf life, Y-axis: Number of responses for that position.

One of the students mentioned (and other students agreed) that turmeric is *Ayurvedic*, hence, doesn't spoil easily and is thus at the last position. Another student added that 'being *Ayurvedic*' is the reason why turmeric is applied to wounds. *Ayurveda* is an alternative medicine system of natural healing with historical roots in

India. It appears from students' responses that they have tried to establish a connection of food spoilage with *Ayurveda,* indicating the false generalisation that if anything is used in *Ayurveda,* in this case, turmeric, it will have a longer shelf-life. Students may not be aware of the fact that milk, too, has a place in *Ayurveda* but spoils quickly. Thus, following the constructivist approach, presenting students with examples of foods used in Ayurveda but having a shorter shelf-life would help them understand that any food item with *Ayurvedic* properties need not necessarily have a longer shelf-life.

Interactions on 'preservatives' (Day 2 & 3)

In our interactions with students we found that they were unaware of the word used in the textbook for 'preservatives'. The word in Marathi for preservative (परिरक्षक) is highly technical and it is not surprising that students were unaware of this word. This word is unfamiliar to most adults too. When we discussed this word we found that students were confused between 'preservatives' and 'preserved foods'. Since one of our aims in the SSRD-PAR project is to focus on language, we would like to engage students with etymology of certain technical terms. Thus, introducing the term परिरक्षक = परि (around) + रक्षक (protector) could possibly enable a better understanding of the term.

Students were however able to tell about the harmful effects of preserved food such as "*too much oil may lead to throat infection (pickle)", "high blood pressure", "high sugar (diabetes)", "stomach infection*". These responses indicate students' awareness of disadvantages of consuming preserved food items. Further, to probe students' knowledge on the advantages of making preserved foods at home, we considered the example of *papads* (poppadoms). It was apparent that the practise of making *papads* was common in many students' families. This led to an animated discussion about the advantages of making *papads*. The responses received from students were: "*we save money by making papads at home," "we can make papads of various sizes and composition as desired," "can regulate the nutrients," "can be sure of hygiene."* Surprisingly, students did not, on their own, mention that we could also sell papads and make money. This is despite the fact that *papad*-making is a thriving cottage industry in India.

Engaging with food packets (Day 4)

Since empty food packets are rich in information regarding ingredients, nutrients, storage and packaging conditions, we thought that these packets are good resources to engage students in discussion about nutrition, storage and shelf life. Each group of 5-6 students was given an empty food packet and was asked to observe the packets carefully. The students were asked to mention all the details they could find on the food packets.

Not all food packets had an expiry date, instead, some had a date of packaging and a "Best Before" date. Most students struggled to read and understand the information in English and also due to the small font of the details on the food packet. Also, deducing the expiry date from packaging date and 'best before' date was challenging, as this required reading the dates in English and counting. However, a few months after this intervention, it was heartening to see that students mentioned the concept of 'expiry date' in at least 3-4 interactions, on related sessions on medicines and food. It is apparent that students had possibly picked up the skill to read a label after this activity or were aware of the need to do so.

Worksheet (Day 5)

This section presents students responses to the worksheet which required them to respond in writing or through drawings about methods of preserving foods. Students gave diverse examples of preservation of the food items provided on the worksheet. They drew or wrote about various techniques like drying, freezing, use of preservatives like oil, sugar, salt, etc. for preserving these foods (Table 1). The responses indicate students' experience from observation/participation in preserving foods. However, certain responses like '*keeping in dried grass/hay*' for mango is actually a technique to ripen mangoes in a short duration of time. Similarly, keeping foods in vessels is a way to store and not preserve a food item. Such responses indicate the need to clarify the difference between 'preservation' and 'ripening'. Interestingly, students also wrote that '*coconut can be left on the tree*' or '*fish can be left in water'*, so that these foods follow their natural course, which, again, are not methods of preservation, but are relevant methods of preventing wastage of food. It was heartening to see that students have such broad conceptions that involve ideas of delaying harvesting, fishing only when needed and converting into other food products like extracting oil.

Theme/ Categories	**Food Item (Mango, Coconut, *Amla*, Milk, Fish)**
Method of preservation	Drying, [(drew Sun, coconut, amla], Applying salt (fish)
Make a food item	*Barfi* (coconut sweet), *Paneer* (cottage cheese from milk)
Natural course	Let it be on tree (coconut), Let it be in water (fish)
Refrigeration (short-term)	Keeping in fridge (milk)
Storage, not preservation	Keep in vessel (mango), Keep in bag (coconut)

Table 1. Students' representative responses to the question on methods and forms of preserving various foods. Words in parentheses indicate the foods for which the particular response was given.

In the next part of the worksheet, students were asked "What is your favourite preserved food? What are the advantages of that food? What are the risks of eating that food? Can you suggest healthy alternatives for such foods?" Table 2 summarises the students' representative responses. Students' responses indicate that they were able to suggest alternative foods that could be made at home using similar source materials, compared to the commercially available foods that contain a large amount of salt, sugar or oil as preservatives. From the worksheets as well as classroom discussions, it was apparent that students were aware of the ill-effects of excess oil, sugar and salt on health. They were also aware of regulating the amount of preservatives while preparing side dishes such as jam and sauce at home.

Preserved food	**Advantages**	**Disadvantages**	**Alternatives to preserved food**
Pickle	Can eat during meals (as a side dish)	Can cause coughing (due to excess oil)	Tomato, Mango (can make side dish/salad using tomato and mango)
Jam	It stays longer	Too much sugar	Fruit (homemade jam using fruits)
Sauce (ketchup)	Longer shelf life	Salt in blood (sic)	Add less salt while making tomato sauce at home

Table 2. Representative responses by students to the question on benefits, disadvantages and alternatives for preserved foods

The worksheet, thus provided an opportunity to discuss, think critically, draw and write about students' understanding of 'methods of food preservation'. This worksheet can be modified to include other items within students' experiences, and can be a resource material for teachers to initiate discussions around the topic 'Methods of Preserving Food'. Additionally, it will be helpful if students can collate information on various foods preserved in their family/community traditionally and the different ways of preserving foods in communities. This can be done by recording oral history of the various food preservation techniques followed for different foods, from elders in the community.

CONCLUSIONS

The study indicates that students were able to connect experience from their daily lives with the themes in the chapter and could also acknowledge the social aspects of food preservation methods. They were aware of the health risks associated with food preservation. The various tools of teaching, namely picture cards and empty food packets aroused students' curiosity with respect to shelf-life of foods, and storage and packaging conditions. These tools including the worksheet are inexpensive educational strategies that involve students in activities and discussions. Thus, there is a wide scope for making 'Food' as a part of curriculum throughout schooling, especially with respect to 'Methods of Preservation', as it opens up new avenues for students to explore various areas of learning associated with 'Food'. It is surprising that there is no topic related to 'Food' in both the Maharashtra State Board and the NCERT curriculum after grade 7. We would like to urge the inclusion of various aspects of 'Food' under the sub-themes such as design and eco-friendly practices in packaging and disposal, 'food poisoning' as a major health issue and its prevention in higher classes.

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