Bridging the Gap: An Alternative Solution to an Alternative Framework

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This paper discusses the alternative frameworks of elementary school students from four ethnic groups—Chamorro, Filipino, Pohnpeian, and Yapese. An interview was conducted by 20 teacher candidates from Guam (comprising Chamorros and Filipinos), nine from Yap, and 15 from Pohnpei. The conceptions of the elementary students who were interviewed indicate a need to make students aware that the way they think is quite different from the framework used by scientists. The 44 teacher candidates in this study developed instructional strategies to assist students in building the appropriate conceptual links between what they already know and what they ought to know. The effectiveness of their instructional strategies is the focus of this study.

Keywords: alternative framework, misunderstanding, misconception, conceptual change

Introduction

When a student is faced with a new encounter, he/she constructs the meaning of it by connecting the new information received with prior knowledge. When the existing idea that is called upon to explain the new encounter proves its usefulness, the linked idea is confirmed.

It may be that there are some perceived similarities between the new experience and a prior one. In this case, an incomplete fit may occur, because there are only some similarities that exist between the current and prior experiences. The linked idea will have a complete fit only if it is slightly modified. Otherwise, prior knowledge is retained and the new knowledge is not accommodated.

However, in the construction of a modified knowledge, a misunderstanding or a misconception might take place. A good example is the students’ construction of meaning of the word energy. Young students always associate energy with strength (Ferrer, 2008). When asked about the food that gives them the most energy, rice is a consistent response. To them, eating rice would make them stronger compared with eating sweets or drinking high-energy drinks with high percentage of sugar.

When the new encounter does not fit at all with any prior learning experience, the information from the new encounter is abandoned. There are, however, possibilities that the knowledge gained from the new encounter may be accommodated falsely. If the student perceives that the information before him/her is important for examination purposes, then this information is accommodated in the short-term memory. After the need for it is satisfied, it is removed from memory as if that information is never encountered at all.

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Students’ Conceptions: The Driving Force for Teaching

The afore-mentioned discussions suggest that students’ conceptions can override the knowledge being presented in class, distort new information, or co-exist with new information. These conceptions need to be addressed in instruction so that students will understand the lesson presented to them. Before any attempt to address it, the teacher should assess first the kind of conceptions students bring to class.

In this study, the students’ conceptions of food were assessed using the interview-about-instances. This type of interview is a conversation between the interviewer and a student about situations represented in diagrams or pictures to probe the student’s construction of meanings. In this interview, the student is presented with a specific set of examples and non-examples of the concept. The student is asked to identify which cases are examples of the concept and then to explain that decision (Southerland, Smith, & Cummins, 2005).

Each teacher candidate from the following ethnic groups—Chamorro/Filipino (N = 20), Pohnpeian (N = 15), and Yapese (N = 9) was tasked to interview five elementary school students following the interview-about-instances procedure discussed in class.

The results of the interview-about-instances are shown in the summary Table 1.

Table 1

<table>
<thead>
<tr>
<th>Categories of responses</th>
<th>Frequency of responses by ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chamorro</td>
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<tr>
<td></td>
<td>N = 60 (%)</td>
</tr>
<tr>
<td>1. Solids eaten at mealtime are food (rice, chicken, fish, meat)</td>
<td>87</td>
</tr>
<tr>
<td>2. Liquids are not food (juice, milk, choco drink, lemonade, coconut water, soup)</td>
<td>92</td>
</tr>
<tr>
<td>3. Snacks are not food (e.g., cake, sandwich, nuts, ice cream, chips)</td>
<td>80</td>
</tr>
<tr>
<td>4. Those grown at home are food (fruits and root crops)</td>
<td>25</td>
</tr>
<tr>
<td>5. Fruits are not food</td>
<td>67</td>
</tr>
<tr>
<td>6. Sweets are food</td>
<td>17</td>
</tr>
<tr>
<td>7. Cooked things are food</td>
<td>37</td>
</tr>
</tbody>
</table>

The results of the interview revealed partial understanding and misunderstanding of the concept of food. Most of the misunderstandings came from the lower elementary students. More than 93% of the respondents believed that liquids were not food. The students’ responses show a dichotomy between foods and drinks. The two separate labels are posted everywhere in restaurants and supermarkets, and they are used to interpret drinks as not foods.

The same holds true with another label-snacks. They are not considered food, because they are not eaten at meal times. More than 75% of the respondents held this conception. Food was regarded as solids eaten at meal times (87%-93%) and did not include drinks or snacks eaten between meals.

Mixed responses were noted about fruits. For Chamorros and Filipinos (67% and 75% respectively), fruits were not regarded as food. They were considered as a separate category just like in supermarkets where “fruit section” and “food section” were found. However, Yapese and Pohnpeian respondents asserted that fruits were food, because they grew them, cooked some of them (e.g., banana, papaya, and bread fruit) and were served during meal times. To them, all root crops were also food, because they were always cooked and served at meal
times. On the contrary, the Filipino respondents alleged that they were not food, because they did not eat them. Only 37% of the Chamorros held on to the belief that they were food, because they grew them at home and they ate them.

An interesting revelation about ice cream came from the Yapese respondents. To them, ice cream is not food; it is a drink. They wait for it to melt and they drink it. Also, they do not have the term for “eat the ice cream” but they have a term for “drink the ice cream” in their language. Parents use the “drink the ice cream” term with their children.

Both Yapese and Pohnpeian respondents considered sweets as food (91% and 93% respectively). Chamorros and Filipinos believed otherwise. Sweets give them tooth decay and diabetes, and they make them hyper. The negative connotation associated with sugar is very common among younger students.

From the afore-mentioned discussion of results, the students’ framework clearly shows that it is a part of the everyday culture and cannot be eliminated. It is, therefore, important to teach students the difference between the two ways of looking at food and where it is appropriate to use the science framework. Furthermore, the students’ alternative conceptions of food need to be addressed by bridging the gap between what students know and what they ought to know.

**Bridging the Gap**

From a constructivist perspective, science teachers have to acknowledge the fact that children’s minds are full of ideas. Some of these ideas are misconceptions. Others show limited understanding of concepts. Misconceptions are resistant to change. Since they are tenaciously held in mind, they cannot be eliminated easily. What is needed is teaching for conceptual change. Conceptual change strategies activate students’ alternative concepts, stimulate dissatisfaction with their previous knowledge, and persuade students to accommodate the scientific knowledge that is presented in a plausible and understandable way (Alkhawaldeh, 2007). Conceptual change requires a constructivist approach in which learners take an active role in “testing out” their ideas, reorganizing their knowledge, and proving the correct concepts to themselves (Ferrer, 2008). Many studies showed conceptual change approaches—no matter which ones—as more efficient compared with traditional teaching strategies (Duit, Treagust, & Widodo, 2008).

Following were the various techniques used by the teacher candidates in this study to help students change their conceptual framework. There were 20 teacher candidates from Guam (comprising Chamorros and Filipinos), nine from Yap and 15 from Pohnpei who developed these techniques.

1. **Use of the food pyramid (Technique 1 by the Guam teacher candidates).**

   The food pyramid showed examples of food including those that were not considered food by the students, such as milk, juice, ice cream, cake, candies, carrot, lemon, banana, papaya, bread fruit, and yam.

   The students in groups discussed the foods in each food group and the nutrients derived from them. They were asked to challenge each other’s ideas and be explicit about their meanings. They were required to negotiate conflicts in their beliefs and then synthesized their knowledge that they would report to the whole class.

   After each group presentation, the students were given a handout on food nutrients for each food group to reinforce their newly acquired knowledge. They were also given food samples in picture cards. They were asked to group them according to the categories in the food pyramid.
(2) Study of food labels (Technique 2 by the Pohnpeian teacher candidates).

The students were shown food labels for drinks—milk, chocolate, and fruit juice. They analyzed the nutrients mentioned in the labels. Then they classified the drinks according to food groups in their textbook. In this way, the students were able to see that drinks were also food.

Finally, the students were asked to define what food was following a series of leading questions. Their definition was substantiated by what food did to the body. Then they were shown the pictures of foods that they did not consider as food during the interview. They were asked questions to challenge their initial beliefs about those foods. The idea was to make the students see the faults in their misconceptions and change them on their own.

As reinforcement, the students were asked to classify those foods in question according to food groups and discussed the nutrients they gave the body.

(3) Cooperative learning stations (Technique 3 by the Yapese teacher candidates).

Students were divided into three groups according to the food groups they follow in their curriculum—energy-giving foods, protective foods, and body-building foods. Handouts for these food groups with accompanying pictures of food were placed in the three stations. In cooperative learning groups, the students went from one station to another and discussed the contents of the handouts. A cooperative learning environment is necessary for successfully conceptual changing instruction (Franke & Rogner, 2011).

Then the students were given worksheets that required them to classify foods according to food groups. Those that they identified as non-foods in the survey were included in the worksheet. They were asked to discuss their answers with their group mates.

**Impact on Students’ Learning**

The students were given a post-test on identifying and classifying foods according to food groups. The results of these assessments are shown in Figures 1-2 that follow.

![Figure 1. Understanding of food (Identification task).](image-url)
performance in the food identification task.

The post-test consisted of two tasks—identification of foods and classification of foods into food groups. The post-test results for the identification task reveal 100% understanding of what food is by naming correctly foods and non-foods (see Figure 1, post-test). Only a handful of them (7 or 7% of the Guam student participants; 5 or 6% of the Pohnpeian participants; and 6 or 13% of the Yapese participants) were not able to meet the standard for the classification task (refer to post-test 1 in Figure 2). Since classification is a higher order thinking skill, it is difficult for some students to carry out this task without the pre-requisite skills to classifying.

To address the classification difficulty of the students, an application exercise was developed. It was the creation of a menu for lunch representing a balanced diet. This exercise which was suggested to be carried out through a cooperative learning activity would enable the students to discuss in detail the food nutrients present in the foods they want included in the menu. This application exercise which was considered a reinforcement activity was tried out with the participants the following day. Post-test 2 on classification was given and the results yielded 100% full understanding of foods and the nutrients they provide the body (see Figure 3, post-test 2).

According to Harlow (2009), students learn new information in two ways; they can either assimilate the new information, when the learning fits within current knowledge structures, or accommodate the new information. When the existing information must change to accommodate the new, the process of knowledge reconstruction or modification can take longer. As in the afore-mentioned scenarios, reinforcement—an added stage—was needed.
Figure 3 shows the performance of the students in this added stage of lesson development. The reinforcement strategy proved effective at improving the performance of the students in the classification task.

**Concluding Statements**

The findings of this study show that students from different cultures share many similar ideas about food. They have deeply imbedded misconceptions that are rooted in their daily experiences. Until these misconceptions are corrected, they will effectively disable the students from moving on to scientifically accepted models (Harlow, 2009).

There are instructional strategies which teachers can utilize to encourage conceptual change. Bransford (2000) suggested a bridging strategy by guiding students with leading questions. The reasoning behind these questions is to have the students come to their own conclusions about their misconceptions. If the students are able to see the faults in their misconceptions and change them on their own, then these new connections will be stronger.

Equally important in the learning process is the use of continuous feedback with students. Continuous feedback helps students know where they are in their learning and where they are going (Brophy, 2004). Feedback from both teacher and students are needed. It is specially beneficial in science learning because of the natural process of science through inquiry. Science discourse gives way to challenging misconceptions, because comparing ideas can shed light on personal misunderstandings (Harlow, 2009).

If students are to advance their knowledge of the world around them, they have to develop ideas that are more acceptable from the scientific point of view. Ferrer (2008) urged teachers to assist students in building the appropriate conceptual links between what they already know and what they ought to know to ensure that no misunderstanding could set in during the process of knowledge construction. Teachers have to provide a wider range of experiences that challenge students’ conceptions that are contrary to scientific ideas. Some examples of these experiences include further investigation that would test the workability of the students’ ideas in a different but related contexts, scaffolding new ideas provided to students through the use of technology, and organizing whole-class discussions so that different ideas about the same concept can be brought together and discussed.

**References**


