Teaching Nutrition to Preschool Students using the Temporal Contiguity Principle

By

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ABSTRACT

Multimedia learning has become increasingly popular as it proceeds to understand how different senses such as the visual and auditory systems work together to present information. The aim of the present study was to examine the effect of temporal contiguity, a principle of multimedia learning, while displaying images and narration of fruits and vegetables to increase memorization of content. 21 preschool students between the ages of 4 and 5 from Arizona State University's Child Study Lab were recruited for the purpose of the study. Students received one of two versions of a short video while inside the classroom. The two videos displayed information either at the same time or successively. Children's knowledge was assessed with a drag and drop categorization game. The findings show there were no significant differences between the two conditions. Future studies should consider a longer training period when developing multimedia learning technology to ensure content is retained.

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INTRODUCTION

In recent years, multimedia learning has become increasingly used in classrooms. Over 500 research studies have shown a positive increase in learning effects on achievement testing while using computer-based technologies for tutoring (Roschelle., Pea, Hoadley, Gordin, & Means,2000). While there are many different forms of learning technology, multimedia learning considers that the learner may have a limited amount of cognitive resources. Multimedia learning considers these limitations by combining different senses of the learner, for example hearing and sight. This proposed study will focus on a younger population, specifically preschool students, while using multimedia designs. Specifically focusing on the principle of Temporal contiguity, the concept information such as narration and illustrations being presented simultaneously rather than successively.

Research in this area has yet to focus on multimedia designs in the population of preschool students, specifically looking at the principle of temporal contiguity. This population is important to consider when understanding the developments in technology learning because of the impact it may have later in their education. This study will look to identify learning differences. These students will be provided with a nutritional learning plan, provided by the preschool. This learning plan will focus on the student's ability to identify food groups, in this case the differences between fruits and vegetables. Findings from this study will contribute to uncovering insights related to multimedia learning as an effective type of learning for younger children.

By designing an interactive multimedia video for younger children, this research will contribute to multimedia learning in a younger population and whether it is an effective type of learning to use for younger children. This research aims to facilitate the production of these technologies, and to advocate for their use in the classroom to further educational learning. The study seeks to ask the question, does the simultaneous presentation of illustrations during narration result in higher learning, when presented in the preschool setting, as compared to the non-simultaneous presentation of information? Multimedia learning has shown to be effective within older student populations (Mayer, 2012), but yet to be shown effective in that of preschool students. This study predicts that preschool students will retain more knowledge from a multimedia video utilizing the concept of temporal contiguity than videos without.

LITERATURE REVIEW

Cognitive Development. In children has been widely studied across theories of developmental psychology, in relation to what children can understand in early development and learning. Learning in young children can depend on the multi-sensory networks of the brain such as visual and spatial regions (Goswami & Bryant, 2007). This is largely dependent on the neural networks that are distributed when learning. Cognitive processing and knowledge develop from our perceptual systems. Children, like adults have a limited amount of working memory, where information is stored until it is used for cognitive tasks, such as learning. When teaching or presenting content through technology, it can be critical for students to retrieve information in a way that will not overload the amount of working memory.

Language and vocabulary development can be extremely important as well when forming cognitive development for preschool students (Goswami & Bryant, 2007). Children can build upon information in situations such as grammar and creating sentences, allowing for their knowledge to expand. This type of development can be extremely important for learning and enabling cognition. An experiment was conducted to examine preschool children's ability to identify questions to the proper knowledge area. The experiment consisted of fifty preschool students who interacted with two puppet experts to inquire which key opened a box, which had a prize inside. By asking the puppets questions, the children would discover special details of the keys. Mills, Legare, Bills, and Mejias (2010) discovered there was a difference in the way preschool students asked questions. Three- year old's did not direct their questions toward a specific knowledge source. For example, 3-year-olds questions were indirect and were not related to the question at hand. While four- year old preschool students could direct their questions toward specific sources, but their questions were ineffective as well, meaning they were able to understand the concept, but the questions were not related. Five-year old preschool students were able to ask the specific source, as well as form questions that were relevant to the knowledge area, (Mills, 2010). Developmentally, preschool students may exhibit differences when understanding the relationship between two things. This research establishes that preschool students can develop questions and use tools in order to solve problems, although this may differ depending on the age and experience of the children.

Children begin asking questions at a very early age, from the child's perceptive the questions they ask may be authentic and real, wanting to receive an answer even if the question does not seem relevant. Danovitch and Mills (2018) seek to understand how children's explanations can promote learning and exploration. The road from explanation to exploration can vary depending on the child. For, example explaining science concepts may promote a different type of exploration than a concept like English. Children. The authors argue that children are able to use explanations to understand concepts they do not know, and this may lead to exploration of science concepts. At young ages, children can understand whether specific statements and topics that make sense at that moment, but not all engage in exploration based off of the child's interest, (Danovitch & Mills, 2018). Developmental differences can spark interests in areas such as whether children engage in science or feel comfortable asking questions about unfamiliar topics. This chapter provides relevance and evidence to whether or not children ages three and older can evaluate and recognize when information makes sense. Giving children tools to explore questions they may have, may spark exploration. This study gives insight to children of young ages and their ability to explore concepts they are not familiar with and gain knowledge through their own exploration. This is important when understanding how children come to understand concepts at such as young age.

Cognitive development is different in each age group, and learning varies in what students may understand. Early understanding of the development of learning are beneficial to explore as it can open educational opportunities for preschool students to engage in. An experiment was conducted to examine preschool children's ability to identify questions to the proper knowledge area. The experiment consisted of fifty preschool students who interacted with two puppet experts to inquire which key opened a box, which had a prize inside. By asking the puppets questions, the children would discover special details of the keys. Mills, Legare, Bills, and Mejias (2010) discovered there was a difference in the way preschool students asked questions. Three- year old's did not direct their questions toward a specific knowledge source. For example, 3-year-olds questions were indirect and were not related to the question at hand. While four-year old preschool students could direct their questions toward specific sources, but their questions were ineffective as well, meaning they were able to understand the concept, but the questions were not related. Five-year old preschool students were able to ask the specific source, as well as form questions that were relevant to the knowledge area, (Mills, 2010). Developmentally, preschool students may exhibit differences when understanding the relationship between two things. This research establishes that preschool students can develop questions and use tools in order to solve problems, although this may differ depending on the age and experience of the children.

Educational Technology in Preschool. Furthermore, educational technology has been increasingly used in the classroom and has shown to be a fundamental tool for learning to promote development in young children (Couse & Chen, 2010). The increasing amount of engagement and interest in activities of the use of technology such as computers in the preschool setting have been effective and provide a way for students to express their thinking in a more detailed manner. Researchers, Course and Chen (2010) explored tablet computer use within the population of preschool students, and the productiveness of the children engaging to draw. Results revealed children preferred the tablet as well as the matter in which teachers incorporate technology in the classroom, can make a huge difference in its effectiveness.

In recent years, technology opportunities in the classroom have advanced. Even within the preschool setting, computers and iPad can be used as a way of engagement in the daily environment (Aronin & Floyd, 2013). By targeting younger learners, such as preschool students, achievement in the classroom can be improved long term when technology is used in the classroom (Pentimonti, Zucker, Justice, & Kaderavek, 2010). Students achievement can also be influenced by the way teachers work with students to engage in learning and technology. As students of any age become more familiar with using technology, it is important to consider in this environment and in which ways it can impact learning early on.

Multimedia Learning. Has become an increasingly used form of learning in the classroom. This is important to consider when presenting information. Multimedia learning has become increasingly accepted as a form of learning. For example, one-way multimedia can be used in the form of animation. Mayer and Moreno (2002) developed different forms of instructional messages using narrated animations to explain a series of events such as how lightning storms form. Questions related to these instructions were related to the steps of the processes of these events. For example, some of the messages focused on the temperature and moisture in the air. The multimedia design principle states that learners will be able to build mental associations between words and pictures, in the case of this experiment, animation and narration, (Mayer & Moreno, 2002). These studies suggest that words combine with pictures lead to better learning than words alone. These findings demonstrate there may be differences in learning based off the way information is presented and organized.

Difficulty in learning may arise from many things. For instance, one-way learning can suffer is when cognitive load is overwhelmed by multiple forms of information. In an article by Sweller and Chandler (1994) three assumptions are made of cognitive load theory. Information that can be difficult to learn varies, depending on the situation. In a series of four experiments, Sweller and Chandler aimed to understand why certain information can be more difficult than others to understand using computer applications. The variables under investigation in all four experiments were instruction time, written test time, and written and practical test performance, (Sweller & Chandler, 1994). This study provides insight to cognition when considering higher level activities that may involve more cognitive processing. These findings suggest that cognition can become limited depending on the task and the level of intensity involved, which may vary for each individual. Mayer's Cognitive theory of Multimedia learning provides the idea that learning is processed through two different systems, the visual and verbal systems (Mayer & Moreno, 1998). The implications of designing for multimedia learning come from seven different principles to reduce cognitive strains and improve learning through the dual processing system.

With information being presented in many formats, there are certain inputs that are being targeted such as visual and auditory. Hede, A. (2002) suggest an integrated model of interactions a learner has while being presented with multimedia information.

Information being presented can have a “split attention” affect if the designers of multimedia presentations are not careful with the placement of information. The split attention affect is said to give the learner a split of audio and visual information, which may not be best. When designing multimedia presentations and to avoid the split attention affect, authors suggest creating a guideline for how to present the information, such as creating simple navigation, simplifying information that is presented at the same time, and providing multiple ways to access the information (Hede, A., 2002). By following a path of these design recommendations, multimedia instruction can be used more effectively. Understanding how to develop future multimedia information can be helpful to the current study when understanding how to design information to flow properly. These design recommendations can be useful when designing multimedia learning environments for every age group.

Contiguity Principles. Temporal contiguity refers to the presentation of information such as words and pictures at the same time, rather than separately (Mayer & Moreno, 1998). The benefits of presenting information through auditory and visually are said to enhance learning because the student will not have to search for information, instead linking the information through a bimodal presentation will ensure the benefits of temporal contiguity will be used. For example, studies in preschools using the concept of temporal contiguity, in relation to vocabulary and later word comprehension, revealed that oral text and illustration do show a higher learning gain within this population (Papachristopoulou,2013). In this study, the hypothesis of the simultaneous presentation of story books providing more learning gains compared to the successive presentation of storybooks was confirmed. According to Mayer's temporal contiguity principle separately (Mayer & Moreno, 1998), the cognitive load on children's working memory was reduced, resulting in higher learning of material.

Limited cognitive resources associated with the presentation of multimedia technology can be addressed by presented text and pictures simultaneously. One-way cognitive resources become limited is by presenting text and pictures separately, learners may use more cognitive resources searching for information visually. The simultaneous presentation of text and pictures is known as the principal of spatial contiguity. Following this principle, images are presented in conjunction with its related textual information. For example, spatial contiguity dictates that a diagram illustrating the brain should also display textual information, like the name of the organ, with the image. Further research on educational technologies and principles, such as spatial contiguity, may explain the differences between tradition learning and multimedia learning.

Spatial Contiguity is a major principle of multimedia learning. In a study by Paek, Hoffman, and Saravanos (2017), the authors hypothesized that the influence of spatial contiguity would be present even when learning was not the specific goal of a task. Using adult participants, a usability test was done by displaying screens with different amounts of spatial contiguity on them, while no direction was given on the task. The entire procedure was done online, there were three forms that were based on learning theories. Different phases and conditions were given to participants while sitting in front of a computer screen. The conditions varied based on the responses to the stimuli, some were neutral, and others were not.

Multimedia effects proceed to understand how multiple senses are used when processing information (Sundar ,2000). This information can be processed many different ways, such as text, picture, audio, as well as other forms. Sundar (2000) explored the relationship between types of multimedia used on a website. To do this, sixty undergraduate students from a communications class were randomly assigned to one of five different conditions. The material used in the study was a news website, all experimental conditions were similar but had differences in the way they were designed according to text, text and pictures, text plus audio, text plus audio plus pictures, and text plus audio plus video. These conditions were manipulated to answer four different variables. Story recall, story recognition, ad recall, and ad memory. Results suggest a few different findings, one very important finding, is that pictures along with text have a positive effect on memory-enhancement. (Sundar, 2000) These findings, help to understand the sensory differences between different kinds of multimedia effects and how it will be useful for understanding the best way content should be most beneficial to the learner.

Cognitive development of preschool students at this age can spark an interesting outlook on multimedia learning environments. Educational technology within the preschool population has a promising future, as students are engaging with material on technology devices (Aronin & Floyd, 2013). At any age, it is important to consider how to present information, as working memory can only hold so much at a time. As these concepts of design, have evolved from cognitive psychology and understanding how information is processed to each individual learner. Preschool student’s cognitive development should be taken into consideration when designing multimedia learning environments as it can be difficult to design for a preschool student and to understand their cognitive capabilities.

METHODS

Participants and Setting

The present study included 21 preschool students at Arizona State University's Child Study Lab (CSL). The Child Study Lab is a place of research and learning for college students, as they interact with students daily in a classroom setting. The children at the CSL participate in ongoing research studies; therefore, parents received a parental permission slip to sign consenting students to participate. Participants were randomly stratified to conditions based on PVVT scores and age. PVVT (Peabody Picture Vocabulary Test) is a Standard American English assessment to estimate receptive vocabulary. This ensures that the children in the control group are cognitively similar to the children in the intervention.

The physical classroom setting consists of 5 tables with a carpet space for group activities. Observation windows consume one wall of the classroom, allowing for parents and research assistants to observe research and daily lesson plans within the classroom. There were 4- 5 adults, one of whom is the lead teacher, and 3-4 teachers' assistants in the classroom at all times. Students were chosen from the older classroom based on their level of comprehension of the task; therefore, this eliminated participants in the younger class as they demonstrated a lack comprehension of the task based off of their age and may render the task invalid. Students in the older classroom were between the ages of 4-5, while the younger classroom consists of children 3 and younger.

Material

Design. This study involved a two-group between subject randomized experiment design. To reduce the chances of carryover effects, participants were placed into one of two group, the simultaneous group or the non-simultaneous group. The research conducted aimed to test the following hypothesis: The study predicts that preschool students will retain more knowledge from a multimedia learning video utilizing the concept of temporal contiguity than without, specifically does the simultaneous presentation of information during narration result in higher learning, as compared to the non-simultaneous presentation?

Learning Content. The videos consisted of 24 different fruits and vegetables overall, displaying four at one time. The videos showed four different fruits and vegetables at one time, while the name of the fruit or vegetable was labeled at the bottom of the image. A screen shop form of the video is presented in Appendix A. The content in the videos, matched the items on the pretest and posttest. The videos consisted of 13 fruits and 11 vegetables. A screen shop is shown of the video screen in Appendix B.

Assessments. Two Group Pre-Post: Participants were given a pretest and a posttest in both conditions. A screen shop form of the pretest is shown in Appendix A, the posttest was identical to the pretest. The pretest and posttest for both conditions was done as a categorization game, this allowed researchers to identify which fruits and vegetables the children were able to identify correctly to their category using a drag and drop function. A pre-test was conducted to establish baseline of students' knowledge of food groups. Students were given a similar post-assessment that included new items from the food groups to understand whether the information was retained and transferred. A baseline was established, and the final outcome data was compared to the baseline to assess the amount of content learned.

Simultaneous. Participants were assigned to the simultaneous group. Participants received a 1 minute and 11 seconds video displaying various fruits and vegetables. The simultaneous presentation of information meant that the narration as well as the images proceeded to be presented at the same time. This condition implemented the temporal contiguity principle of the cognitive theory of multimedia learning. It implemented this principle by presenting images and narration simultaneously rather than successively.

Non-Simultaneous. Participants were assigned to the non-simultaneous group. The non-simultaneous group had the same videos in terms of content. Participants received a 1 minute and 28 second video. The difference displayed in this group was that information was successive, meaning the images would appear on the screen, 2-3 seconds later narration and text would appear. This version of the video violated the temporal contiguity principle of multimedia learning by presenting images and narration successively. A screen capture of the video is displayed in Appendix B.

Procedure

A parental permission slip was given to parents through email as well as put into student folders to take home to inform them of the study. Children were also asked for verbal consent before participating to ensure their participation was voluntary. Children in the Multiage and Pre-k classes were asked to complete the study while in small groups during the classroom day. The multiage and Pre-k classroom consists of children who are older, as well as relating to what time of day the children attend the preschool. Some of the children are in both classes, while some may only be in one or the other. Depending on the time the children were there, was when they would attend small groups and make a rotation to the current study.

Implementation of the videos was done in the classroom during small group rotations. Small groups allow for the rotation of students at each table in the room, which gave the opportunity for students to be randomly assigned to an area or activity for the amount of time it takes to complete the task. The pretest and posttest were conducted in the classroom as well.

The videos were produced using Adobe creative for video production and narration. Implementation of the two videos was done through Qualtrics. Qualtrics is a tool used to set up, collect, and analyze data, as well as the setup of modules. The questions pertaining to the pre and posttest were also done in Qualtrics using the "drag and drop" feature. Using Qualtrics allowed for the randomization of content for each participant.

The experiment was completed in one session for each child individually. Children were asked to sit at a table inside the classroom with two researchers. During the testing session students had access to headphones, as well as a touchscreen tablet to complete the study. The child would begin by completing the pretest, which took 2 to 3 minutes depending on the child and their comprehension of the task. The pretest consisted of a categorization of different fruits and vegetables. Once the pretest was completed, students reviewed one of the two conditions, they were asked to put on the headphones and watch the video displayed. The posttest was then given immediately after the child had reviewed the video. The posttest was identical to the pretest, in which the child would drag and drop the item to its appropriate category. When the child had completed the posttest, they were asked to return to the regular classroom activities. Additionally, children were given a sticker for their participation in the study.

RESULTS

Table 1

Group Descriptives for Each Condition

Condition	n	M	σ
Non-Simultaneous pretest	11	18.55	4.70
Simultaneous pretest	10	21.00	3.05
Non-simultaneous posttest	11	19.10	4.85
Simultaneous posttest	10	22.20	2.53

Note: number of participants in each condition, their mean scores, and standard deviation.

Table 1

Mean scores for each condition are shown in table 1. Pretest scores for both conditions show students improved from pretest to posttest by a few points. The highest possible score was 24, showing students pretest scores were only able to increase by very few points in the posttest.

Data were analyzed using a 2x2 mixed ANOVA with a within-subjects factor of Knowledge test (pretest and posttest) and a between-subjects factor of condition (separated and contiguity). Main effects of the knowledge test for students' scores on pretest and posttest, *F*= (1,19) = 4.31, p = .052, n_{p2}=.19 show no significant interaction between the pretest and posttest of both groups. Main effects of between condition, *F* (1,19) = 2.74, p =.114, n_{p2}=.13 showing no significant main effect on the difference between condition scores. These results do not support the temporal contiguity principle of multimedia learning

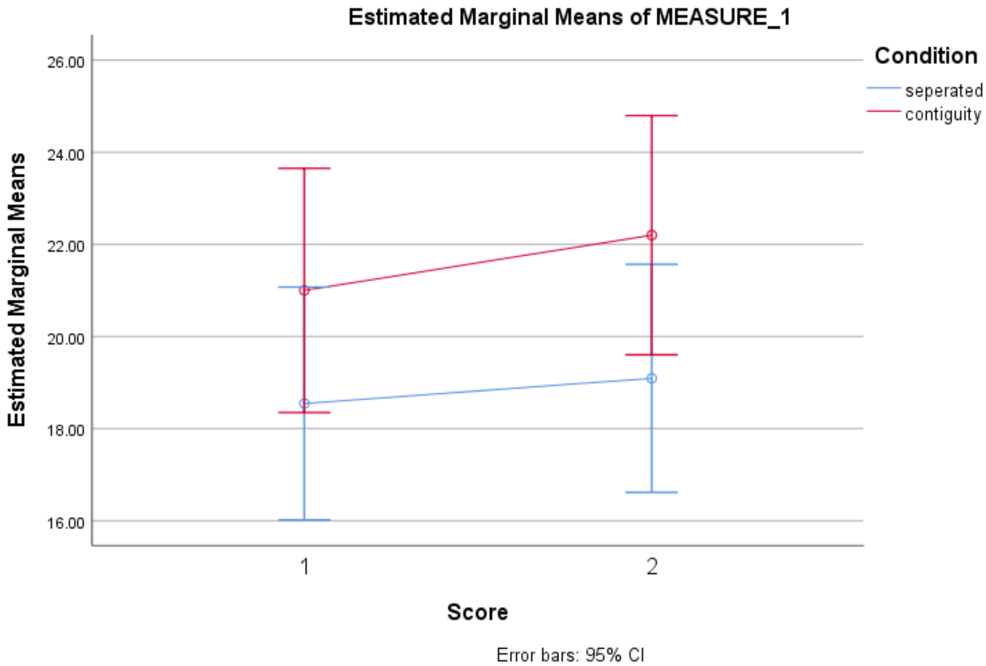

Figure 1: difference in means between groups with standard error bars

The figure shows both conditions with the estimated means of both groups. The error bars in the figure show an overlap, revealing the two means are not statistically significant ($P>0.05$).

DISCUSSION

The findings suggest that students did retained more knowledge in the simultaneous presentation because of their higher posttest scores but not enough to be significant. The overall prediction was not confirmed but the findings do contribute to the hypothesis. This may be a stepping stone to future studies and whether developing technology in this population is useful.

The present study introduced multimedia learning to the preschool population, focusing on the principle of temporal contiguity. Two videos were produced to examine the effects of temporal contiguity, one being the simultaneous presentation (images and narration at the same time) and the non-simultaneous presentation (images and then narration presented successively). It was revealed that there were no significant findings the pretest to the posttest for both conditions. The study predicted that preschool students would retain more knowledge from a multimedia video utilizing the concept of temporal contiguity than videos without. Mayer’s theory of multimedia learning suggests that the temporal contiguity principle (Mayer & Moreno, 1998), will reduce the cognitive load on students and result in higher learning. Although, these results were not confirmed from the current study, students still improved in scores from pretest to posttest. This shows it may still be useful to investigate further in designing multimedia learning platforms that follow the contiguity principles.

Past literature on cognitive principles of multimedia learning have reviewed temporal contiguity in a few different forms. Mayer & Anderson (1992) found the simultaneous presentation to be superior to the presentation of narration and animation either before or after. Specifically, students demonstrated improvements on transfer problems than students who received before or after narration (Mayer & Anderson,1992). Investigation of the temporal contiguity principle have held consistent for evidence that the principle is effective. Although, for this study the memorization of content was analyzing and not problem-solving transfer. This is important to consider as each population may show the need for a different form. Participants from this study did not reveal to learn more from the simultaneous presentation, showing it may not be essential when designing learning platforms for preschool students.

Differences were not found between the conditions and knowledge tests, but active learning activity was shown within the current study. All previous implementation of this effect has been in non-interactive environments (Ginn's, 2006; Mayer, 2009, Mayer et al., Moreno & Mayer 1999). According to the ICAP (Chi & Wylie 2009), an active learning environment would outperform a passive environment. So, it is possible that the addition of the active learning in this population was enough to overshadow any effect that temporal contiguity might have produced. Additional research is needed to investigate this possibility.

Further iterations of the study should consider the population and how the content should be presented to preschool students. Mayer and Anderson (1992) presented each, or both narration and animation for 30 seconds. This is a huge time difference in comparison to the current study. The simultaneous and non-simultaneous condition only differed by 2-3 seconds in the amount of time information was presented. It may be beneficial to create a larger time frame between when the images and narration occur, as this was a small amount of time between narration and animation but for the current study was necessary for to keep engagement of students in this age group. The current research aimed to facilitate the production of these technologies, and to advocate for their use in the classroom to further educational learning, it is still up for discussion on whether the temporal contiguity principle is an effective deigning method when used in the preschool setting. Other multimedia principles may be interesting to consider, as there was improvement in learning in the simultaneous presentation.

LIMITATIONS

The study is not without limitations, as testing the temporal contiguity principle has yet to be done in the preschool population. Obstacles did occur during the duration of the study as time and recourses were limited. There are many ways the current study may be altered and maintain attention toward developing technologies for preschool students.

Not all children had interest in participating in the current study therefore the sample size was small. There was also a limited number of students able to participate based on age at the preschool. With 21 children in the study, it is hard to generalize these findings. A small sample size may have also increased the margin of error and reduce the power of the study. Thus, future studies are suggested to target larger samples of students to receive better external validity.

Additionally, due to lack of time, students did not receive a second posttest to ensure results were not based on recency effects and memorization of content was potentially being retained. The duration of study was within 10 minutes. Students received the pretest followed by the video, and immediately receiving the posttest. This may have caused students to remember or categorize the fruits and vegetables based on what they had previously done in the pretest and not what they had received during the videos because the posttest and pretest were identical to each other.

Another area to note is within pretest scores. Students in all groups were similar across pretest scores, which were relatively high. This may cause a ceiling affect as the students have potentially received information on fruits and vegetables in school and at home or in a different form of learning. Observed mean scores show the simultaneous pretest (M= 18.55) and the non-simultaneous pretest (M=21.00) revealing students may have been familiar with the content prior to receiving the video as the total score possible was 24. A video displaying the fruits and vegetables that the children got incorrect in the pretest, may have been better to focus on. Future studies may consider a different choice of content, that may not have been developed at the place of research.

Future research may also consider a longer time frame and further sessions of training videos This may yield for better results, as researchers can look at the transfer and retention of content and not just memorization. Designing multimedia videos for preschool students may call for a different implementation of principles and focus of content. Future research may consider also looking at problem solving transfer questions, as it may yield significant results as it as shown previously. When looking at temporal contiguity there are a few things that should be considered, the content being presented, attributes of the learner, and the sensitivity of the video as in the timing of information. All three of these should be evaluated to best fit the learners need for future research in the area.

CONCLUSION

This study sought to understand and answer the question of whether presenting information simultaneously rather than successively make a difference in learning at the preschool level? The study predicted students would increase their knowledge of fruits and vegetables more so by watching the simultaneous presentation of information, than the non-simultaneous presentation of information. Although results did not show students to have increased their learning more in the simultaneous condition, there was still a larger increase in posttest scores of the simultaneous group.

As educational technology continues to grow and become widely accepted, these tools to help us create these learning technologies are important to consider and should continue to be researched. Additionally, cognitive development of children this young (ages 4-5) can be much harder to gage when developing learning tools. By targeting younger learners, we are able to see just how early and how much can be achieved in the classroom when developing these technologies long term. This research contributes to multimedia learning, specifically the principle of temporal contiguity and whether it can be used at the preschool age level when developing educational technology.

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APPENDIX A

PRETEST AND POSTTEST SNAP CAPTURE

Drag and drop the correct food item to its food group

Items

Avocado

Artichoke

Bell Pepper

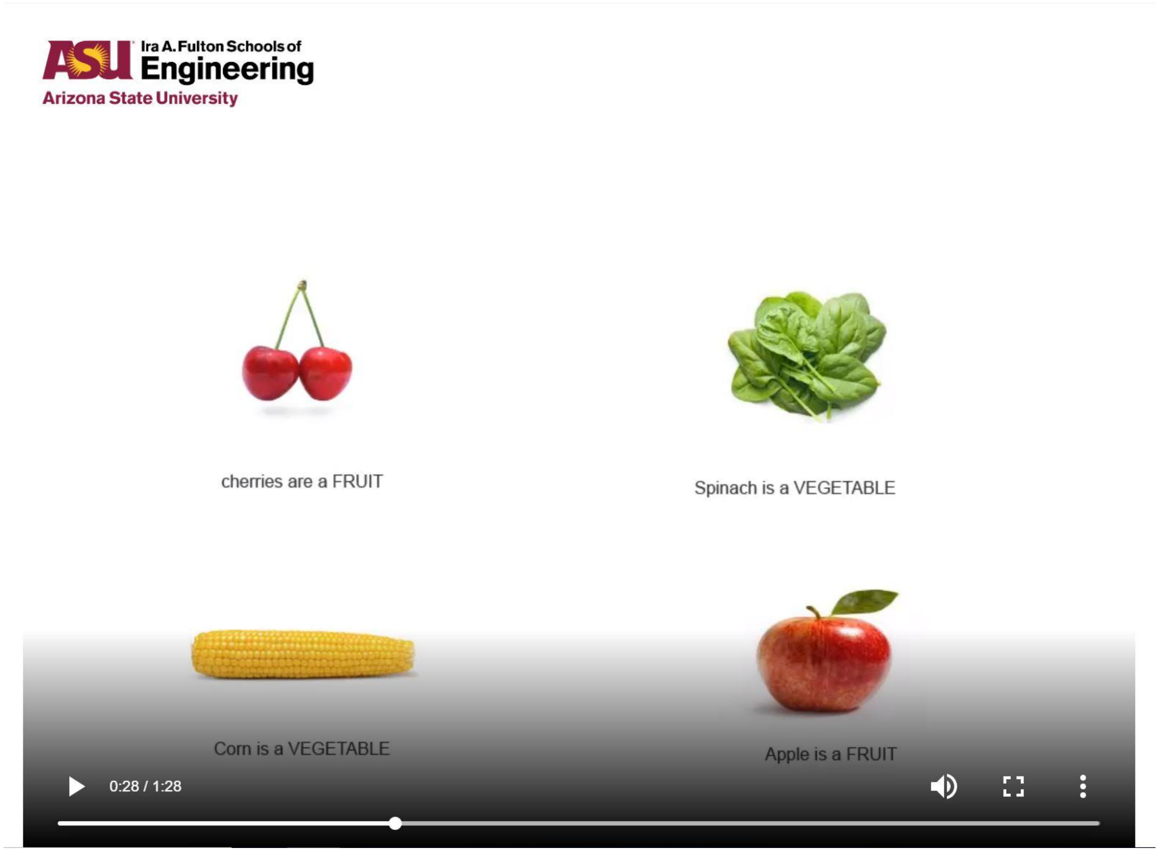
Bananna

Vegetable

Fruit

APPENDIX B

SNAP CAPTURE OF VIDEO CONDITIONS


Ira A. Fulton Schools of
Engineering
Arizona State University
cherries are a FRUIT
Spinach is a VEGETABLE
Corn is a VEGETABLE
Apple is a FRUIT
0:28 / 1:28

APPENDIX C

INTERACTIVE QUESTION SHOWN AFTER VIDEO

Match the Fruit or Vegetable to the correct food group

Items	Vegetable	Fruit