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Using Relational Frame Theory to Teach Nutritional Values

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Abstract

Obesity is a significant health concern people of all ages on a global level. There have many studies that addressed nutrition concepts, however, those results are inadequate to lead to long term improved health because the improvements were too weak, too short lived, or did not generalize to other environments. There is a need to enhance the educational component and one solution is to design the instructional component using a theory of language and cognition, Relational Frame Theory (RFT). This method not only has potential to help the student learn information about foods, but also learn how to make comparisons between foods. This study implemented a nutritional education program using a relational frame theory format to teach nutritional relations using the relational frame, "healthier," and assessed for derived relations. The first step involved teaching equivalence relations between nine foods categorized into three groups, maximum nutritional value, moderate nutritional value, and minimal nutritional value. After the initial equivalence training and remediation procedures all the participants demonstrated mastery on equivalence relations that were taught and derived. Next, participants were taught two comparison relations and assessed for comparison relations that were taught and derived. Of the comparison relations assessed, two of the participants improved their performance in the comparison relations that were taught.

Using Relational Frame Theory to Teach Nutritional Values

Obesity is a significant health concern that not only affects adults in the United States but persons of all ages on a global level. Health problems associated with obesity include: cardiovascular problems, insulin resistance or diabetes, respiratory difficulties, increased risk of cancer, increased risk of stroke and hypertension, psychological problems, and infertility. According to Partnership for a Healthier America (2020), "approximately 17% of the U.S. youth have obesity, and nearly 1 in 3 children and adolescents are either overweight or have obesity." Because of adverse health conditions linked to obesity and the alarmingly rapid increase in the number of overweight and obese children and adolescents there has been a great appeal by many organizations for treatments and interventions. Nutrition education programs that are implemented in elementary schools can be a valuable method to improve the health of children (Pope, 2016). However, nutrition education programs are often deficient or nonexistent because of demands on time and resources and an intense focus on test preparation (Story et al., 2006, 2009). The current research data indicates that there are weaknesses in current nutritional interventions.

Review of Literature

Some studies have addressed color code classification systems to organize food into groups and then teach the classification system to participants. Epstein, et al. (1978) evaluated the use of a school-based program to modify eating behaviors of young children. During the intervention foods categorized into three color coded groups were arranged on the student's plate. Reinforcement was awarded contingent on the child eating the percentage allowed for each food type and there was an increase in the consumption of "healthy" foods during the intervention. Stark, et al. (1986) studied the effects of a behavioral program designed to modify young children's food choices during a snack period by organizing and color coding foods into four categories of snack foods; cookies, chips, fruits, and vegetables. During nutritional training the children were shown pictures of the available foods and asked which they would choose for a snack. The child was reinforced for choosing a green food. Nutrition training resulted in the children choosing a greater number of green foods, the fruits and vegetables.

These studies extend the literature by teaching information about the comparative healthiness of foods by reinforcing consumption of "healthy" foods. Although these studies showed an increase in the consumption of "healthy" foods, there were no tests of knowledge. Therefore, the methods and assessments used in these studies provided no evidence the participants learned any nutritional concepts that could be expanded upon and generalized to new foods.

Several studies have implemented various nutrition education curriculums. Witt, et al. (2012) implemented the *Color Me Healthy* (CMH) program for six weeks in preschool classrooms. The CMH program was, "developed to help young

children develop healthful eating and physical activity behaviors at a young age" (Dunn, et al. 2004, p .327). Use of the CMH program resulted in an increase in the consumption of fruits and vegetables. Cason (2001) developed a "learner-centered, multiple intelligences theory-based curriculum for preschool children." Results show that children could not only correctly identify more fruits, vegetables, and healthy snacks after participating in the curriculum, but they were able to identify to which food group they belonged and that some foods are healthier. However, forty percent of the children did not participate in post intervention assessments. In addition, the researchers did not ensure each teacher was teaching the same content in the same manner and there is the possibility that teachers varied in the delivery of the program. Johnston, et al. (2019) evaluated the use of *The Food Doctor*, a curriculum developed and implemented by a team of medical students. Results show that students showed improvements in nutritional knowledge. However, the program was implemented and paid for by medical students who took time to develop rapport with the students. It was reported the high degree of rapport achieved by the researchers was difficult to achieve with new volunteer instructors.

While these interventions and curriculums are promising these results are inadequate to lead to long-term improved health by learning nutritional concepts. There is a need to enhance the educational component by teaching a strategy that will allow children to generalize knowledge to new foods. In order to accomplish this, teaching strategies that will increase children's ability to infer information about foods based on facts they already know about foods will need to be implemented. One theory of language and cognition that can provide the teaching framework in this way is Relational Frame Theory (RFT). This method not only has potential to help the student learn information about foods, but also learn how to make comparisons between foods.

Relational Frame Theory

RFT was developed as a response to earlier behavioral techniques to teach relationships of equivalence (Sidman, 1971). While stimulus equivalence focused on relationships of sameness, RFT expanded on the ideas of equivalence to describe how we learn various relationships such as opposition, classifications, and comparison (Hayes, et al., 2001). RFT is a theory of language and cognition that can enable researchers to learn how people respond to relationships among items, including the ability to make comparative choices. It is logical that an education program to improve nutrition by making more healthy food choices would begin by teaching children to make comparative choices. For example, the apple is healthier than the candy; therefore, it is better to eat the apple. Based on overall nutritional content foods can be organized into ones that have maximal nutritional value, moderate nutritional value, and minimal nutritional value. Because foods can be categorized into groups based on nutritional value, RFT procedures could be a potential method for teaching nutritional relations. Studies using food

categories have yet to demonstrate a generalized and flexible understanding of food concepts, therefore using RFT to design an educational program to teach comparisons among food groups may improve the effect of these educational programs.

RFT can be used to promote entire networks of food concepts such as which foods are healthiest. When items are interrelated they can form networks of relationships. This method involves teaching a few relationships so that the individual can then use that information to derive or infer many more relationships. One can derive relationships in a bidirectional manner (Hayes, et al. 2001). For example, if one is taught that an apple has a similar nutritional value as an orange; one can infer that an orange has a similar nutritional value as an apple. In addition, one can derive relationships between three or more related stimuli. For example, if one is taught that an apple has a similar nutritional value as an orange and is taught that a banana has a similar nutritional value as an orange one can infer that the banana also has a similar nutritional value as an apple. In this example two relationships are taught and four are inferred or derived.

There are many different types of relations including equivalence, opposition, and comparison. An equivalence relation might be "an apple is the same as a banana." An oppositional relation frame might consist of "night is the opposite of day." In a comparative event, one event is responded to based on a quantitative or qualitative relation; "Suzy is faster than John." According to Hayes (2004), humans can respond to items that share physical characteristics (formal) as well as relationships between items that do not share any physical resemblance (arbitrary). RFT could potentially be used to effectively and efficiently teach relationships based on frames of comparison. For example, if the following two relations are taught, broccoli is healthier than pizza and pizza is healthier than cookies, one could derive the following four relations: broccoli is healthier than cookies, pizza is less healthy than broccoli, cookies are less healthy than pizza, and cookies are less healthy than broccoli. In this example, two relations were taught and an additional four relations were derived.

Relational Frame Theory Research

RFT teaching procedures can also be effective when teaching comparative relationships, such as, "more-than" and "less-than" (Barnes-Holmes, et al,, 2004, Berens and Hayes, 2007, Gale and Steward, 2020). Results from Barnes-Holmes, et al., (2004) and Berens and Hayes (2007) show that relational frames are learned and once learned the relational frames foster the emergence of derived relational responding in young children. That is, by learning a few relationships many more relationships can be derived. Gale and Steward (2020) extended the findings of Berens and Hayes (2007) when they implemented RFT teaching procedures to teach comparative relations to children with autism.

RFT procedures have proven to be efficient. Lipkens, et al. (1993) taught ten relationships and assessed for an additional twelve relationships. Overall, the child learned a total of twenty-two relationships while only being directly taught ten relationships. This same type of generative results was seen in studies that addressed comparative relationships indicating that RFT can provide a foundation in which to teach comparisons in an effective and efficient way. In addition, studies have demonstrated RFT teaching and assessment procedures have also produced maintenance and generalization of skills (Lipkens, et al. 1993 and Barnes-Holmes et al., 2004).

Obesity is a global health concern that is affecting persons of all ages and there has been a call from many organizations to provide nutritional education that will help facilitate a change in lifestyle that promotes healthy nutritional choices. RFT procedures have been efficient and effective; they could be used to supplement the current research that exists on nutritional choices.

Research Question

Based on overall nutritional content foods can be organized into ones that have maximal nutritional value, moderate nutritional value, and minimal nutritional value. Because foods can be categorized into groups based on nutritional value, RFT procedures could be a potential method for teaching nutritional relations. Studies using food categories have been somewhat effective, but have not focused on generalized and flexible responding to nutrition concepts, therefore using RFT to design an educational program to teach comparisons among food groups may improve the effect of these educational programs.

The purpose of this study was to implement a nutritional education program that used a RFT format to teach nutritional relations using the relational frame, "healthier," and assess for derived relations. Using this methodology, a small number of relations were directly taught to participants then additional relations that were not taught but were derived were assessed.

METHODS

Participants

A total of seven students participated in the study, with three completing all phases. Four students did not meet mastery criteria during the study and they were excused from the study. All of the students were enrolled in a general education pre-school class and none of the students were identified with a disability. The three students' who completed all phases of training results are reported. There were two females and one male student with their ages ranging from four years-six months to four years-ten months. All three students were African American and English was their primary language. Each child was administered a pretest that assessed for equivalence and comparison relations. This included relationships that would later be taught and those that would be derived.

Setting

The study took place in an office located inside a public elementary school. The office contained two desks, three chairs, two filing cabinets, a laptop computer, and a computer printer. The office was free from distractions, there was limited content on the walls and it was quiet. The room was approximately one hundred and fifty square feet. Each child participated individually. The child sat at a child-sized desk in a chair and the experimenter sat to the side of the child. The materials were presented to the child on the desk. A second observer sat behind and to the side of the child and observations were recorded using a clip-board and data sheets.

Dependent Variable

Students were assessed on two types of relations, equivalence and comparison. The percentage of correct answers on the pretest and posttest that assessed for taught relations and derived relations for both equivalence and comparison relations were compared to one another. The child was assessed on their ability to correctly choose foods with the same nutritional value as well as the healthiest food, which would be foods with more nutritional value. Training sessions included ten to twelve trials. The pre- and posttest contained seventy-two items. Training and testing sessions lasted an average of fifteen minutes.

Data Collection

All assessment measures and training trials were recorded on a protocol developed by the researcher. The protocol included the trial, verbal prompt to be read to the child, and section to score the child's response. The child was asked to point to one of two pictures. A correct response received a score of "1" and an incorrect response and a non-response received a score of "0." Each score was recorded as percentage of correct answers.

Interobserver Agreement and Treatment Fidelity

To ensure reliable and valid measurement of the target behaviors, interobserver agreement (IOA) was conducted by a school staff member who was trained on data collection procedures. The second observer recorded the child's response on a data collection sheet that was identical to the researcher's data collection sheet. The trained staff member recorded the child's answer on 100% of assessment measures and 25% of the training trials. After the assessments and training trials were competed the researcher and second observer compared results. IOA results were recorded on IOA Check Form. IOA was calculated by dividing the number of agreements by the total number of trials, IOA was 100%.

To ensure treatment fidelity, that is, whether the researcher presented the trial in the correct manner, a school staff member who was trained on data collection conducted a fidelity check on 100% of the assessment measures and on 25% of the training trials. If a trial was not presented in the correct manner the second observer crossed the trial out on their data collection sheet. After the assessments and training trials were competed the researcher and second observer compared results. Trial fidelity results were recorded on a Fidelity Check Form

and trial fidelity was calculated by dividing the number of agreements by the total number of trials. Trial fidelity was 100%.

Materials

Nine foods were organized into three groups (1, 2, or 3) based on national value, maximal, moderate, and minimal. The foods with maximum nutritional value (Group 1) included an apple, a grilled chicken breast, and sweet potatoes. The group that had moderate nutritional value (Group 2) included preserved fruit in a can, a fried pork chop, baked potato with butter. The group that had minimal nutritional value (Group 3) included fruit candy, a sausage, and potato chips.

Group 1 Maximum nutritional value
A1 = apple
B1 = chicken breast
C1 = sweet potato

Group 2 Moderate nutritional value
A2 = canned fruit
B2 = pork chop
C2 = baked potato

Group 3 Minimal nutritional value
A3 = fruit candy
B3 = sausage
C3 = potato chips

To teach equivalence relations, two foods from each group were taught to be the same, for example, an apple is the same as a chicken breast. Students were presented with a stimulus food picture and two additional food pictures. To teach and assess equivalence relations the student was asked "Which of these goes with this one?" To teach comparison relations, a food from each group was taught to be the healthier, for example, an apple is healthier than canned fruit. When teaching and assessing comparison relations the student was presented with two food pictures and asked, "Which is healthiest?" and "Which is least healthiest?"

Assessments

Pretest A pretest was conducted to assess equivalence and comparison relations. This included relationships that would later be taught and those that would be derived.

Equivalence Mastery Test The Equivalence Mastery Test assessed for the equivalence relations that were taught and derived. The children were required to score at least 90% in order to move to the next teaching phase. If the child did not

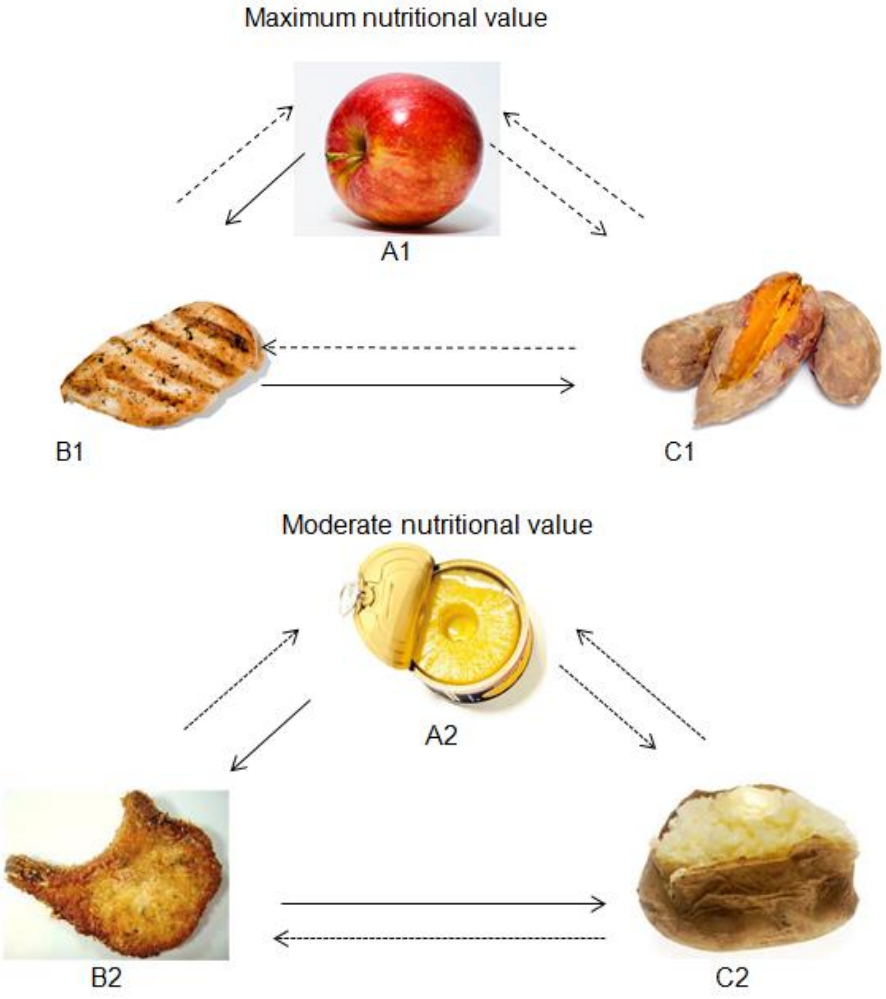
achieve the 90% mastery criteria, they returned to the original A-B and B-C equivalence training and proceeded through the training sequence again.

Posttest 1 If the child got at least 90% of the items correct on the Equivalence Mastery Test, the comparison relations that were to be taught, and derived were also assessed. Then the assessment was considered to be Posttest 1.

Posttest 2 A posttest was conducted to assess relations that were taught and derived for equivalence and comparison relations.

Design and Procedures

The children were given a pretest prior to training. Figure 1 shows the three food groups and each relationship that was taught and derived.



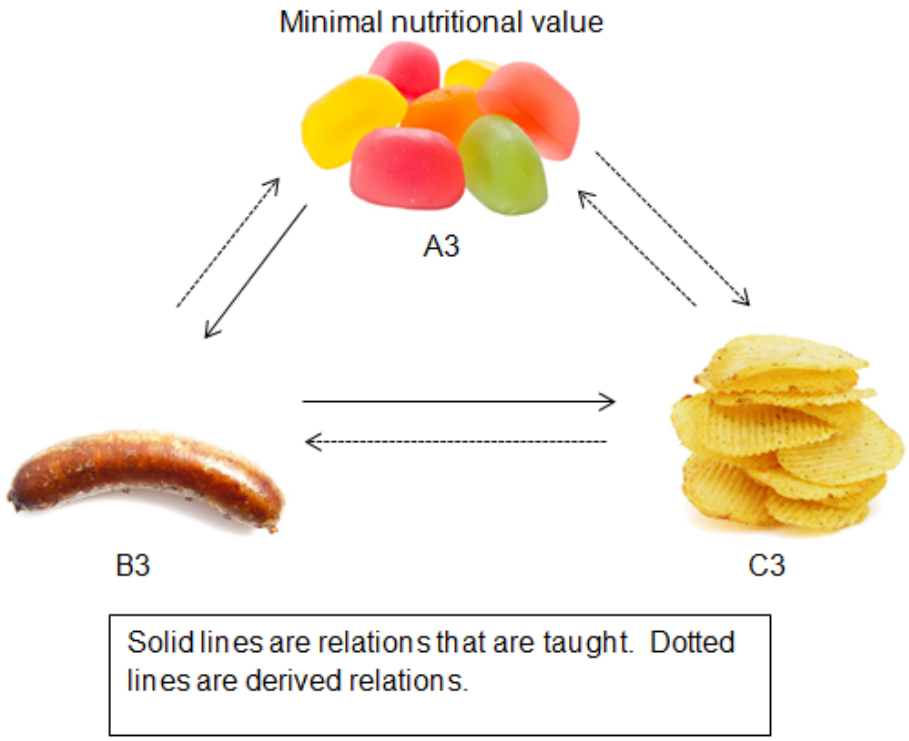


Figure 1. Taught and Derived Equivalence Relationships.

The solid arrows indicate equivalence relationships that were taught and the dotted arrows indicate equivalence relationships that were derived. The following A-B and B-C equivalence relationships were taught: A1-B1, A2-B2, A3-B3, B1-C1, B2-C2, and B3-C3. For example, the child was taught that an apple (A1) has a similar nutritional value as a chicken breast (B1), and a chicken breast (B1) has a similar nutritional value as sweet potatoes (C1). Next, the children were assessed for all the taught relationships and the following derived relationships: B1-A1, C1-B1, A1-C1, C1-A1, B2-A2, C2-B2, A2-C2, C2-A2, B3-A3, C3-B3, A3-C3, and C3-A3. Following equivalence training the children were taught a comparison relationship, A1-A2-A3. They were taught that an apple (A1) is healthier than canned fruit (A2) and canned fruit (A2) is healthier than fruit candy (A3). Finally, the children were given a final posttest that assessed for all taught and derived equivalence and comparison relationships.

Equivalence Training In equivalence training the student was presented with three pictures. The pictures were arranged in two rows with one picture in the first row and two pictures in the second row.

The researcher pointed to the top picture and said, "Touch the one that goes with this." After a correct response the child was reinforced using praise and after

an incorrect response a correction procedure was employed. Each child received explicit training on A-B equivalence in blocks of ten trials. The child completed trial sets until at least 90% of the items on two consecutive trial sets were answered correctly before continuing to the next teaching phase. B-C equivalence was taught in the same manner. In order to ensure the children had mastered equivalence training and they could provide answers independent of feedback combined trials of A-B and B-C equivalence were completed by the child with no feedback in blocks of twelve trails. The child was required to get at least 90% of the items correct on two consecutive trial sets of combined A-B and B-C equivalence relations before continuing to the Equivalence Mastery Test. If the student did not achieve mastery within the first two trial sets then they received training with 100% feedback. Then the feedback was faded on a VR-2 schedule, which is the child received feedback on a variable ratio of every two trails. Next, the child attempted combined A-B and B-C equivalence relations without feedback. If the child did not meet mastery criteria on the combined trials they returned to the original A-B and B-C equivalence training and proceeded through the sequence again. If the child did not meet mastery criteria after five days of training, they no longer participated. Then a new participant was selected based on pre-test assessment scores.

Comparison Training A "healthier" relation was taught between A1 and A2. For this relation participants were taught that foods with maximal nutritional values are healthier than foods with moderate nutritional values. The child was presented with two food item pictures side-by-side. The child was told, "Touch the one that is healthier?" The child touched their choice. After a correct response the child was reinforced and after an incorrect response a correction procedure was employed. Each child received explicit training on combined A1-A2 and A2-A3 comparisons in blocks of ten trials. The child completed trial sets until at least 90% of the items on two consecutive trial set were answered correctly before continuing to Posttest 2. See Figure 2.

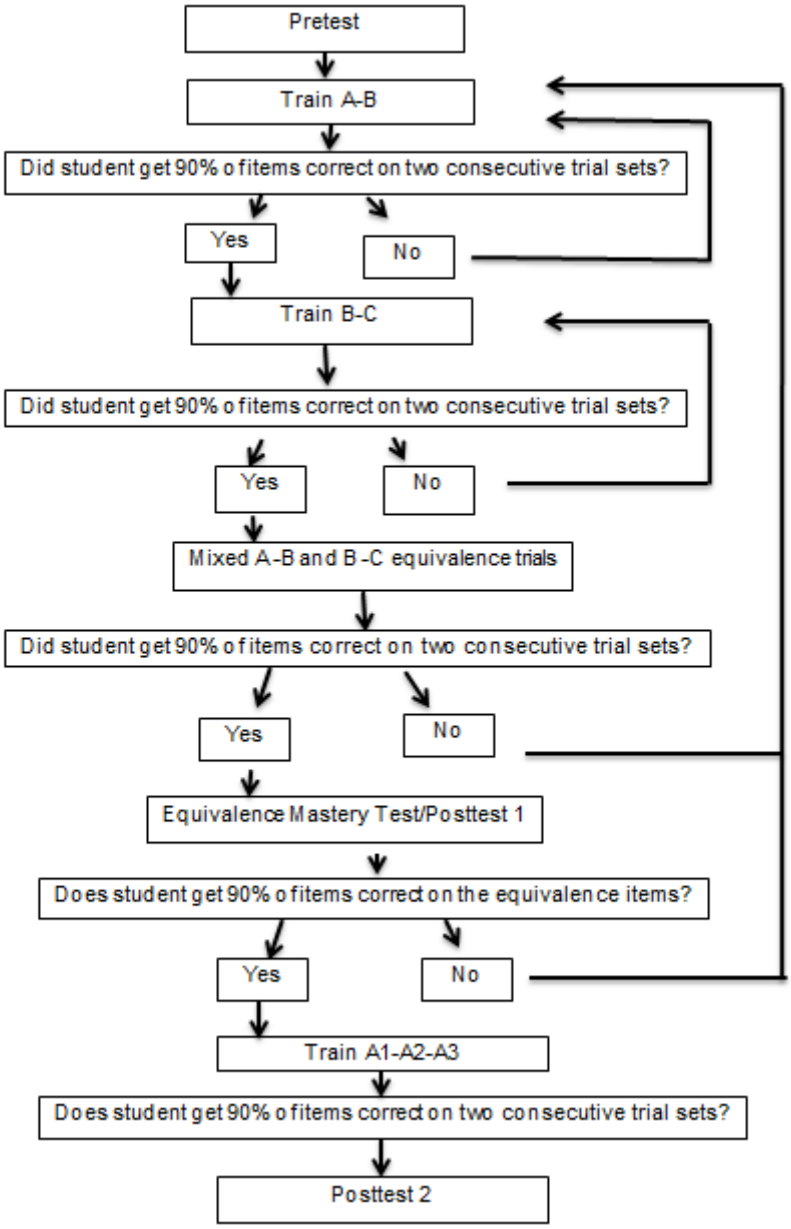


Figure 2. Experimental Sequence

Results

Equivalence Results All 3 participants scored at or below chance on the Pretest equivalence relations. During equivalence training Participant 1 required a total of

thirty-nine trials and four re-entries to A-B and B-C training to complete training on equivalence relations. Participant 2 required a total of twenty-nine trials and four re-entries to A-B and B-C training to complete training on equivalence relations. Participant 3 required three re-entries to A-B and B-C training and total of twenty-five trials to complete training on equivalence relations. See Table 1 and Figure 3 for all equivalence assessment results. All three participants did not provide the correct response on one relation. Participant 1 did not provide the correct answer for one equivalence relation that was taught. Participants 2 and 3 did not provide the correct answer on one of the equivalence relations that was derived.

Table 1. *Equivalence Results*

Participant	Relation	Pretest	Posttest 1	Posttest 2
1	Equivalence taught	50%	83.3%	100%
1	Equivalence derived	50%	100%	100%
1	Equivalence Total	50%	94.4%	100%
2	Equivalence taught	16.7%	100%	66.7%
2	Equivalence derived	58.3%	91.7%	75%
2	Equivalence Total	44.4%	94.4%	72.2%
3	Equivalence taught	33.3%	100%	100%
3	Equivalence derived	58.3%	91.7%	75%
3	Equivalence Total	50%	94.4%	83.3%

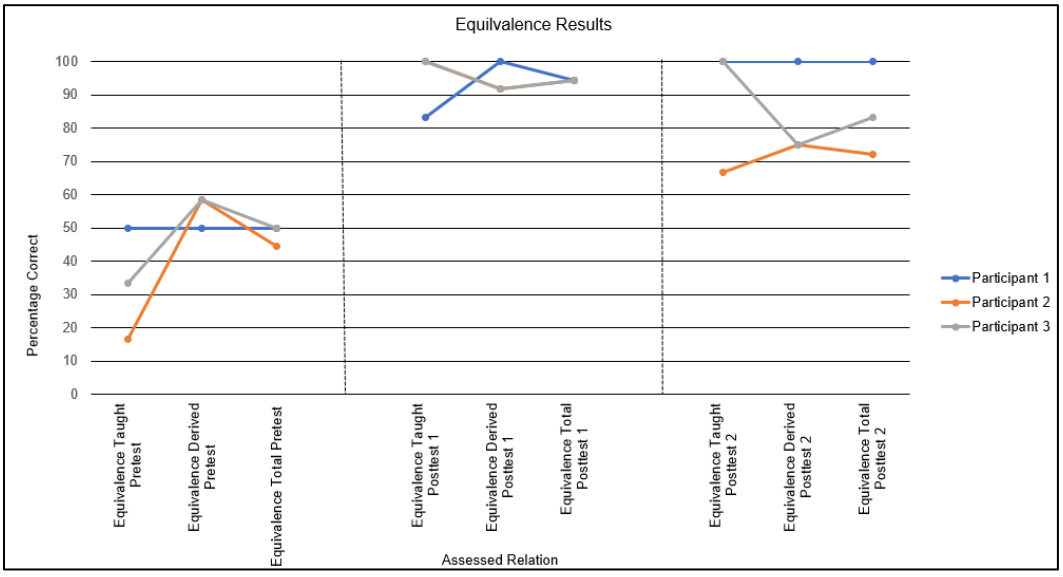


Figure 3. Equivalence Results

Comparison Results All 3 participants scored at or below chance on Pretest 1 and Posttest 1 Comparison Relations. During comparison training Participant 1 required a total of two trials to complete training on comparison relations. Participant 2 required a total of four trials to complete training on comparison relations and Participant 3 required a total of three trials to complete training on comparison relations.

After comparison training Participants 1 and 3 provided the correct answer on 100% of the comparison relations that were taught. See Table 2 and Figure 4 for all comparison assessment results. Participant 2 provided the correct answer on 50% of the comparison relations that were taught. When Posttest 2 scores were compared with Pretest scores Participant 1 showed a slight increase in correct responses that were derived. Participant 1, 2, and 3 increased correct responses for derived comparison relations from Posttest 1 and Posttest 2.

During comparison only two "healthiest" relationships were taught and no "less healthy" relationships were taught. On the assessments there were twenty-five "healthiest" relations and twenty-five "less healthy" relations that were derived. Participants 1 and 2 answered incorrectly on a greater number of items that assessed "less healthy" relations while Participant 3 answered incorrectly on more items that assessed "healthiest" relations. See Table 3.

Table 2. *Comparison Results*

Participant	Relation	Pretest	Posttest 1	Posttest 2
1	Comparison taught	0%	50%	100%
1	Comparison derived	53.8%	42.3%	55.8%
1	Comparison Total	51.9%	42.6%	57.4%
2	Comparison taught	50%	0%	50%
2	Comparison derived	55.8%	38.5%	48.1%
2	Comparison Total	55.6	37%	48.1%
3	Comparison taught	0%	50%	100%
3	Comparison derived	50%	42.3%	48.1%
3	Comparison Total	50%	42.6%	50%

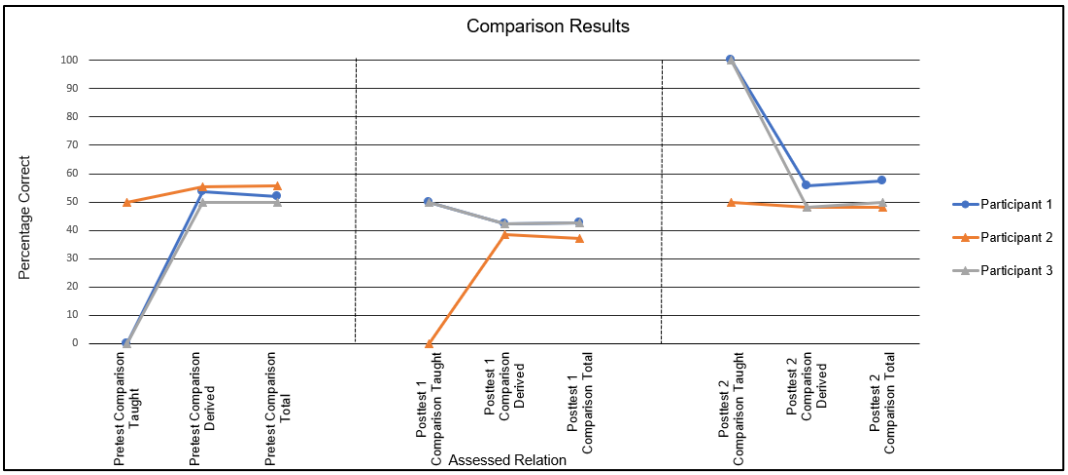


Figure 4. Comparison Results

Table 3. *Comparison of Percentage Incorrect*

Subject	Less healthy % incorrect	Healthiest % incorrect
1	13/25 (52%)	8/25 (32%)
2	15/25 (60%)	11/25 (44%)
3	10/25 (40%)	15/25 (60%)

Discussion

This study implemented a nutritional education program using a relational frame theory format to teach nutritional relations using the relational frame, "healthier," and assessed for derived relations. The first step involved teaching equivalence relations between nine foods categorized into three groups, maximum nutritional value, moderate nutritional value, and minimal nutritional value. After the initial equivalence training and remediation procedures all the participants demonstrated mastery on equivalence relations that were taught and the emergent derived relations of equivalence. Subsequently, after the participants met mastery criterion on the equivalence relations, they were taught two comparison relations and assessed for comparison relations that were taught and derived. All three participants improved their performance in at least one comparison relation.

Prior research demonstrates that labeling and posting nutritional information may increase the selection or purchase of healthy foods (Dubbert, et al., 1984, Mayer, et al., 1986, and Cinciripini, 1984). However, these studies do not provide evidence that nutritional concepts, such as which foods are healthiest, were learned. Interventions that use classification systems to organize foods into groups based on nutritional value and then taught the classification system to participants were effective in teaching the comparative healthiness of foods

(Epstein, et al., 1978 and Stark, et al., 1986,). However, these studies do not address the participants' ability to generalize and expand their nutritional knowledge. This study attempts to extend the research on nutritional inventions by using RFT procedures to teach the relationships between foods that are organized into three groups, foods with maximal, moderate, and minimal nutritional value.

In this study all three participants were successful in learning equivalence relations that were taught. These results add to the results of studies that used classification systems to teach food groups (Epstein, et al. 1978 and Stark, et al., 1986). Not only were all three participants successful in learning equivalence relations that were taught, they were successful in deriving additional equivalence relations that were not directly taught. In all, six equivalence relationships were taught and twelve equivalence relationships were tested. This indicates the students derived six additional equivalence relationships that were not directly taught. These results add to the Lipkens, et al. (1993) findings where ten relations were taught and ten new relations were derived. RFT procedures have also been effective in teaching comparative relations, such as more-than and less-than (Barnes-Holmes, et al., 2004, Berens and Hayes, 2007, and Murphy and Barnes-Holmes, 2004). In this study, two of the participants, Participant 1 and Participant 3, improved their performance on the comparison relations that were directly taught in a small number of trials. That is, two participants in this study were able to choose the healthier food on the two relationships that were directly taught.

Limitations and Recommendations All three participants were successful in learning the equivalence relations that were taught and then using those relations to derive additional equivalence relations. One limitation of this study is the implementation of procedures that used only two answer choices for both the equivalence and comparison training and the mastery criteria was set at 90% on the training trials, equivalence mastery test, and posttest 1. This criterion could have been too low because the participants were required to use the equivalence relations to aid in deriving additional comparison relations. If the participants only knew 90% of the equivalence relations they could not be expected to derive 100% of the comparison relations. For example, if the participant was taught an apple is the same as a chicken breast and a chicken breast is the same as a sweet potato, they would be expected to derive the following four equivalence relationships: an apple is the same as a sweet potato, a sweet potato is the same as an apple, a chicken breast is the same as an apple, and a sweet potato is the same as a chicken breast. Then, if the participant was taught the following comparison relationship, an apple is healthier than canned fruit, they would be expected to derive the following five relationships: Chicken breast is healthier than canned fruit, a sweet potato is healthier than canned fruit, canned fruit is less healthy than an apple, canned fruit is less healthy than a chicken breast, and canned fruit is less healthy than a sweet potato. However, if the participant failed to derive any one of the original

equivalence relationships they would not be able to utilize all of the equivalence relationships to derive the additional comparison relationships. When implementing procedures that only used two response choices Sidman (1987) advocated for high mastery criterion in order to ensure that the taught and derived relationships were truly mastered. No participant scored 100% on the equivalence relations on Posttest 1and only one participant maintained the equivalence relationships throughout the comparison training and testing. The other two participants' performance decreased on equivalence relationships from Posttest 1 to Posttest 2. A recommendation for future research is to require a high mastery criterion (100%) on each individual relation before moving to the next phase. If the high mastery criterion is not met on the derived relations remediation techniques should be implemented (Sidman, 1987).

Similarly, the second limitation of this study is this degree of success was not demonstrated in the comparison training. The low performance in the comparison training could be due to the small number of training trials that were offered. An average of three sets of ten comparison trials were completed before moving to the posttest compared to an average of thirty-two sets of ten equivalence trials. In addition, during equivalence training the participants were required to meet mastery criteria on an equivalence mastery test before moving to the next phase of the study. If the participants did not meet mastery criteria remediation training trials were conducted. There was no mastery test for the comparison trials and therefore, no remediation procedures were implemented for the comparison training. One recommendation for future research would be to use a comparison mastery test and remediation procedures when teaching the comparison relations. It is possible that with more comparison training trials, comparison mastery tests, and remediation techniques the participants could potentially have improved their performance on comparison training.

This study is also limited because no equivalence maintenance assessment was completed. In order for the participants to successfully derive the comparison relations they had to maintain and utilize the equivalence relations that were taught and derived. In this study once the participant met mastery criterion for the equivalence relations they immediately began the comparison training and then they were given the final posttest. Two participants performance decreased on the equivalence relations on the final posttest. This indicates the equivalence relations were not maintained throughout the comparison training. To help ensure equivalence relations were maintained one recommendation is to use a time delay of at least a couple of days between the equivalence training, in which the participant met mastery criterion, and the beginning of the comparison training. After the time delay, to ensure that the equivalence relations were maintained, another equivalence mastery test could be administered before comparison training

was implemented. If the participant did not meet mastery criterion, remediation training could begin.

Additionally, this study did not take into account the participants' age when developing the design and procedures. This study required participants to make inferences by comparing relations among foods. According the Piaget's Four Stages of Cognitive Development, this skill emerges during the Concrete Operational stage and children typically enter this stage around the age of seven years old (Cook & Cook, 2005). The ages of seven participants in this study ranged from four years-six months to five years-five months. Therefore, participants may have had difficulty deriving additional relations that were not directly taught because their cognitive development may not have reached the more advanced stage. Future research should account for Piaget's Stages of Cognitive Development when choosing participants and developing the design and procedures.

During the study there was lack of experimental control. The researchers did not inquire if the teachers or parents taught or discussed any nutrition concepts or the study with the participant. Additionally, it is possible the participants discussed the study amongst themselves. Since the participant partook in testing and training on multiple days any discussion about nutrition concepts or the study could have aided the students' performance. Future research should focus on methods that assist with gaining more experimental control.

Lastly, while this was an educational activity and students were taught nutrition concepts this study is limited because there was no application to actual eating. Although the results show some success it is not known whether the knowledge gained transferred to students making "healthy" food choices. Future research should not only focus on knowledge that was learned but also on application to eating habits and food choices.

Conclusions Obesity is a growing health concern for individuals of all ages and there is a need for interventions that focuses on teaching children nutritional concepts and values. RFT is a theory that enables researchers to learn how people respond to relationships, which includes the ability to make comparative choices. This study implemented RFT procedures to teach equivalence and comparison relations. Participants received the majority of the training on equivalence relations and therefore, they were more successful on the equivalence relations. After the initial training trials, mastery tests, and remediation training trials, six equivalence relationships were taught and eighteen equivalence relationships were tested. This indicates the students derived twelve additional equivalence relationships that were not directly taught. However, the comparison training was not as successful. After the study when examining the design and procedures it is evident that more emphasis was placed on the equivalence training. These procedures were effective when teaching food groups, for example, an apple, chicken breast, and sweet potato

are all healthy foods. Future research needs to focus on maintaining the equivalence relationships while also teaching the comparative relationships. In conclusion, this study has demonstrated that nutritional concepts can be learned through effective instruction regardless of age. By organizing a nutrition education curriculum based on methods such as these used here, it is possible to teach nutrition concepts and potentially overcome the obesity epidemic.

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