

Running Head: CHILDREN'S CONCEPTIONS OF HEALTH

**Children's self-documentation and understanding of the concepts 'healthy' and
'unhealthy'**

Suzane Reeve

Philip Bell

Learning Sciences

University of Washington

Final Manuscript Draft

Full Citation:

Reeve, S., & Bell, P. (in press). Children's self-documentation and understanding of the concepts 'healthy' and 'unhealthy'. *International Journal of Science Education*.

Children's self-documentation and understanding of the concepts 'healthy' and 'unhealthy'

Abstract

This paper describes a study in which thirteen nine- to eleven-year-old children, of diverse ethnic, linguistic, and socioeconomic backgrounds, were asked to use a digital camera and small notebook to document the range of things they consider to be healthy and unhealthy. Using open-ended interview questions, the children were then asked to explain each item, including what it was, why they chose it, and why they thought it was either healthy or unhealthy. The range of definitions of 'healthy' and 'unhealthy' invoked by the children was surprisingly broad, encompassing not only illness and proper nutrition, but also environmental health, mental health, cleanliness, and other meanings. Findings across all thirteen children are displayed, and a case study of one child serves as a detailed example of the types of meanings children ascribe to the words 'healthy' and 'unhealthy', as well the kinds of analyses being employed on these data. The theoretical implications of these results for research on children's ideas about health, as well as implications for the design of health interventions, are discussed.

Introduction

Over the past two decades, a multitude of authors have called for the need to take children's prior knowledge or 'preconceptions' into account in the design and implementation of instruction (Bransford, Brown, & Cocking, 2000). One significant research agenda in this direction has focused on identifying naive conceptions learners frequently have, often with the object of replacing these conceptions with correct or 'expert' understandings (e.g. Carey, 1985; diSessa, 2006; Smith, diSessa & Roschelle, 1993; Teixeira, 2000). Some researchers, however, have suggested that the processes of learning and conceptual change are much more complex than simply recognising false conceptions and replacing them with correct ones. Bell (2002), Linn (1995) and Palmer (1999), for example, discuss cases in which multiple conceptions exist alongside each other, some scientifically correct and others not. diSessa (2002) complicates the picture further, putting forth a view of conceptual change he characterises as a 'complex knowledge systems' or 'conceptual ecology' view (p. 31). From a conceptual ecology perspective, knowledge consists of multiple subparts, each of varying types and scales. Naïve learners will possess and invoke different combinations of these subparts in a given context than expert learners, such that the number of individual sub-elements and the changing connections between them defines the process of conceptual change. This frame evokes a definition of knowledge as dynamic in time and space. diSessa's work provides evidence of this viewpoint in the domain of physics learning, showing how individual students can simultaneously hold different understandings of the same phenomena, as well as use different everyday principles as justifications for their ideas in context-dependent ways (diSessa 1988, 2002). We argue that young people's reasoning in other content areas is also compatible with a conceptual ecology perspective, and report here on research illustrating such reasoning. We focus specifically on complex knowledge systems as

being rooted in specific activities and contexts, showing that young people's understandings can be multifaceted and connected to personally significant ideas.

Personal health, and the accompanying understanding of human biology on which it depends, is one such area. The popular press reports almost daily on medical findings about diet and lifestyle, emerging diseases, and global health and illness, meaning that most individuals in our society are exposed to multiple and sometimes conflicting images of health. In addition, human physiology describes a number of complex and interacting systems that can be difficult to understand even after focused study (Michael, J.A., et al., 2002; Michael, J.A., et al., 1999). In many cases, making decisions about personal health also requires interacting with a web of social resources and institutions, including friends and family, insurance companies, and various kinds of health care providers. The number and complexity of the ideas involved, and the multiplicity of consequential everyday contexts, make the domain of human health another likely candidate for testing the validity of the conceptual ecology theory and developing it further.

The area of personal health also carries great social and economic significance, as the incidence of so-called 'lifestyle' conditions, such as obesity and type 2 diabetes, increases dramatically along with the cost of treating them (US Department of Health and Human Services, 2001; Centres for Disease Control and Prevention, 2006). A recent consensus report in the USA states that 90 million adults in that country 'have difficulty understanding and acting upon health information' (Nielsen-Bohlman, Panzer, & Kindig, 2004, p. 1), and calls for the educational and health care systems, as well as broader societal and cultural institutions, to act to increase health literacy. With these ideas in view, it becomes vitally important for researchers to understand how people develop ideas about personal health, especially during childhood and adolescence, and how they choose when and whether to act upon them.

In this paper, we use data from a photodocumentation task about personal health to illustrate the ideas of thirteen nine-, ten- and eleven-year-old children from diverse backgrounds. We begin by surveying previous research about children's understandings of health, review findings of our research, and finally discuss how these findings support the use of a 'conceptual ecology' model, both theoretically and as applied to curriculum design.

Previous research on children's ideas about health. Children's understandings about health have been investigated from a number of different theoretical and conceptual perspectives. Some studies conducted by physicians or health researchers investigate understandings of health by examining concepts of illness or disease (Koopman, et al., 2004; Perrin, Sayer & Willett, 1991; Perrin & Gerrity, 1981; Bibace & Walsh, 1981). While these studies are informative and provide a wealth of information about the development of children's understandings, they (either implicitly or explicitly) treat health and illness¹ as two opposing constructs, neglecting the possibility that children's understanding of health encompasses a broader range of ideas. Some philosophers of health, however, such as Nordenfelt (2007) and Schramme (2007), claim that health encompasses not only regular functioning of all bodily organs, but also a subjective dimension that measures the ability to achieve desired goals. This subjective dimension may differ based on social and cultural norms. Empirical research by Wetton and Moon (1988), Wetton and McWhirter (1998), Natapoff (1978), Millstein and Irwin (1987), and Boruchovitch and Mednick (1997) suggests that children's understandings of health bear out this claim.

Wetton (e.g., MacGregor, Currie, & Wetton, 1998; Wetton & Moon, 1988; Wetton & McWhirter, 1998) pioneered the use of the 'draw and write' technique for researching children's ideas of health. This protocol involves presenting children with a scenario or story, asking them to draw a picture of their ideas about it, and then writing words or sentences to explain the picture. Wetton and her colleagues have used this technique to investigate a range

of health issues with children aged 4-11. For example, in a nationwide study of English, Irish, and Welsh children's views about health (Wetton & Moon, 1988; Wetton & McWhirter, 1998), the 'draw and write' technique helped researchers to isolate six main areas of focus for a new health education curriculum. These areas included topics related to bodily health, such as 'how my body works' and 'healthy eating,' but also emotional and community health, such as 'keeping safe' and 'relationships.' The authors wrote,

Above all the children's words and images revealed the wealth of the children's knowledge. Sometimes the meaning was non-sense, when conflicting information had been forced to fit pre-existing constructs with which the children were comfortable. More usually it matched and went beyond narrow, adult, medical constructions of the meaning of health. (Wetton & McWhirter, 1998, p. 277)

In a survey of US children's ideas about the word 'health' and what it means to be healthy, Natapoff (1978) found that, although a significant proportion of children included the idea 'not sick' in their definition of health, even more children described health as feeling good or being able to do desired activities. Other frequently cited answers were being able to eat regular foods and exercise, and being clean. Natapoff states of her findings, 'It became clear...that being healthy and being sick were two different things' (p. 998). Research by Boruchovitch and Mednick (1997) with children attending middle and low-SES schools in Sao Paulo, Brazil corroborate Natapoff's results. Boruchovitch and Mednick conclude that children saw health and illness not as opposite sides of the same coin, but as 'distinct though related concepts' (p. 454).

Despite some important exceptions, there is relatively little published research portraying the various meanings children associate with health in their own words. If, as the above-cited studies suggest, children's understandings of health are really more complex than has been traditionally assumed, the added depth made possible by a conceptual ecology frame would aid in constructing a more complete picture. Envisioning health understandings as a multi-faceted conceptual system, as opposed to a one-dimensional continuum of health and illness, allows for more breadth and nuance in framing children's actual ideas.

The work reported here attempts to fill some of the gaps in previous research on children's conceptions of health. We use an open-ended prompt to elicit children's understandings of the terms 'healthy' and 'unhealthy', and allow children to generate their own set of concrete artifacts with which these two relatively abstract terms can be discussed. The research questions addressed in this paper are:

- (1) What meaning(s) or definition(s) of health do children hold, and in what settings and activity systems are those meanings encountered?
- (2) What everyday activities or ideas influence children's understandings about health?
- (3) What are the implications of children's understanding of health for design of classroom instruction?

Methods

The work described here is part of an ethnographic study taking place in a city in the northwestern USA (see Bell, et al., 2006). Our team of researchers has been investigating children's everyday encounters with science and technology in one community, across the contexts of the children's lives. This larger study focuses on thirteen 9- to 11-year-old children and their families, who were recruited in the fall of 2005 and winter of 2006 through information distributed at the children's school. Observation and/or participant observation by researchers has taken place in the school, including the classrooms, playground, lunchroom, computer classroom, gym, music room, and library; in the children's homes; and in various community locations, including sporting events, church functions, museums, and camping trips. Fieldwork to date amounts to approximately 75 hours of data per child. Though the number of participants in this work is considerably smaller than that of previously cited interview or survey studies, the depth with which we are able to investigate children's

ideas and the activity systems or beliefs that underlie them is correspondingly much greater, given the significant time spent collecting data on each case.

Task description. The task described in this paper took place in the winter and spring of 2006, and involved all thirteen children from the ethnographic study. We used autodocumentation techniques (Clark-Ibanez, 2004), followed by ethnographic interviewing, to elicit children's ideas about the concepts 'healthy' and 'unhealthy'. During a regularly scheduled home visit in the winter or spring of 2006, each child was given a small digital camera, a spiral notebook, and a printed sheet describing this assignment, which was to 'take pictures or write about the range of things you think are healthy or unhealthy' (see Appendix 1 for the task assignment). The prompt language was purposely left open-ended, so children could determine the kinds of items they might consider to be healthy or unhealthy in any way they chose. In order to protect the privacy of those not consented into the study, children were requested to take pictures only of objects, or of people who had given consent for this research, such as themselves or family members. If children were unable to take pictures of something they wanted to include in their assignment, they were instructed to write about it in their notebook or discuss it later with researchers. Children and parents were also asked to review together the child's pictures and notebook entries before our next visit, and to delete any items they did not wish us to see.

On our next home visit, usually within one to two weeks of the task assignment, we reviewed each child's pictures and notebook entries with him or her in an ethnographic interview format. Using a laptop computer and projector, we displayed the photographic images and reviewed any entries the child made in his or her notebook. For each item, we typically asked the following questions: Tell us what this is. Did you think this was healthy or unhealthy? Why? Where did/do you normally see this item/person? Researchers also asked follow-up questions about other items or activities that were referenced in the conversation

(e.g. diet soda consumption in relation to regular soda, or steaming foods in relation to frying). In some cases, children also volunteered or were asked where they learned about an item being healthy or unhealthy, although this prompt was implemented less systematically. Interviews ranged from approximately twenty minutes to over an hour in length.

Parents could be present during these interviews if they chose, and a parent was present for part or all of eight of the thirteen interviews, although the degree to which they participated varied. In no cases was more than one parent present for a given interview. Regarding family member participation in interviews, we follow the approach of Shweder (1996), who suggests that 'members of a cultural community acquire their culture through praxis; in other words, they resonate to, activate, or absorb unarticulated concepts and principles through exposure to behaviour' (Shweder, 1996, p. 33). Shweder states that 'members of the same culture share not only a language and specific customary behaviours, but also an "evaluative discourse," and that the "value of culture for social analysis is not so much that the informants speak to the investigator, but that they speak to one another and can be overheard"' (Hammel, 1990, quoted in Shweder, 1996, p. 33). From this perspective, the way family members talk to each other about health beliefs and practices is equally or perhaps even more illustrative of actual understandings than an interview with the child alone. Thus, we did not ask that family members be excluded from these conversations. In order to limit our analyses to health understandings with which the young people themselves are familiar, however, the ideas described in this paper reflect only those actually stated by the children.

Participants. At the time of this task, the children ranged in age from 9 years, 8 months to 11 years, 4 months. Six of the children (four boys and two girls) were in fourth grade (nine to ten years old), and seven (three boys and four girls) were in fifth grade (ten to eleven years).

Participants and their families come from a broad range of ethnic and mixed-ethnic backgrounds, including Chinese, Vietnamese, Filipino, East African, African-American, Haitian, Mexican, Samoan, and European-American. Eleven of the children have parents who are first-generation immigrants to the USA, and of those eleven, five of the children themselves immigrated to the US. In four of the thirteen homes, the primary language spoken is not English.

The elementary school from which our participants were recruited is in a lower-income urban neighborhood. Roughly 60% of children attending the school qualify for free or reduced price lunch. Within our thirteen families, however, socioeconomic status varies widely. Family structure also varies among the participant families. Three of the thirteen households consist of only one parent and one child, with an additional eight households having two resident parents and at least one child. In five households, extended family members, such as an uncle or grandparent, either currently live or have lived in the home during the course of our observations.

The neighborhood where most of our families live is located in an industrial area of a Pacific Northwest city, near a number of factories and a large airfield. Hospitalisation rates for childhood asthma in this community are among the highest in the county. Two of our thirteen child participants suffer from severe or mild asthma, and three either have or have had significant food allergies (to milk, nuts, seafood, and other products).

Data analysis. Each ethnographic interview was video- and audio-recorded in the child's home. Tapes were then content-logged, a process by which the content of each cassette is viewed and briefly described in a corresponding text document (cf. Jordan & Henderson, 1995). Content logs for the interview portion of the visit were then expanded to include details of the interview, such as the questions researchers asked and the children's replies.

The videorecordings and content logs were analysed both for the localised 'member meanings' that individual children gave to the ideas 'healthy' and 'unhealthy', as well as for broader themes that multiple children addressed in common. Individual member meanings and cross-case categories were derived as much as possible from the children's own words, although the groupings of them across the cases, and in some examples groupings within a case, were imposed by the researcher after the fact. For the quantitative analysis, in cases where a child assigned multiple meanings to one item, the item was counted separately in each category.

Explanations children provided about various items' healthiness or unhealthiness were not evaluated for their correctness or degree of alignment with accepted scientific knowledge. Rather, we tried to understand from the children's point of view, through asking open-ended questions and probing about the children's understandings and experiences with each item, the meanings of health they chose to invoke. Our purpose in this research was to describe the breadth of health concepts the children chose to employ, as well as some of the everyday influences that contributed to these concepts' formation.

Results

The results described here build on a previous analysis of the member meanings and activity contexts of three of the thirteen children (Bell, et al., in preparation). This paper presents only one additional in-depth case, but summarizes also the autodocumentation items and interview responses across all thirteen children, highlighting some of the main themes we encountered. The first segment of the results section addresses the broader, cross-case analysis, and is followed by a closer account of one child's understandings.

Cross-case analysis. Figures 1-4 show descriptive statistics for all the items described in our ethnographic interviews with the 13 children. As seen in Figure 1, the children labeled

a total of 269 items as being either healthy, unhealthy, or both healthy and unhealthy. For the combined 'healthy and unhealthy' category, the degree of health either depended on the context, or a given item was said to be 'part healthy and part unhealthy' simultaneously. For example, one nine-year-old boy described a commercially-made sweet cinnamon bread as 'half healthy and half not healthy'; the healthy half was the bread, while the unhealthy half was that it was 'covered in brown sugar'.

[insert Figure 1 about here]

Figure 2 shows the items the children chose to photograph, write about, or discuss, as grouped into everyday categories (i.e. food and drink, household items, activities, etc.)² As shown in the chart, over 60% of the items children discussed were either food or non-alcoholic beverages. Of the remaining 40%, however, children discussed a range of other items, including plants and trees, medications, drugs and alcohol, and a variety of activities, such as exercise, reading, watching TV, or playing computer games. In a few cases, children also photographed themselves or close family members as examples of being healthy.

As stated above, the emphasis in the data on health-related objects may partially be an artifact of the protocol, since we asked the children to avoid taking pictures of any people outside their families in order to preserve their privacy. Some children did, however, describe specific people they considered to be healthy either verbally or in journal entries, such as a friend who had recently recovered from an illness or a gym teacher who eats healthily and exercises. Some children also included pictures they had taken of themselves.

[Insert Figure 3 about here]

Each individual child discussed the majority of his or her items in terms of their effects on human health, and five of the thirteen children explained their items' degree of healthiness exclusively in this respect (see Figure 3). An additional five children also explained health in terms of the effects on nature or the environment, and six children described items in their interview as being in a state of health or lack thereof (see Table 1 for additional detail).

[Insert Table 1 about here]

For slightly less than half of the items, a child either volunteered or researchers asked the child where he or she learned about the healthiness or unhealthiness of a particular item he or she chose to include. Figure 4 shows the children's attributions for the sources of their knowledge. The two most important sources children cited for their understandings of health are school (32%) and their parents (32%); all but one child cited more than one source for his or her knowledge. Within each child's interview, parents and school were often leading sources cited, but in some cases TV shows or a child's personal experiences were more frequently mentioned.

[Insert Figure 4 about here]

Though space does not permit a more thorough analysis of children's knowledge sources in this paper, the data in Figure 4 indicate the importance of understanding a broad range of children's everyday activities with respect to their understandings of personal health. They also suggest the appropriateness of employing a conceptual ecology framework, since the children described multi-faceted understandings of health derived from a variety of

sources. The ethnographic nature of our research allows us to draw on both our observations of these children over a significant time period and their explicit interview statements, to map out potential origins of and influences on their health understandings. We argue that such analyses, built upon data sets gathered from across the social settings frequented by youth, play a vital role in understanding the development of children's conceptions of health and the activities and people that influence them.

These findings about the sources of children's understandings also imply that school-based health and science curricula must take out-of-school activities into account. If this is not done, the versions of health learned inside the classroom may continue to be separate from and have little influence on what is learned and practiced outside it.³

Across all thirteen cases, the items on which children chose to focus and their explanations about them described a surprising breadth of meanings for the concept of health. Table 2 shows the various categories children used to explain why the items they photographed were healthy or unhealthy, along with the total number of items for which each definition was invoked and one or two illustrative examples of interview responses. As described above, these categories were imposed on the data by the researchers after looking across all interviews. In deriving these categories, however, we have attempted to remain as close as possible to the children's actual words and/or intent in the context of the interview. Subsequent analyses might interpret children's responses in light of the specific contexts of everyday life being documented through the ethnography.

[Insert Table 2 about here]

As shown in the table, the children drew on a variety of aspects of health in explaining their thoughts about the items they chose to capture or write about. The most frequently cited

explanations involved a specific outcome from a healthy or unhealthy object or activity, such as causing illness, damaging a specific part of the body, healing cuts, or causing accidents. Ten of the thirteen children used this explanation for at least one of their items. Weight gain or loss was also cited many times as an indicator of health, with weight gain always seen as unhealthy and weight loss as healthy. Though this category was addressed on fewer items overall than the illness/injury category, it was more widely present across the children, being cited by eleven out of the thirteen for at least one item.

The category titled 'Food Pyramid' encompasses a number of relatively unelaborated explanations children gave that correspond to the guidelines in the Food Pyramid produced by the United States Department of Agriculture (www.mypyramid.gov), such as several servings daily of whole grains and fruits and vegetables, moderate amounts of cheese, meat, and other proteins, and small amounts of sweets and oils. Explanations placed in this category included explanations such as 'nuts are good for you', or 'all fruit is healthy' (see examples in Table 2). Children did not explicitly invoke the Food Pyramid itself during their interviews, although it is safe to assume from our classroom observations that they had all participated in instruction about it.

In a general sense, the majority of meanings provided by the children related either to (a) the absence of illness or disease or (b) the ability to do desired things. The most frequently-mentioned category of explanations, causing or curing illness or injury, is explicitly related to the absence of illness. Meanings related to weight gain were sometimes phrased either in terms of subsequent illness or an inability to do desired activities, such as run fast on the playground. Also, though not explicitly called out by the children, meanings designated in the 'Food Pyramid' and germs/bacteria/spoiled foods categories are implicitly related to keeping the body disease-free and functioning optimally. The children's frequent association of health with either the absence of disease/illness or the ability to do desired

things is compatible with the findings of Natapoff (1978) and Boruchovitch and Mednick (1997), discussed earlier in this paper.

Other meanings discussed by the children in our study fell into the categories of mental and emotional health; environmental health; organic or 'natural' foods; health as determined by growth, strength, or colour; cleanliness; and elements of the natural environment that help to sustain human life (e.g., trees that produce oxygen, air for people to breathe). Each child described health from multiple perspectives, often giving explanations that incorporated different definitions of health for the same item, or that described complex and nuanced ideas. Their responses also revealed meanings that serve specific functions for the children and are rooted in activities that are important to them and their families.

For example, Wendy, a ten-year-old girl, photographed an octopus dish her mother prepared for a friend's birthday party. After describing the different parts of the octopus in the photo and how it was prepared, Wendy told the researchers that the dish is unhealthy because it is raw, and might have germs in it. When asked if there is a way to make it more healthy, Wendy suggested: '[If] you cook it, ... then it burns ... all the germs, but then it also burns the nutrition'. From analysing Wendy's responses in this interview segment, we were able to see two main points. First, our conversation elicited ideas not only about healthy and unhealthy, but also about food preparation, likes and dislikes of family members, and the context in which she saw this food. In accordance with diSessa (2002), Wendy's concept of the octopus's degree of healthiness is not unitary, but is connected to a web of related ideas and situational specifics relevant to her. Second, her understanding of the consequences of cooking octopus actually relates to a common activity system in the Chung home, that of making juices from fruits and vegetables. Wendy's comment about '[burning] the nutrition' out of the octopus at first seems unconventional, but on further examination, we see that it is

related to her understanding of how their family's juicer works. As she explained in a subsequent interview:

'This machine [juicer] is, like made to, um, keep the minerals. Like cause sometimes when you blend things, um, the blender creates a lot of heat, and then it...like, burns the um, healthy stuff? But then this ((points to the arms of the juicer)) is like magnetic to the proteins and stuff, so that it sticks on, so then when the juice comes out, then it still has the protein... So then it's still healthy and natural, except made into juice.'

Wendy's statements suggest that she has applied her understanding of the juicer's advertised nutrition-enhancing properties (i.e., retaining the healthy qualities of fruits and vegetables through avoiding excessive heat) to the preparation of other foods, including cooking meat. Her ideas about the health of the octopus dish are thus related to her knowledge of family members and common home practices, in addition to her understanding about the presence of germs in raw foods. They are rooted in everyday activities and encompass a number of different conceptual and pragmatic dimensions, consistent with a conceptual ecology or knowledge systems view of children's ideas about health.

The data cited here show that our participants assign a wider variation of meanings to the term 'health' than is recognised in either the materials or the instruction offered through their school health curriculum, creating a potential gap between teaching and learning in these situations. Invoking the concept of 'health' does not simply call up a one-dimensional idea for them, but activates a web of meanings about weight loss, the environment, emotions, specific illnesses, personal experience, and other topics. In accordance with diSessa (2002), it seems that changing a child's understanding of aspects of health entails much more than creating a path from concept A to concept B. Curriculum and teaching strategies that undervalue the influence of previous experience on children's ideas, and the nuanced complexity those ideas may assume in different situational frames, could endanger the process of real conceptual change.

Case study. One child in particular, a nine-year-old boy named Sam, used an unusually large number and breadth of definitions in describing the items he photographed. Sam is an only child who lives with his two parents. His mother is Chinese and was born in Guatemala, and his father is Caucasian and is originally from the Northwestern USA. Sam considers his ethnicity to be Chinese. English is the main language spoken in Sam's home.

Sam photographed, made videos of, or verbally referenced a total of 40 separate items during his interview. Since the average number of items cited by each child was 21, Sam captured many more items than most of our other participants. In the analysis that follows, we discuss the various meanings of health Sam described, as well as some potential sources for his understandings.

The meaning of health that Sam cited most frequently was weight gain or loss: Sam discussed weight gain with reference to a chocolate donut, eggs, cinnamon bread, bacon, milk, cheese, cake, and dried berries. For example, Sam described bacon as unhealthy, saying, 'If you eat too much grease, and pig fat, you kind of weigh more, and stuff. It's harder to move and run faster'. Sam and a few of our other participants also used the term 'fattening' differently from its conventional, adjectival form. In describing cheese, for example, Sam said 'It has a little bit of fattening in it. So if you eat too much, you'll get wider'. Children's use of the word 'fattening' (and in one case, 'addiction') to mean objects that are contained within substances was striking. In Sam's case, he also described a donut in his interview as being 'fattening', a usage that is more culturally familiar. Sam thus used the word 'fattening' both as a noun, something in the cheese that makes you wider, and as an adjective, a characteristic of the donut. We can only speculate about the origin of this noun usage of 'fattening' and 'addiction', since the children who employed it came from different school classes, grade levels, and family backgrounds. It indicates, however, that some children may be understanding health terms that are common in our current culture differently

from their intended or technical meanings. It may be part of an everyday linguistic register for food-related ideas.

Sam also invoked many of the other health meanings commonly used among children in our study, such as causing illness or injury (e.g. beer, a hot iron, playing too many computer games); growth, strength, and colour (e.g. houseplants, trees in the yard, Sam's healthy teeth and gums); and explanations aligning with the 'Food Pyramid' (e.g. dried fruit, spaghetti, commercial health drink). Besides these, however, Sam captured a much wider breadth of items than most children, and invoked definitions that few or no other children did. For example, one of the ways Sam defined items as healthy was for their aesthetic wholeness or 'lack of being broken'. Regarding a short video he made of a stairway in his home, Sam described it as 'healthy, because there are not very many gouges in the wood'. Similarly, Sam described the shower in the family's downstairs bathroom as 'healthy...cause the tile is all good and together. Everything is stable'. Healthy in this sense seems to be a reference to the design purity (or state) of material objects. Sam also invoked a definition of health as things that are clean or new, as with a pile of clean clothes in the laundry room as healthy, or a description of rusty tools as unhealthy.

Figure 5 is a representation of some of the meanings Sam assigned to the idea of 'healthy' or 'unhealthy', together with some related activity systems in which he participates and knowledge sources he cited explicitly during his interview. There seem to be two major influences on how Sam approached the self-documentation task: first, his parents and perhaps other family members, and second, Sam's interest in technology and building.

[Insert Figure 5 about here]

Sam spends quite a bit of time with family members, including his parents, a grandparent and cousins. He makes explicit mention in the interview of how his parents have told him that cheese can be 'fattening' (Sam describes this as having 'fattening in it'), that too much egg yolk 'makes you start to get wider instead of taller', and that the skin of an apple is healthy. Researchers have observed some discussion in the home about exercise and the importance of staying active, which probably relates to Sam's mention of too much TV and video games as unhealthy because they make you 'turn into a couch potato'. Sam says that Laser Tag, on the other hand, is healthy because 'you get exercise while running and shooting lasers at each other'.

At the end of the interview, one of the researchers asked Sam where he thinks he has learned about what is healthy and unhealthy.

Sam: If I couldn't figure it out, just best guess.

Rudy (Sam's father): Mom and Dad didn't teach you anything, huh?

Sam: Ha, ha. Yes you did. Most of that, I got from you guys.

Though he never referenced it explicitly in describing his items, Sam's school class was also doing a unit on Food Chemistry at the time at the time of this interview. Sam told the researchers that his class was learning about 'Foods. Foods and if they're healthy, not healthy. And what consequences you would have if they weren't healthy'.

The second major influence on Sam's completion of the healthy/unhealthy documentation task seems to have been his interest in technology and building things. Sam's father is skilled in computer repair, and Sam has a deep interest in technology and a facility for patiently reading instructions and learning how to operate or build things. This interest may relate to the large number of pictures and videos Sam took with the camera, especially because this was the first time in the research study that we gave children this kind of photodocumentation task. Sam told the researchers during his interview that he figured out on his own how to take videos with the camera, and ended up filling the entire memory card

with videos and photos. A number of the items he photographed represent the technology present in his home (TV, video games, computer). Sam stated that too much of all of these things is potentially unhealthy, again perhaps relating to the emphasis in his home on getting exercise and being active.

Sam's case is a strong illustration of the unexpected variety of definitions children may associate with the terms 'healthy' and 'unhealthy'. As discussed earlier, it suggests that designing health interventions that are relevant and connected to children's thinking presents a more complex task than has sometimes been assumed.

Conclusion

Children's understandings of health can be more complex than has been traditionally assumed. As mentioned in the introduction, a significant fraction of the prior research on children's health has focused specifically on concepts of illness. Though the children in our study did frequently discuss health in terms of an absence of disease or an ability to do desired activities, they also perceived healthy things (including trees, air, clean clothes, rusty tools, and litter) as falling into more than these two categories. Our findings support the idea that health and illness are not opposing ends of a continuum, but rather are overlapping but distinct concepts for children. The children in our study invoked a broad range of definitions for health, including accepted nutritional guidelines, plant growth, pleasing tastes and smells, effects on weight gain, freedom from germs or from artificial processing, aesthetic wholeness, and cleanliness. The data described here clearly lend themselves to a conceptual ecology frame in the pattern diSessa (2002) outlines, in that these children treat the concept of 'health' as a multidimensional idea, composed of multiple and related knowledge elements. Instruction that focuses on simple, unitary definitions of health is not likely to coordinate well with the rich understandings these children have associated with multiple contexts and meanings. We know too little about how those knowledge elements, understandings, and

associations might or might not be invoked by the teaching of formal health curricula. What might be the positive or negative results of neglecting some entirely, or of emphasising a few at the expense of others?

Bruner (1960) contended that 'any subject can be taught effectively in an intellectually honest form to any child at any stage of development' (p. 33). In order to do this, however, the content must be 'translated into [the child's] way of thinking' (p. 39). As illustrated by the research described here, many current health curricula have insufficiently considered children's ways of thinking, and are thus unable to build on their existing understandings. Health instruction must go beyond topics whose importance have been determined solely by adults, and involve children more actively in examining and developing their own ideas.

Finally, the work cited here, together with a number of other studies in the literature, discuss only children's conceptions of health and what it means to them to be healthy or unhealthy, the children's health beliefs. Perhaps more important and necessary, however, for the overall goal of promoting children's health is connecting this knowledge of children's conceptions to an understanding of what motivates their actual behaviours and practices, and to what extent beliefs such as those cited here are relevant in health decision-making. The ethnographic study in which this work is embedded provides a unique opportunity to relate children's stated beliefs with observations of theirs and their family members' actual decisions and activities. We continue to research and analyse this issue, which is a vital next step in research on children's health.

¹ Though some scholars distinguish between 'disease,' which relates to biological pathologies, and 'illness,' which also includes the patient's emotional and social experience of the disease state, most of the articles cited here use the term 'illness' to encompass both meanings.

² The total number of items in Figure 2 differs slightly from that in Figure 1: in the case of nine items, children gave no explicit statement about whether they were healthy or unhealthy.

³ We recognise, as well, that self-reported influences may significantly understate the actual range of influences on learning.

⁴ Taste or smell was in almost all cases a secondary, and not a primary, justification for an item's health or lack thereof.

References

- Bell, P. (2002). Using argument map representations to make thinking visible for individuals and groups. In T. Koschmann & R. Hall & N. Miyake (Eds.), *CSCL 2: Carrying Forward the Conversation* (pp. 449-485). Mahwah, NJ: Lawrence Erlbaum Associates.
- Bell, P., Zimmerman, H.T., Bricker, L.A. & Lee, T.R. (in preparation). The everyday cultural foundations of children's biological understanding in an urban, high-poverty community.
- Bell, P., Bricker, L. A., Lee, T. R., Reeve, S., & Zimmerman, H. T. (2006). Understanding the cultural foundations of children's biological knowledge: Insights from everyday cognition research. In S. A. Barab, K. E. Hay & D. Hickey (Eds.), *Proceedings of the Seventh International Conference of the Learning Sciences (ICLS)* (pp. 1029-1035). Mahwah, NJ: LEA.
- Bibace, R. & Walsh, M.E. (1981). Children's conception of illness. in Bibace, R. & Walsh, M.E. (Eds). *Children's conceptions of health, illness, and bodily functions* (pp. 31-48). San Francisco: Jossey-Bass.
- Boruchovitch, E. & Mednick, B.R. (1997). Cross-cultural differences in children's concepts of health and illness. *Rev. Saude Publica*, 31, 448-456.
- Bransford, J.D., Brown, A.L. & Cocking, R.R. (Eds.). (2000). *How people learn*. Washington, D.C.: National Academy Press.
- Bruner, J. (1960). *The process of education*. Cambridge, MA: Harvard University Press.
- Carey, S. (1985). *Conceptual change in childhood*. Cambridge, MA: Bradford/MIT Press.
- Centres for Disease Control and Prevention (USA). (2006). Diabetes: Disabling, deadly, and on the rise. <http://www.cdc.gov/nccdphp/publications/aag/ddt.htm>. Accessed 9 October 2006.

Clark-Ibanez, M. (2004). Framing the social work with photo-elicitation interviews. *The American Behavioral Scientist*, 47(12), 1507-1527.

diSessa, A. A. (1988). Knowledge in pieces. In G. Forman & P. B. Pufall (Eds.), *Constructivism in the computer age* (pp. 49-70). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

diSessa, A.A. (2002). Why 'conceptual ecology' is a good idea. In M. Limón & L. Mason (Eds.). *Reconsidering conceptual change: Issues in theory and practice* (pp. 29-60). Dordrecht: Kluwer.

diSessa, A. A. (2006). A history of conceptual change research: Threads and fault lines. In K. Sawyer (Ed.). *The Cambridge handbook of the learning sciences (1st ed.)* (pp. 265-282). Cambridge: Cambridge University Press.

Jordan, B. & Henderson, A. (1995). Interaction analysis: Foundations and practice. *The Journal of the Learning Sciences*, 4(1), 39-103.

Koopman, H.M., Baars, R.M., Chaplin, J., & Zwinderman, K.H. (2004). Illness through the eyes of the child: The development of children's understanding of the causes of illness. *Patient Education and Counseling*, 55, 363-370.

Linn, M. C. (1995). Designing computer learning environments for engineering and computer science: The Scaffolded Knowledge Integration framework. *Journal of Science Education and Technology*, 4(2), 103-126.

MacGregor, A.S.T., Currie, C.E. & Wetton, N. (1998). Eliciting the views of children about health in schools through the use of the draw and write technique. *Health Promotion International*, 13(4), 307-318.

- Michael, J.A., Wenderoth, M.P., Modell, H.I., Cliff, W., Horwitz, B., McHale, P., Richardson, D., Silverthorn, D., Williams, S. & Whitescarver, S. (2002). Undergraduates' understanding of cardiovascular phenomena. *Advances in Physiology Education*, 26, 72-84.
- Michael, J.A., Richardson, D., Rovick, A., Modell, H., Bruce, D., Horwitz, B., Hudson, M., Silverthorn, D., Whitescarver, S. & Williams, S. (1999). Undergraduate students' misconceptions about respiratory physiology. *Advances in Physiology Education*, 22, S127-S135.
- Millstein, S. G. & Irwin Jr., C. E. (1987). Concepts of health and illness: different constructs or variations on a theme? *Health Psychology*, 6, 515-524.
- Natapoff, J. N. (1978). Children's views of health: A developmental study. *American Journal of Public Health*, 68, 995-1000
- Nielsen-Bohlman, L., Panzer, A.M., & Kindig, D. (Eds.). (2004). *Health literacy: A prescription to end confusion*. Washington, DC: National Academies Press.
- Nordenfelt, L. (2007). The concepts of health and illness revisited. *Medicine, Health Care, and Philosophy*, 10, 5-10.
- Palmer, D.H. (1999). Exploring the link between students' scientific and nonscientific conceptions. *Science Education*, 83, 639-653.
- Perrin, E.C. & Gerrity, P.S. (1981). There's a demon in your belly: Children's understanding of illness. *Pediatrics*, 67, 841-849.
- Perrin, E.C., Sayer, A.G., & Willett, J.B. (1991). Sticks and stones may break my bones...Reasoning about illness causality and body functioning in children who have a chronic illness. *Pediatrics*, 88, 608-619

Schramme, T. (2007). A qualified defense of a naturalist theory of health. *Medicine, Health Care, and Philosophy*, 10, 11-17.

Shweder, R.A. (1996). True ethnography: The law, the lore, and the lure. In R. Jessor, A. Colby, & R.A. Shweder (Eds.), *Ethnography and human development: Context and meaning in social inquiry* (pp. 15-52). Chicago: University of Chicago Press.

Smith, J.P., diSessa, A.A. & Roschelle, J. (1993). Misconceptions reconceived: A constructivist analysis of knowledge in transition. *The Journal of the Learning Sciences*, 3(2), 115-163.

Texeira, F.M. (2000). What happens to the food we eat? Children's conceptions of the structure and function of the digestive system. *International Journal of Science Education*, 22(5), 507-520.

U.S. Department of Health and Human Services. (2001). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Rockville, MD: U.S. Public Health Service.

Wetton, N.M. & McWhirter, J. (1998). Images and curriculum development in health education. In J. Prosser (Ed.), *Image-based research: A sourcebook for qualitative researchers* (pp. 263-283). London: Falmer Press.

Wetton, N.M. & Moon, A. (1988). Lifestyles -- an education in health. *Westminster Studies in Education*, 11, 59-67.

Table 1. Three applications of the terms 'healthy' and 'unhealthy'

Application	Sample response
Healthy/unhealthy for humans	'This picture is healthy because it's, it's a banana tree that is going to produce bananas...and the bananas will become healthy for people to eat and will help people to live'. (nine-year-old girl)
Healthy/unhealthy for nature or environment	'Oil leaks are unhealthy because it kills sea animals trapped in the oil'. (eleven-year-old boy)
In a state of health or lack thereof (healthy entity)	'My gym teacher is healthy,...because he eats a lot of nutritious stuff...and he exercises a lot, too'. (ten-year-old girl)

Table 2. Children's definitions of health

Definition/Category	Frequency	Sample responses
Causes or cures illness or injury	61	<p>'...if you eat too much [chocolate], you might get obese, and then you might get cancer, and then get a heart attack and die. If you eat too much...And you might get cavities'. (ten-year-old boy)</p> <p>'[Apple juice] makes you see better, makes your skin softer...I used to have, like, cuts right here, but now it's, like, all healed'. (ten-year-old boy)</p>
Weight gain/loss	42	<p>'I learned that aerobic exercise is, um, exercise that contains [sic] your heart to beat faster, which could lead people to lose weight. So, if like someone was to walk every day, it wouldn't really help them if they were trying to lose weight because, um, their heart isn't beating faster'. (ten-year-old girl)</p> <p>'If you eat too much cheese,...it has a little bit of fattening in it. So if you eat too much, you'll get wider'. (nine-year-old boy)</p>
'Food Pyramid'	40	<p>'[Multi-grain cereal is] good, because grains are good'. (ten-year-old girl)</p> <p>Spaghetti is healthy 'cause you get your meat'. (nine-year-old boy)</p>
Vitamins/minerals/'nutrition'	27	<p>'Apples are healthy, since they carry a lot of vitamins...Fruits in general always carry a lot of vitamins'. (eleven-year-old boy)</p> <p>'[An orange is] healthy because it has a lot of vitamin C and, um, it has a lot of nutrition in it'. (ten-year-old girl)</p>
Growth/strength/natural colour	23	<p>'[meat] makes you grow and it makes you strong'. (ten-year-old boy)</p> <p>A houseplant is 'healthy because it grows really fast...faster than most plants'. (eleven-year-old girl)</p>
Organic/fresh/natural	20	<p>Organic vegetables are healthy, 'because it doesn't have pesticide on it'. (ten-year-old girl)</p> <p>'Good sugar comes from fruits, but bad sugar comes from, like, artificial stuff'. (ten-year-old boy)</p>
Environmental health	16	<p>'Cars have gas and the gas pollutes the sky and that can cause global warming, which is not healthy for living creatures and people'. (nine-year-old girl)</p>

		'Smoke is unheathy [sic] for your lungs and nature. It could destroy trees and plants'. (eleven-year-old boy)
Germs/bacteria/spoiled food	13	Spoiled mango is unhealthy because 'I'll get food poisoning'. (ten-year-old girl) '[This octopus is] unhealthy 'cause it's raw...it might have something BAD in it, like, um, some, like a germ. The octopus might be sick, and then they ate it. [If] you cook it,...then it burns...all the germs, but then it also burns the nutrition'. (ten-year-old girl)
Energy	12	'When, like, you're tired and stuff...you just eat fruit and...you'll have more energy'. (ten-year-old boy) '[A water bottle] is healthy...because, you, um, if you drink out of it you can get energy, lots of it'. (nine-year-old boy)
Emotional/mental health	12	A rose from her mother is healthy because 'it brings love...the love smells deeply inside of the petals'. (nine-year-old girl) '[Reading] keeps your mind alert and thinking'. (eleven-year-old boy)
Sustain human life	10	'I think [a tree is] a healthy source, because it helps provide oxygen for us to breathe in and stay alive...It provides a source of, like, energy that we need to survive'. (eleven-year-old boy)
'Drugs'	10	'Coffee's bad for you because it has caffeine, and caffeine's like a, like a drug. Sort of'. (ten-year-old boy)
Taste/smell ⁴	10	'[This plant] seemed like it would be healthy, just because there's so much green in it, and a lot of natural scents'. (nine-year-old girl)
Clean/dirty	9	'Clean clothes...[are] healthy, because they are clean, and you can wear them'. (nine-year-old boy)
Exercise	6	'[Exercise] can keep you fit, and it can also like unclog your arteries, and burns calories, too'. (eleven-year-old boy)
Aesthetic wholeness (one child only)	5	'The stairway...[is] healthy, because there are not very many gouges in the wood'. (nine-year-old boy)

Figure 1. 'Healthy' and 'unhealthy' items (n = 269)

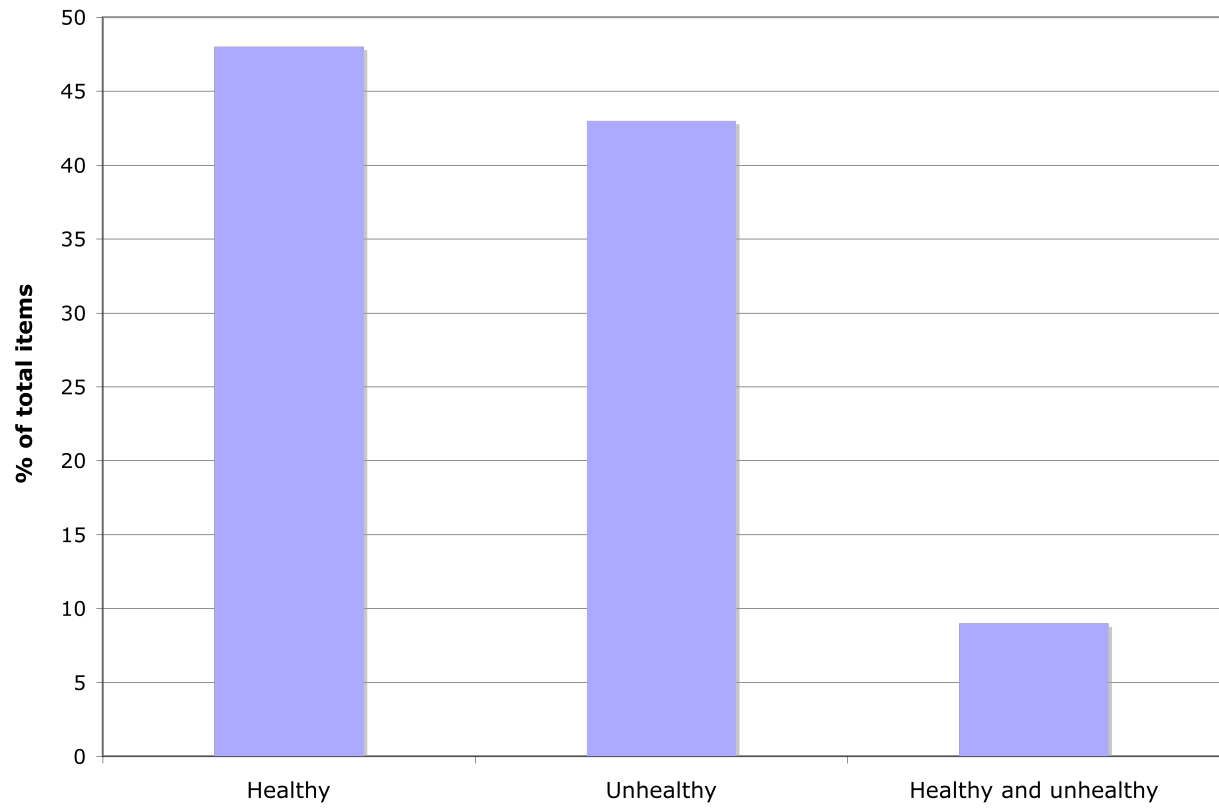


Figure 2. Items documented by the 13 focal participants, displayed by type

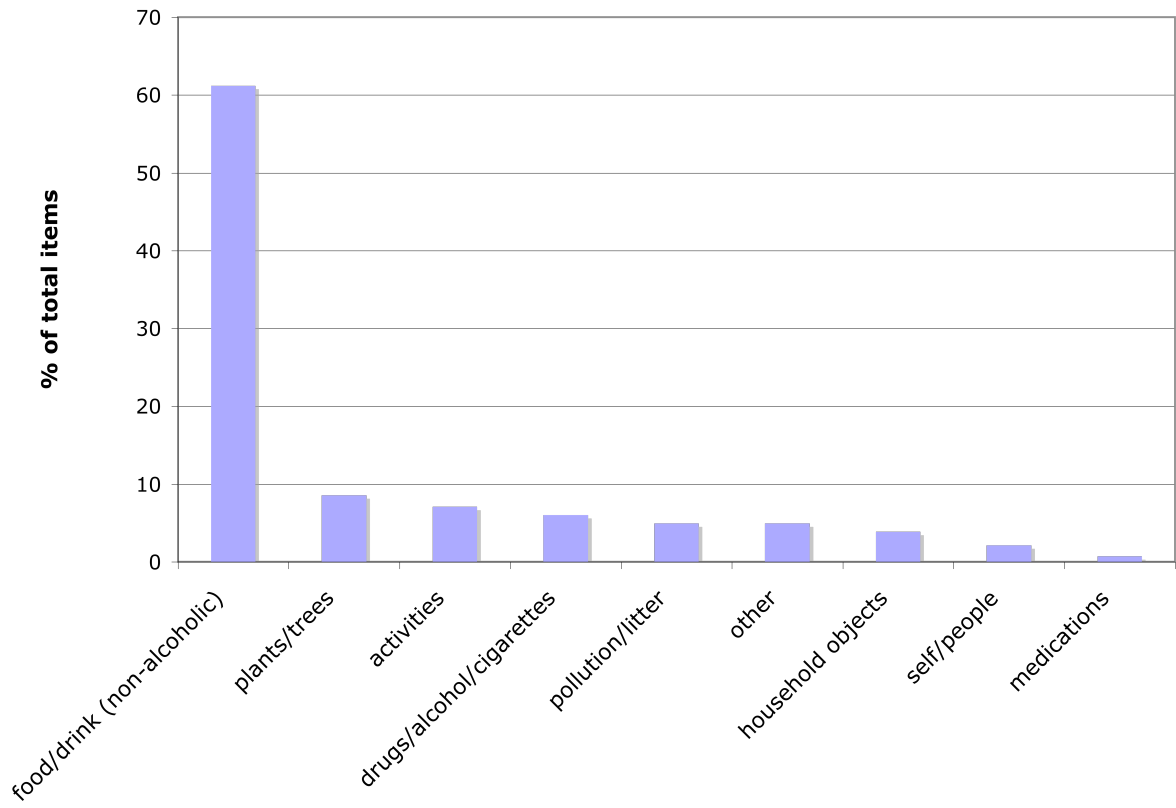


Figure 3. Item categories

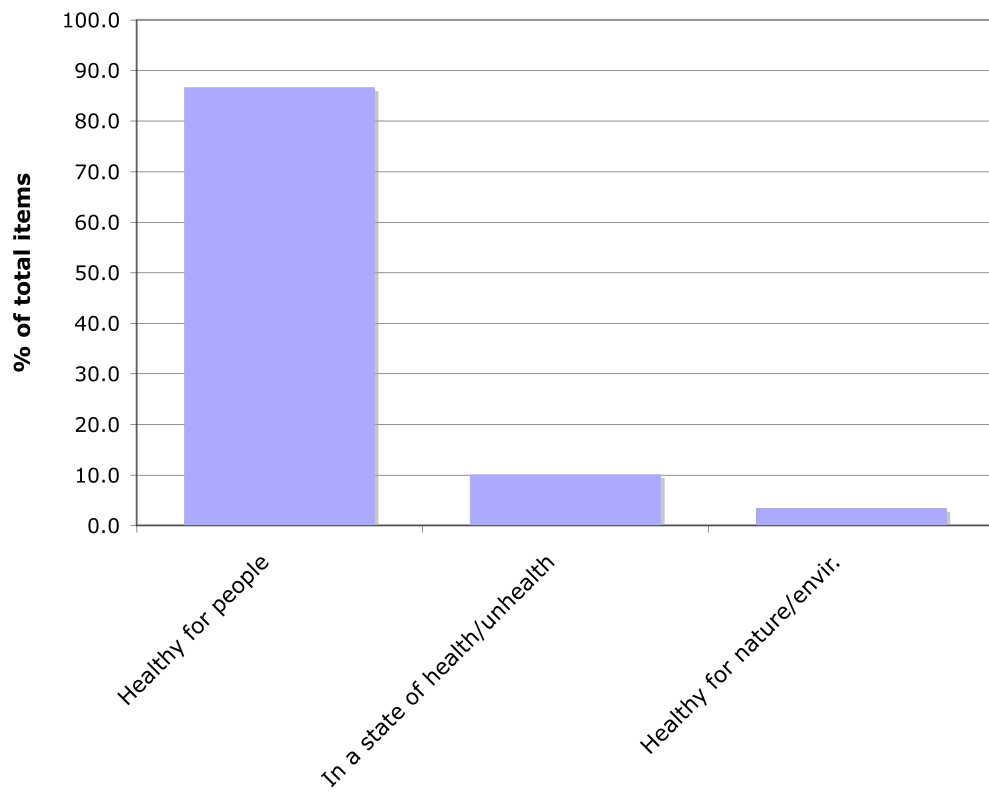


Figure 4. Knowledge sources (n=123)

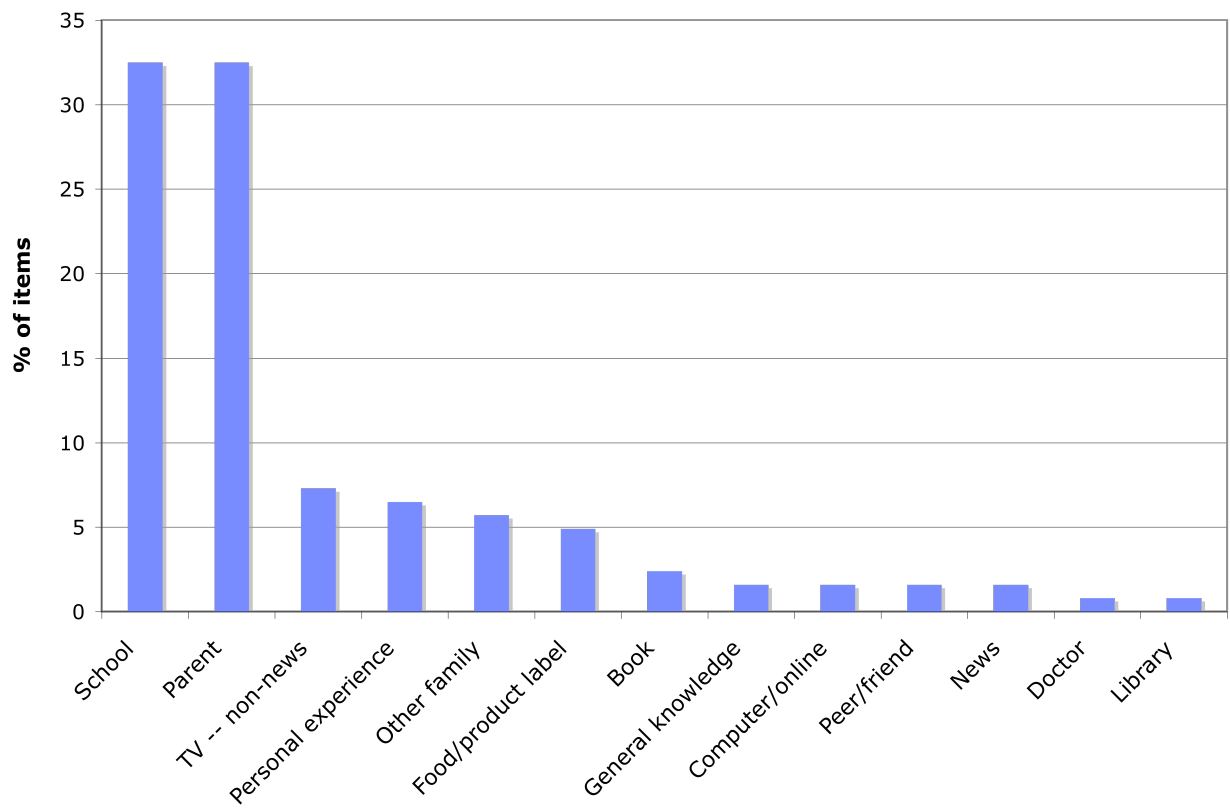
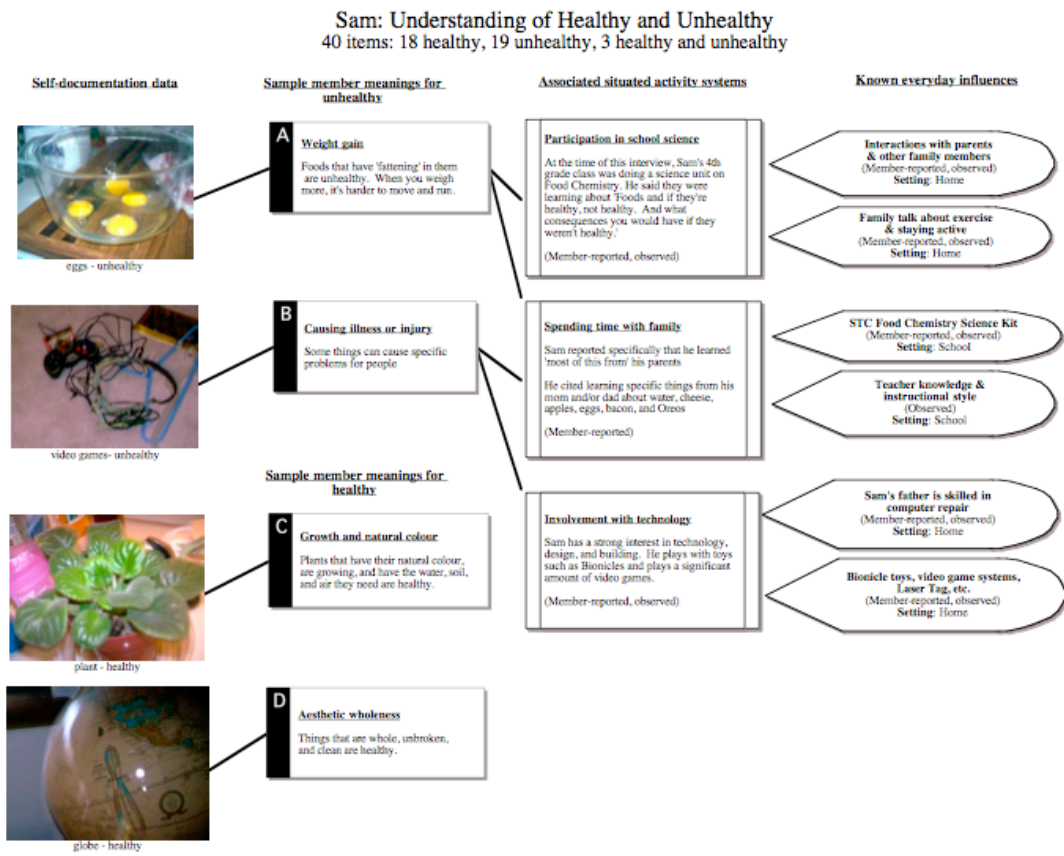


Figure 5. Everyday expertise representation of healthy and unhealthy for one case (Sam).



Appendix 1. Prompt for self-documentation task about health



Keep a photo journal for a week!



This Week: You can help us learn by taking pictures and writing about the range of things that you think are **healthy** and **unhealthy**.



Over the next week or so, we want you to **keep a journal**:

- Take a picture or write down anything you come across that reminds you of things that are 'healthy' and 'unhealthy'.
- You can collect printed materials, draw pictures, or add things like charts in your journal too if they help you explain what you saw.



Take pictures of what you see.

Write down in your journal:

- what you saw,
- where you saw it,
- when you saw it, and
- why it reminds you of **healthy** or **unhealthy**

- Only take pictures though when you know you're allowed to!
- When you take a picture, **take pictures of things, not people**.
- Try not to get any people in the picture because we will not have asked them if it is okay to take their picture. Instead, write about it in your journal.
- Next time we meet, we will talk about what is in your journal and talk about your pictures.

Reviewing the Photos Before Our Next Meeting

Before our next meeting, you need to look at your pictures.

- Make sure that you were free to take each picture and that you asked permission if you needed to.
- Make sure you don't have people in your pictures, only things.
- Make sure you feel okay about sharing each picture with us.
- Delete any picture that you don't want to show us.
- Before we come over, show each of the pictures to your mom or your dad. They can make sure the pictures are okay too. They should delete any picture they don't want us to see.



When we meet with you next week, we will ask you questions about the things you wrote and took pictures of that you think are healthy and unhealthy.

Let us know if you have any questions.

You can email or call us at:



Thank you & we'll see you next week!

