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**THE EFFECTS OF REPRESENTATIONAL AND REAL EVENT
CONTEXTS ON VERBAL AND NONVERBAL LEARNING**

By

Carrie Wojcik Luce

A THESIS

**Submitted to
Michigan State University
in partial fulfillment of the requirement for
the degree of**

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Department of Audiology and Speech Sciences

2004

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ABSTRACT

THE EFFECTS OF REPRESENTATIONAL AND REAL EVENT CONTEXTS ON VERBAL AND NONVERBAL LEARNING

By

Carrie Wojcik Luce

The convenience, portability, and accessibility of pictures have led to their predominant use in language therapy. It is unknown whether using such symbolic stimuli (i.e. moveable pictures, toys...) to simulate events as opposed to real stimuli has a differential effect on the verbal and nonverbal learning of young children. The purpose of this study was to determine whether children who participate in an event using real objects differ from those who participate in the same novel event using a dynamic pictorial representation. Fourteen typically developing preschool children were randomly assigned to one of two teaching conditions. Seven children participated in a juice-making event using real objects and 7 participants participated in a representation of a juice-making event using models and moveable pictures of the objects involved in making orange juice. Significant differences were found between the real and representational groups on both verbal measures. Nonverbal performance measures also revealed significant differences. The potential clinical impact of these findings can not be determined without further research on children with clinical impairment. Nevertheless, these results suggest that both verbal and nonverbal learning may be aided by participating in real events.

Thesis Advisor: Dr. Ida Stockman

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I would like to thank Dr. Ida Stockman for her support and vision. It was her excitement and dedication that lead me to become interested in child language, and eventually research. She has been an instructor, advisor, and an example throughout this project.

I would like to acknowledge the committee members. My thanks to Dr. Alice Whiren & Dr. Paul Cooke for their time and input. Dr. Whiren 's work in child development was invaluable as was Dr. Cooke's advice and tutelage throughout my graduate career.

I would like to thank the staff and parents of the children at the Christian Childcare Center, Kidzone, Spartan Child Development Center, and members of the St. Johns community for their cooperation.

To the professionals who took time to aid in data collection, I am grateful for the hours you spent without complaint analyzing the data. Lori Seagraves and Eve Marshall, your time and commitment were appreciated greatly.

To my family, a special thanks. To my daughter, Paige Wojcik-Wilson, you were my motivation. To my husband, Jason Luce, without you this project would not be possible, not only due to your support but through your creativity and ability to make things work. To my sister, Licia Clowtis, thank you for being my cheering section, my editor, my day-care provider, my personal chef, and so much more. To my parents, Carol & Steve Clark, thank you for always knowing I could, even when I thought it was impossible.

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CHAPTER I

Background of the Study

Effective strategies for teaching verbal and nonverbal concepts can include a number of factors. The manipulation of certain factors may result in a more effective approach to teaching and clinical intervention than others. Efficacy research has long sought to reveal the types of variables that contribute to the best practice approach to therapy. Given that many factors can potentially influence the process of knowledge acquisition, a theoretical framework is useful for guiding the exploration of variables that may be manipulated to enhance learning.

The theoretical foundation for most clinical and pedagogical practices, which are aimed at facilitating learning, stems from the fundamental debate about whether innate predispositions or experiential interactions with the environment have the most impact on knowledge acquisition. Most current theoretical models recognize both innate ability and environmental stimulation as important factors in knowledge acquisition.

A Piagetian/Constructivist Framework

The interaction between biological innate factors and interactions with the environment is central to a constructivist theoretical view of learning and development, as argued by classic Piagetian and neo-Piagetian scholars (Affolter, 1991; Affolter & Bischofberger, 2000; Nelson, 1986; Stockman, in press). However, innate ability is not a variable that can easily be controlled or changed to heighten a child's ability to learn. But, the surrounding environment

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does provide a plethora of experiential options that may be manipulated to enhance a child's ability to learn about the world around them.

Practitioners who want to facilitate children's learning are particularly focused on the problem of how to construct the environment in ways that enhance learning. While many factors can impact knowledge acquisition, this study focused on the importance of event participation. It was motivated by the assumption that learning, even language learning, is naturally facilitated by active event participation in natural situations. Event participation requires more than just performing a series of actions in the environment, such as experiencing temporal relationships, causality, and functionality within a given context. Katherine Nelson (1986) defined an event as people involved in purposeful activity by action on objects and interacting with each other to achieve some result. The event then involves social and physical interaction, and not just action, as action itself can be decontextualized or lacking in purpose when isolated from an event. For example, holding a pen involves the action of grasping and picking up the object, but it does not give cues about the functional use of the object. Learning about an object by simply acting upon it may be described as decontextualized learning, whereas learning about an object in a functional event, such as drawing, provides a functional or contextualized learning experience. Piagetian-inspired theory strives to explain how knowledge may be obtained by interacting with the environment in order to achieve some goal.

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This theoretical orientation is compatible with a constructivist view of learning. From this perspective, a child cannot be given or handed over knowledge in a passive way. The child must construct the knowledge by acting on and interacting with the environment in both physical and social ways. Schwebel and Raph (1973) described “construction” as a number of processes that go on during continuous interaction of the person and his/her environment. Some of these processes can be described in terms of Piaget’s fundamental theoretical constructs, which drive learning and developmental changes, namely **assimilation** and **accommodation** of the sensory input provided by the surrounding environment. Furth (1970) describes **accommodation**, as cited in Piaget (1962), as the ability to apply a general structure to a particular situation, which leads to a differentiation of a previous structure and the emergence of new structures. In lay terms accommodation may be simplified as the ability to generalize or apply stored knowledge of the environment to a new situation or event. The process of applying the new knowledge can then lead to a differentiation of a previous structure and emergence of new structures from taking in new information. **Assimilation** is then the taking in of environmental stimuli and incorporating them into what is known about the environment. These constructs are used to explain the way intelligence is developed rather than how to teach concepts. That is, classic Piagetian theory was focused more broadly on characterizing or describing the broad types of conceptual knowledge that resulted from the cognitive process of assimilation/accommodation across the lifespan. The emphasis was not on revealing what is involved online in the

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A Neo-Piagetian Framework

The importance of environment, development, and experience to knowledge acquisition, as described by classic Piagetian theory, has provided the groundwork for many neo-Piagetian theorists who seem to be interested in understanding the process of learning in real time and in the real contexts of perceiving and moving (Stockman, in press). This neo-Piagetian focus should guide practitioners more directly about what to do when trying to enhance learning from pedagogical and clinical experiences. Neo-Piagetian scholars have laid the groundwork for many of the assumptions made in this study.

Neo-Piagetian scholars have built on Piagetian theory in their attempts to understand the components of an experience that are required to enhance learning in children with developmental deficits. For example, Felicie Affolter (1991), who studied with Piaget in the 1950's, incorporated Piagetian principles in her clinical intervention framework for children along the autism-PDD spectrum, who present with severe developmental deficits and adult patients with acquired neurological disorders.

Affolter (Affolter, 1991; Affolter & Bischofberger, 2000) and her colleagues were influenced in particular by Piaget's focus on sensorimotor processes in early development as foundational for cognitive development. She and her clinical team revealed in their cross-sectional and longitudinal research that children with severe developmental disorders often have sensorimotor deficits.

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Such deficits are correlated with reduced and abnormal sensorimotor activity. So a major cornerstone of their developmental model is that nonverbal physical interaction in problem solving events of **real** daily life experience is the root of development. Accordingly, the intervention framework aims to build the perceptual-cognitive foundation for developing nonverbal and verbal (semantic concepts in particular) by involving children in physical interactive experiences (Stockman, 2000).

During the sensorimotor or pre-symbolic stages of development, the child's manipulation and interaction with the environment provides the perceptual input and feedback necessary to acquire knowledge about the world. However, Affolter (1991) argued that the perceptual input that is basic to learning is the tactual-kinesthetic experience embedded in movement interaction events, and its coordination with input from other sensory modalities (namely, vision and audition) in real causative events. The implication is that a therapeutic framework should focus on enhancing the tactual experiences in the stream of multimodal input during physically interactive causative experiences in real event contexts. Tactile-kinesthetic experiences are presumed to be detected and stored by the nervous system as changes in resistance embedded in the tactile-kinesthetic perception of movement experiences. Resistance refers here to a physical notion, namely the perception of the amount of force in the environment that opposes movement activity. One senses that an object has been touched when the body encounters total resistance or opposition to movement activity. Experiences with the varying levels of resistance offered by the environment

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when moving around in it are needed to give the child an understanding of the difference between self and the surrounding environment. The world becomes a more familiar place as the child also learns to coordinate the auditory and visual effects of touching and moving experience within events (Affolter. 1991; Affolter & Bischofberger, 2000). The tactile-kinesthetic experiences embedded in touching and moving give critical perceptual information about causative actions while auditory and visual modalities along with the tactile-kinesthetic modalities give critical information about the effects of movement (i.e., causative changes that result from movement interactions).

In sum, Affolter's work is guided by the assumption that the nervous system extracts resistance information from the interaction experience with the environment in order to learn about cause-effect relationships in the real world. Based on this work it was assumed that resistance from enhanced tactual experience and interaction has some role in the learning process. Thus the importance of resistance in nonverbal and verbal learning becomes integral when constructing therapeutic strategies.

It also is argued that the tactual-kinesthetic sensory modalities are more primary than the auditory and visual information. This assumption is supported by observations of clinical populations with different types of sensory-perceptual deficits, namely those with deficits in hearing, seeing, feeling/mobility. It is well known that hearing-impaired children, who are not exposed to sign language at a young age, will have a language delay, and also present with a delay in spoken language. That is because they cannot fully perceive auditory speech cues.

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Furthermore, blind children's language acquisition was reported to be delayed (Fraiberg, 1977; Mills, 1993) because they cannot perceive the visual cues of speech signals or other spatial cues that feed concepts about the world. Affolter and Bischofberger (2000) reported that while these two groups of children have delayed perceptual development early on and delayed language onset, they do go on to develop normal cognition and language within the scope of their sensory impairment. Deaf children, without comorbid impairments, can easily acquire sign language or even oral language with the use of aided audition (hearing aids and cochlear implants). However, children with tactile-kinesthetic impairments present verbal and nonverbal skills that are not only delayed, but are deviant relative to typically developing children and those with hearing or visual loss (Affolter & Bischofberger, 2000).

A Clinical Model Based on Neo-Piagetian Theory

The Affolter interaction approach integrates the sensory experience in a nonverbal way through manually guiding the body of patients with deficits to interact with the environment, building on the foundation of the tactile-kinesthetic experience. This nonverbal interaction, through guided interaction therapy, in real daily problem solving events is purported to aid word learning by providing a referent for the words given later to describe the event (Stockman, 2000). The authors of this approach propose that nonverbal interactions provide the conceptual basis for language learning (Affolter & Bischofberger, 2000). They assert that event participation provides the natural contexts in which language is

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typically used, structured, and learned. Therefore the event itself becomes an integral piece in language learning.

Analysis of the Affolter approach leads to the assumption that explorations through touch leads to familiarization with events. Children are assumed to gain knowledge about the world from predictable events, but also through their ability to change components of the events. Children were observed to use previously acquired knowledge of activities as causes to elicit certain effects. The habits they had learned through participating in daily activities, not just observing them, allowed children to produce a desired effect, even when changes to the environment were present. A number of the basic trends of this developmental framework for child interaction stems from the supported theoretical and empirical work of other scholars. A sampling of this work is summarized below.

The Importance of Action Events in Learning

There are examples of both indirect and direct support for the importance of action in real events for learning. Indirect support may be found in investigations of event knowledge and language learning proposed by Katherine Nelson (1986). She is another neo-Piagetian scholar who has done extensive theorizing about the importance of event structures in knowledge acquisition. Nelson's definition of an event or event knowledge, as discussed earlier, hinges on the importance of interaction with the environment through purposeful goal oriented interactions with the environment, including social interactions. She further explains that these goal-oriented interactions lead to representations of schemas. This theory supports the importance of previous experience for

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creating event representations that provide foundational symbolic referents (Nelson, 1986).

Support for the importance of event participation regarding event knowledge also comes from Elizabeth Slackman's (1985) work. Slackman (1985) studied the effect of active participation on learning a novel or unfamiliar event. In this investigation 41 preschoolers and 43 first graders participated in practice trials in either a causally or temporally driven event. The children participating in the active condition reenacted and verbalized the event immediately after the demonstration. The participants in the passive condition, within both groups, simply relayed their knowledge of the event verbally.

The investigator found that the children who acted out the event recalled more of the event overall than those who only verbally relayed their knowledge. Furthermore, children who acted out the event were more likely to recall the cause and effect unit presented in the event.

Additional analysis revealed that children in both age groups remembered actions that were linked causally. Preschoolers also were better able to sequence a causal event than a temporal one. It was concluded that both active participation and the degree of causal relatedness of an event, influence how much typically developing children remember about an event.

Lois Bloom is another scholar allied with the neo-Piagetian tradition, who provides indirect support for the importance of action. It has been documented that typically developing children frequently describe their own actions (Bloom, 1981) before they communicate the actions and interactions of others

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(Huttenlocher, Smiley, & Charney, 1983; Stockman & Latham 2002; Latham & Stockman, 2002).

More direct support for viewing actions in real events as important to development can be found in Stockman's (in press). This book highlights the role of action in both nonverbal and verbal learning. In particular, it is argued that understanding the meaning of words draws on conceptual knowledge of the environment (Jackendoff, 1996; Lakoff, 1994; Landau & Gleitman, 1985; Pinker, 1984, 1987; Nelson, 1986). In very young children conceptual development is often focused not only on exploration of the world around them, but also on their own bodies and how their bodies relate to objects in the environment. Acting on the environment results in cause-effect experiences that arise from changes between body and the environment, which are the basis for understanding action and interaction.

The process of learning through action and experience through the interaction/construction embodiment theory has been further delineated in Stockman's (In Press) work. This framework touts the use of multiple input modalities in event contexts. This theory of practice is based on the importance of self-action presented in the constructivist view of knowledge acquisition. Support for these assertions can be found in investigations involving both typically developing children, children with clinical impairments, and adults (Mitchell-Fucile, 1992; Stockman & Latham, 2002; Latham & Stockman, 2002; Rowe, 2003).

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Mitchell-Fucile (1992) focused on the importance of taction and self-action on language learning in typically developing children. The purpose of this study was to determine whether object manipulation without vision would better facilitate word to action mapping than observation of the action without tactile-kinesthetic input. Twenty children between the ages of 3 and 4 years, with assessed language abilities at age appropriate levels, participated in this study. The subjects were taught novel action words under two different teaching conditions. The first condition was the visually observed condition. The second was the manipulation condition. Those in the manipulation condition were taught the novel verb while blindfolded and manually guided through the action that corresponded with the referent. In the visual condition the subjects observed the clinician perform the actions.

In general, there were no significant differences between the observation and manipulation teaching conditions for overall word learning. These findings suggest that children can learn as well from their own actions without looking (tactile-kinesthetic input) as from just looking and listening (visual and auditory input). However, additional findings also provide support for tactile-kinesthetic input as primary for comprehension tasks as significant group differences were found on the visual recognition task. The manipulation group performed significantly better than the observation group on this task.

The author concluded that significant differences may have been due to the perceptual focus of the participants during the teaching task. For example, the participants in non-blindfolded conditions may have focused on such visual

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information as what the examiner or objects looked like rather than the action being performed. So when the visual referents (the person doing the task) were changed in the visual recognition test task, some of the children seemed confused about what was important about the event. As a result they gave fewer correct responses. These visual differences did not impact the object manipulation group as their experience was focused on the action itself and not a particular visual representation. These differences support that focused tactile-kinesthetic interaction with objects does promote learning at a basic level.

Further direct support for the interaction/construction embodiment framework is provided by research investigating the differences between observation and a more interactive multimodal approach. Stockman & Latham's (2002) and Latham and Stockman's (2002) investigations of the effect different kinds of input modalities on learning explored the differences in knowledge acquisition when children who observed an event were compared to children who participated in the event. In this study 15 typically developing children with a mean age of 5.1 years and 12 special needs children, with a mean age of 6.4 years, were randomly assigned to either an observation or a participation group. The observation group was exposed to the auditory and visual stimuli via a video taped recording of the juice-making task. The participation group was engaged in the actual activity of making the juice. Therefore, the children were exposed to the visual, auditory, tactile, smell, and taste stimuli involved in making juice with an antique juice press. During the activity both the groups were exposed to a novel noun and novel verb 4 times during the session. This study concluded that

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though there was not a significant difference in the performance of the typically developing groups when the observation and participation groups were compared. Statistical measures did support that special needs children did significantly benefit from the hands-on-experiences, as the special needs observation group fared poorest of all the groups. The data obtained in these investigations suggests that the effects of using a multimodal approach in a real event context may be even more significant for language delayed children than typically developing children.

The benefits of construction/interaction on event learning are not limited to children's verbal and nonverbal learning, but may be beneficial for all learners. Rowe's (2003) study examined the differential effects of mode of sensory input and/or time delay on verbal and non-verbal performance. The investigator sought to determine if a modality bias existed for the group that received combined auditory, visual and tactile-kinesthetic inputs versus the groups that received only auditory or combined auditory and visual inputs. The effect of differing modality conditions on retention of new information was also explored.

This study (Rowe, 2003) involved 21 male college students between 18 and 21 years of age. A comparison of the participants' nonverbal performance and procedural discourse were analyzed to determine if significant differences existed. For the verbal performance, results revealed a significant difference between the auditory-visual-tactile-kinesthetic group and the other two groups (auditory and auditory-visual) after the 20-minute time delay, but not at lesser delay times. The auditory only group performed significantly poorer than did the

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other two groups on the verbal measure. These findings support the use of multimodal input for verbal and nonverbal learning for all learners, with varying symbolic abilities and range of previous experience.

Stockman (2000) also stresses the importance of interaction within event contexts in functional intervention. Event context is described as a natural physical interaction event in real world situations. In the opinion of the author, the therapeutic event must offer the possibility to interact by eliciting changes of the topological relationships between the child and his/her environment. The importance of the event providing opportunities to elicit changes to achieve a functional problem-solving goal is also stressed.

In summary neo-Piagetian theory supports the use of multimodal input in the context of event participation. The importance of actively experiencing an event is cornerstone to this framework. Event participation provides the opportunity to experience resistance cues and extract cause-effect relationships that are basic to constructing the cognitive referents for these events that are encoded by language.

Theory Versus Practice

The preceding discussion has called attention to physical interaction in real events as foundational for developing nonverbal cognitive concepts (e.g. understanding cause-effect relationships) and language skills (its semantic basis in particular). This focus on event-based learning is supported by empirical evidence from observations of typically developing children and adults as well as clinical populations of children and adults with conceptual-cognitive and linguistic

deficits. Despite theoretical and practical support for a “hands-on” approach to learning, it does not necessarily guide pedagogical or therapeutic practices with typically or atypically developing children. While educational/school environments certainly cater to a “hands-on” approach to learning in real event contexts for preschoolers and early school age children (see Montessori practices in particular), the advent of computers in classrooms, and social pressures may erode the emphasis on experiencing the world in real event contexts early on. Such a progression may already be observed as children are being encouraged to develop print literacy skills at earlier and earlier ages. At the same time, television, video, and computer media are already firmly entrenched in home and school environments as modes of instruction and learning. These types of stimuli contrast with the kind of nonverbal physical interaction found in natural events. By and large, these representational stimuli cater to perceptual input that emphasizes the distance senses, namely audition and vision. Representational stimuli may often result in the exclusion of the near senses, e.g. tactile-kinesthetic, which are embedded in bodily movement and action experiences.

The habilitative/rehabilitative contexts for speech/language therapy in particular, have traditionally exploited auditory and visual sources of sensory input for teaching communication skills. This bias in input experience seems to influence the type of stimuli used in instruction to promote learning. For example, reliance on the distance senses forces us to consider only the visual and auditory sources of input. Whereas, focus on bodily participation in real events, involving

touching and movement, force attention to tactual-kinesthetic input in coordination with audition and vision.

However, using real events can be difficult to manage or control across learning events for children with different learning goals. So the sheer reduced practicality of using real events has led professionals to rely more often on representations of events. Yet the stimuli used for representing events are by no means uniform in their functionality or accessibility. The fact that some representational stimuli come closer to symbolizing real events than others may encourage practitioners to use representations in place of real event experiences. It is precisely this observation that motivated the present study. Given the variability in the possible representations that may be used, it is instructive here to review the range of representational stimuli used and consider their possible effectiveness for learning.

Description of Representational Stimuli

Symbolic or representational media may be described as abstract models of stimuli used in real events. These media consist of varying degrees of reality representations. They consist of toys, pictures, interactive pop-up books, and interactive computer software.

Interactions with these representational stimuli involve some degree of simulated or imagined consequence. A simulated event, for the purposes of this study, involves a goal-oriented movement that approximates but does not exactly duplicate the “real” actions (adapted from Kostelnik, Soderman, & Whiren,

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1999), and may not result in the same effect on the environment as the real action event.

The symbolic medium itself is not the only aspect that may affect learning. As described earlier, other aspects of the stimulus and the context are equally important. For example, learning may be influenced by whether the stimuli are manipulable symbolic representations.

The following discussion focuses on, the types of representational media used. They differ in (1) the amount of inference needed to draw conclusions about the purpose of a “simulated” event, (2) the level of symbolic awareness or level of inference needed to comprehend the purpose of using the stimuli, and (3) the sensory input modalities involved in interaction with each set of stimuli. The potential impact of each representational form on clinical and/or pedagogical efficacy is also discussed.

Toys

Toys are the stimuli most often used in early play and exploratory behaviors. Children use toys, among other things, to voluntarily and actively participate in pleasurable activity that has no extrinsic goals, which may be defined as play (Frost, 1992). These play experiences are freely chosen and therefore are not usually found within the confines of the classroom or therapeutic environment where predetermined activities typically are used to meet a specific pedagogical or therapeutic goal. The use of toys for exploration or reenactment is more typically seen in pedagogical and therapeutic practices. Children often may be observed to investigate objects and recreate events with

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different objects, including toys, to obtain or impart information (Whiren, Soderman, Stein, & Gregory, 2002).

Toys can be viewed, in most cases, as the least abstract representations of reality used in exploration and reconstruction events. Some toys are exact miniature representations of real objects and may function or be acted upon in the same way as the real object (e.g. a toy/miniature cup that looks like a real cup and may be used for drinking or pretending to drink). Many toys, however, represent just the visual forms or shapes of objects, but not their size or physical composition (e.g., many toys are made of light weight plastic). Consequently most toys cannot be handled functionally like their real world referents. For example, a toy car cannot be driven, but it may look like an actual car. The car can be made to move like a real car, but the actions needed to make the car move, such as pushing the car along the floor, are not the actions needed to drive a real car. Symbolic objects, like a toy car, may be acted upon, but not in functional ways that achieve the goal of driving a car in a in a real world experience. The appropriate representational use of a toy in a reenactment event demands that the goal of the real event be imagined or internally represented by the agent that caused the action. While toy objects do offer the benefit of a variety of sensory input, most do not provide the goal-oriented cause and effect relationships involved in a real event. To act on the toy objects in ways that simulate real cars, children must have an internal representation of the objects and their functional use in the real world. According to Casby (1991), Piaget's stages of cognitive development predict that complex symbolic play, as

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reflected in a variety of combinatorial play frameworks may be observed at 3 to 4 years of age (as summarized in Casby, 1991). These stages include the ability to use words to represent the experiences in which children have participated or observed.

Based on observations made about early stages of development, toys may be used inappropriately in event reenactment if the child has not already experienced the goal of the interaction in a real event. The use of toys to replicate or simulate functional daily living events may not be effective, if a child does not already have an internal schema for the event so that its goal and the sequence of actions needed to reach the goal can be inferred. Consequently, one ought to be able to learn much about what a child knows about the world by observing the kind of event reconstructions or representations created.

Although this study focused on event **reconstruction**, the use of toys is not limited to recreating what has been experienced before. As children mature, they may use toys to engage in events that are not aimed simply at replicating or recreating what has been experienced before. In contrast to **reconstructive** events or event reenactment, **constructive** events involve the creation of new objects and scenes that stimulate learning, as when children use Lego blocks to compose new objects and scenes or decompose the parts of already known objects to learn how they work. Thus **constructive** events are viewed here as the manipulation of the environment for the purpose of creating a new event. A constructed event need not simulate a real event (e.g., transforming a toy car into a toy robot). In this case, toys are part of a real event.

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In summary, the effective use of toys varies with the toy's functionality and the purpose of the event in which it is used. The efficacious use of toys is dependent on a child's level of **symbolic awareness** (ability to encode and process symbolic information) and maturation, as well as a child's previous experience with the represented event.

Pictures

Still pictures (as opposed to video pictures) provide a static 2-dimensional representation of an object or event. These static representations capture only a moment in time, so that action must be mentally inferred or imagined. Gibson (1979) stated that a "frozen" form does not specify a solid object shape, but only some of the invariant features that a solid object must have. It is implied then, that children must learn to interpret the conventions and techniques used to portray reality in two dimensions. It is assumed that this ability is developed through direct experience with pictures (Jackson, 1971; Miller 1973), given that pictures vary in how representative they are of reality. Still pictures, in particular, are inherently more abstract than most other representational media. They are 2-dimensional representations of a 3-dimensional real world. Photographs of real objects and events the least abstract forms of picture stimuli. Still photographs provide only static representations of events in restricted visual planes at a given moment in time, and they cannot be used functionally to effect change of the environment. They merely represent the environment. Thus picture stimuli, even in their least abstract form, do not allow the learner to witness goal-oriented

interactions available in real event participation. Consequently, the meaningful interpretation of pictures has two prerequisites.

First, the use of pictures in education requires some knowledge of the prerequisite skills needed to understand and identify pictured stimuli. Basically two types of knowledge are required. First, a child's ability to create and interpret pictures relies on previously stored experiences and the knowledge of the real event that is pictured. That is, interpretations of pictured events rely on the describer's nonverbal knowledge of the event. Descriptions of entire events require the child to have knowledge of the single action events that comprise the connected event sequences (Duchan, 1986), which are not provided through picture stimuli alone. In sum, the meaningful use of this medium requires internal representation of previously experienced actions, goals, and outcomes of events.

Second, a child must know something about pictorial symbols. That is, a child must have knowledge about the possible forms that visual representations can take (e.g., a visual depiction of people in cartoons does not look like non-cartoon images of people). Vurpillot (1968) determined that the farther the deviation of a picture is from the retinal image of the object depicted, the weaker the relation between the picture and the visual experience provided by the real object. Miller (1973) supported this statement with the conclusion that the more a picture departs from the real image, the more experience with the pictures is needed to perceive and identify the objects represented. Consequently, a child must go through the process of learning about how real objects or events are typically depicted or represented in picture form (Sigel, 1971).

Because still pictures are 2-dimensional and the objects represented may not be manipulated or changed, the visual modality is the primary source of input. Auditory input may also be used to describe the picture and the event it depicts. This auditory input is provided by the verbal input used to label objects and actions represented by the picture rather than nonverbal auditory signals associated with event participation. Use of picture stimuli then limits the child to auditory and visual input. Pictures do not offer the richer type of multimodal experiences that are embedded in movement and action events and seem helpful to learning (Affolter & Bischofberger, 2000; Stockman & Latham, 2002; Latham & Stockman, 2002). Given their symbolic nature and reduced sensory input, pictures may have limited effect on what is learned in a therapeutic or educational setting.

In sum then, to use picture stimuli successfully in an educational or therapeutic environment would require the educator/clinician to have knowledge of the child's experiences with the pictured event, and pictured stimuli. Experience in a real event would be a precursor to the effective use of this symbolic material as an educational tool.

Interactive Worksheets, Pull-tab/Interactive Books, and Computer Software

Unlike 2-dimensional pictures, several types of representational media provide a better representation of real events because they try to simulate movement and action experience, thereby going beyond visual and/or auditory input.

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Interactive worksheets.

These types of worksheets, which are familiar to educational settings, make use of pictorial events to depict the context cues available in a real event. Interactive worksheets consist of pictures that can be cut out and moved. However, the action associated with the event is far removed from reality as the motion of the hand, arm and body differ vastly from what would be experienced in a real event. The movement of a picture does not provide the goal oriented outcomes witnessed in real events. Therefore, the goal of the event must be internally represented based on visual input and verbal descriptions given by the practitioner in a teaching situation.

So while multimodal stimuli are provided by interactive worksheets, the type of sensory input is vastly different from the input provided by the real event. The visual information provided relies on previous knowledge of the represented stimuli to comprehend the goal of the event. The verbal information provided may also need to be more complex in order to describe the objects and goal of the pictured event.

Pull-tab/interactive books.

These types of books are another representational medium used in educational practice, although it is the most uncommon form of 2-dimensional representational media available. This medium allows for self-action to be used (i.e., an action on a picture) to elicit some change in the environment. Such

stimuli allow for a more multimodal approach to symbolic representation than does the use of conventional two dimensional picture stimuli.

Despite the involvement of multiple input modalities when using these representations, the actions required to effect change are often grossly removed from the actual action or event depicted. In addition, the simulated action can be too coarse of a representation to differentiate one event from another. For example, in most pull-tab/interactive books, a pull of a tab can simulate a car driving/moving. Yet the same action can be used to move a cup to simulate pouring although the real actions are unrelated. However, these movements elicited by the child are not representative of real actions because they neither require the same movement, nor the force or look of the real action. Therefore the child should have previous experience with the real action or sequence of actions needed to do the event or understand it. Although these types of pictures are dynamic representations of an event, the goal or purpose of the event must be inferred.

Interactive computer games.

Computer technology has created another example of using an unrelated action to achieve a visibly noticeable change in the environment. The changes or goals of the events are depicted through changes to graphic pictures through visual representations of the actions. Such dynamic graphic information may provide some visual context cues about the intended purpose and outcome of events. Computers can simulate the configuration of an action event dynamically in time and space, however, it is not the child's action contour but the movement

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of a computer mouse makes things happen. The movement of the computer mouse has no relation to changing the spatial and temporal configurations of the real actions that make things happen in the event. The ability to imagine the purpose of the event is then prompted by a dynamic visual representation of the event. However, the actions used to change the visual input may be more difficult to relate to a specific action or goal, because similar movements (including similar resistance cues and positioning) may be used to effect several different changes. For example, the movement and “clicking” of a computer mouse results in the observation of any number of actions and events, but the action is not representative of the real action experienced in the real event.

Interactive computer software, like the pull-tab books described earlier, provides a dynamic medium in which action can take the form of moving a pictured object indirectly by using a mouse or a tab. But the use of a computer mouse or pull-tab provides the child with tactual-kinesthetic feedback that is not representative of the action involved in the real world event.

There are many preschool software packages available to teach a number of basic concepts. For example, a program used in preschool consists of clicking on grass, hay, or worms and then “feeding” either the hen, horse or chicken. This program simulates the event of feeding an animal the appropriate food. If the child “carries” the food (by clicking on the food and dragging the mouse) to the correct animal, the food simply disappears. The action involved in feeding the animals does not simulate the action of carrying food. The visual output from the computer screen, however, relates the action of the child’s movement of the

computer mouse to carrying food. The goal of the interaction, which is to provide the animals with the correct food so they can eat, is also represented in an abstract way. The food, simply disappears when it is positioned anywhere over the correct animal instead of being eaten only when it is presented to the animal's mouth. Although this event seems very simple, children may struggle with the idea that they are feeding an animal, as several aspects of the event differ from reality.

A certain level of symbolic awareness and previous experience is assumed when using these dynamic pictorial or digital stimuli. The effectiveness of using such dynamic representational events may depend on the child's ability to infer cause and effect relationships, the child's previous experience with the event, and a host of other factors. However, there is little research on the pedagogical and clinical efficacy of using dynamic pictorial and computer-generated representations of events to stimulate learning relative to real events.

Virtual Reality

Desktop virtual reality simulations are available, and are more widely used in educational settings than virtual environments. These desktop systems allow children to interact with a "computer" environment by using a computer mouse to effect change on the environment represented on the computer screen (such as the farm scene described earlier). Current trends in the use of technology in education and the continued reduction in cost of new technologies make the widespread use of virtual environments a not too distant prospect.

Virtual reality provides the next step in making learning environments more like the real environment. Cromby, Standen and Brown (1996) describe virtual environments as computer-generated, 3-dimensional environments that respond in real time to the action of their users. These systems typically utilize specialized input and display devices such as headsets, data gloves, earphones and even bodysuits, to create a total immersion experience.

Virtual reality involves a representational environment that differs from simulated action events. Virtual environments do have the ability to provide some of the cause and effect relationships found in a real event in response to actions that closely replicate those required for participation in a real event. For example, driving a car in a virtual environment would require the participant to position his/her hands on a steering wheel, the movement of his/her hands and arms to turn the wheel, and movement of his/her foot on a pedal to simulate breaking and acceleration. These movements not only provide some tactual kinesthetic input about the event, but they also provide input about visual orientation and auditory information associated with each action. This differs from the some simulated actions, which are unrelated to the actions in a real event, such as the actions needed to effect causative change on interactive worksheets, computer screens, and pull-tab books. **Simulated action** is a pantomime or representation of a real action (lacking real resistance, positioning, and/or movement cues) that is used to effect some visual or represented change in the environment.

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The virtual environment provides the most realistic feedback of any of the representational stimuli. Using virtual reality provides multimodal feedback through goal oriented cause and effect interactions with representations, which are absent from the other representational stimuli used to simulate events. Despite all of the sensory feedback that virtual reality provides, its representation of events lacks real resistance cues, smell, taste, and other inputs that one can get from the multimodal experiences provided by the real world.

Nevertheless, virtual reality may have some therapeutic and educational efficacy, as supported by the research of Cromby, Stranden, and Brown (1996). Nineteen students between the ages of 14 and 19 diagnosed with severe intellectual disabilities participated in a study involving finding 4 items in a virtual supermarket. Nine of the students spent two sessions a week in a virtual environment carrying out the task of finding 4 items and taking them to the checkout. The remaining students had the same number of sessions using other virtual environments. The students that were exposed to the virtual supermarket were significantly faster and more accurate completing the same task in the real supermarket than the students that participated in an unrelated event in a virtual environment.

Summary

The seemingly apparent drawbacks of using most symbolic stimuli to represent events have been discussed. This discussion provides only conjecture about the relative effectiveness of using different types of symbolic stimuli for teaching and learning. Relevant research was found only for the use of picture

stimuli and virtual reality in therapeutic and educational practice. The efficacy of using stimuli such as toys, desktop virtual reality environments, and dynamic pictorial representations (interactive worksheets, pull-tab/interactive books, and pictorial models) has not yet been the topic of any known investigation. The impact of using these types of multimodal representational stimuli on learning is yet to be determined.

Statement of The Problem

The use of a range of symbolic media for teaching opposes the “direct hands-on” experiences with learning from natural events. The former relies on a higher level of development than the latter. This difference may create problems when dealing with low functioning children and children with limited exposure to representations in particular. Children with multiple clinical impairments, including those with language impairment, may be at a level where they do not profit optimally from symbolic media for learning about the world. While practitioners may notice that this is the case, particularly when they use 2-dimensional pictures, they have sought out other symbolic media that come closer to the reality of teaching in natural situations. These in-between media are assumed to be more effective than 2-dimensional pictures, and just as effective as real events in getting the attention of the nervous system. For example, Interactive or dynamic pictures involve some kind of movement activity on the child's part so the child is not passive. Such scaling up of the use of pictures should be applauded as an attempt to use input for learning that integrates tactile-kinesthetic input with other types of sensory input. But, causal

observations suggest that the frequently used pictorial representations, even in a dynamic form, do not provide the same quality of experience as natural events.

Differences between the quality of real and representational events include (1) the ease of identifying or recognizing pictured or representational stimuli, (2) the level of development in symbolic awareness, (3) the possibility of detecting observable cause and effect relationships in the event, and (4) the quality of tactile-kinesthetic feedback provided by the nonverbal physical interaction with the environment. The possible effects of these stimulus differences on learning from an event offer varying levels of theoretical and support for real and representational events, as discussed below.

Ease of Picture Recognition: The Potential Effects of Differences in the "Distance" of Stimuli Used from Real Events

Real events provide first hand experiences with tangible objects and relationships. The literature, which describes developmentally appropriate practices, suggests that all children benefit from "hands-on" learning throughout their education regardless of age (Kostelnik, Soderman, & Whiren, 1999). Nonetheless, the differential effectiveness of using real as opposed to representational media for teaching and learning may be influenced by the event's "distance" or deviations from aspects of reality.

Sigel's (1971) distancing theory purports that the more stimuli, namely picture stimuli, departs from a real 3-dimensional image, the more abstract it becomes. Furthermore, behaviors or events that separates the child cognitively from the immediate behavioral environment (e.g., departures from aspects of the

real objects) increase the learning distance between the child and the object. Sigel also argued that children's ability to deal with representations of their environment is a function of life experiences, and it will vary according to the previous experience of the individual child. Thus, the ability to comprehend and label visual representations requires experience with that particular form of representation. In other words, recognizing and interpreting representational stimuli requires more than just experiencing the corresponding real event. A child must learn how real events are represented in a particular medium (Whiren, Soderman, Stein, & Gregory, 2002).

This view is supported by Lahey and Edwards' (1996) investigation of the effect of picture stimuli on the ability of children with language impairment to understand and label picture stimuli. Sixty-Six children, who were diagnosed with specific language impairment, and enrolled in language intervention, participated in this investigation. The 44 males and 22 females with ages ranging from 4 to 9 years 5 months varied in their ethnic backgrounds. All participants were given formal language processing tasks. The participants were then divided into subgroups based on their patterns of language performance. Non-language impaired children were used as a control group for each of the tasks. The first task required children to name picture stimuli on a computer screen. Children with language impairment were significantly slower in naming pictures than those children without language impairment.

A further task analysis revealed which nonverbal differences may have contributed to these slower naming times. On the non-linguistic task, which

required children to identify picture stimuli, the children with specific language impairments were also significantly slower. The authors concluded that the receptive language quotient was not a significant predictor in the speed of naming in children diagnosed with language impairment. Conceivably, the distance of the representations from reality, as well as the children's previous experience with the representational medium used, contributed to the slower times observed. The language-impaired children's poor performance on symbolic tasks suggests that representational stimuli would be a poor teaching medium.

In contrast, Luchow & Shepard (1981) contended that distancing sensory input may be beneficial to learning when teaching children with special needs. They argued that providing impaired children with a multitude of sensory input may cause sensory overload due to their perceptual impairment. The impact of learning styles and sensory overload may have implications for the efficacy of using real events. Real events tend to be dynamic and involve multimodal sensory input (Stockman, 2000).

To investigate the validity of the assumption that sensory overload may occur, Luchow and Shepard (1981) studied 160 learning-disabled boys, ages 6 to 8 years 11 months. They examined the effect of multi-sensory input on the learning disabled boys' performance on a visual matching task. The effect was tested with four experimental procedures. These procedures required the participants to determine if the stimuli presented were the same or different from the stimuli presented five seconds earlier.

The 4 experimental treatment conditions were: 1) visual to visual, 2) visual plus tactile to visual, 3) visual plus auditory to visual, and 4) visual plus tactile plus auditory to visual. The visual-to-visual condition required the participants to look at a pattern of dots and then select the same pattern 5 seconds later. The visual plus tactile to visual required participants to look at and feel a pattern and later identify the same pattern visually. The visual plus auditory to visual task required the participants to look at a pattern while listening to the same pattern in auditory beep tones and then identify the same pattern visually. The visual plus tactile plus auditory to visual required the participants to look, feel, and listen to the pattern and were then asked to visually identify the same pattern.

The results of Luchow and Shepard's study revealed that children with developmental disabilities who participated in the visual teaching group did significantly better on a visual perceptual discrimination task than did the participants, with similar disabilities, who participated in the visual-tactile, visual-auditory, and visual-auditory-tactile conditions. Although significant differences were found, these results should not lead to the conclusion that the use of multimodal contexts blocks learning. The experimental design used in this study tested pattern recognition, so the stimuli used did not represent any functional object or event. The significant differences observed may be due more to the limited goal of the pattern recognition than to the limited sensory input.

In sum, the use of abstract stimuli may be less effective than the use of real objects according to the distancing theory, but the evidence is inconclusive for all types of representational events. For example, it cannot be stated that all

children have difficulties with abstract stimuli due to increased distance of the picture from reality. In fact, empirical evidence supports that some children may learn from representational stimuli, namely pictures, depending on their prior experience with the stimuli provided and level of symbolic awareness.

The Potential Effects of Differing Levels of Development in Symbolic Awareness

Young children and children with language impairments are purported to have difficulties decoding symbolic media without prior experience with the stimuli (Miller, 1973; Lahey & Edwards, 1996). Language impaired children's difficulties with symbolic stimuli may be due to inadequate previous experience in perceiving real word events and deficits in verbal and nonverbal abilities (Kamhi, 1981). Kamhi, Catts, Koenig, & Lewis (1984) questioned whether language-impaired children demonstrate the same hypothesis-testing and haptic recognition abilities as their mental and age-matched, typically developing peers. The participants were 10 language impaired children and 10 normally developing children matched for mental age according to their performance on the Columbia Mental Maturity Scale. There were significant differences between language impaired children and typically developing children's' ability to perform on the haptic (manipulation) recognition task. The language-impaired children performed significantly poorer than their mental age-matched, typically developing peers. The language-impaired group also performed significantly poorer on the discrimination-learning task. Furthermore, it was revealed that the language-impaired children did not significantly differ from the typically developing group on the concept formulation task.

These results indicate, especially those concerning the haptic task, that there is a relationship between deficits in language impaired children's' linguistic and non-linguistic symbolic abilities. The authors reported that the extent of the conceptual delays observed in the language-impaired children may be related to the complexity of the symbolic information involved in learning a concept. The findings of this study strongly suggest that children with language impairment also present with a more general symbolic representational deficit. These general symbolic deficits may impact language-impaired children's ability to learn from representational stimuli.

Conflicting information can be found in the study done by Olswang, Bain, Dunn, and Cooper (1983). This investigation compared noun and verb learning in two treatment conditions. Two of the participants had better success in the object manipulation teaching condition. One participant faired equally well in both the object manipulation and picture identification condition. The remaining participant had greater success in the picture identification teaching condition. The authors suggested that the different learning styles of the participants contributed to the varied results. Furthermore, this outcome may lend support to the use of representations for children with higher levels of symbolic awareness.

The conclusions drawn by the Olswang, et al. (1983) may be muted by the apparent limitations of this research. The very small sample size makes it hard to form any generalizable conclusions from the results of this study. This investigation provides weak support for children's ability to learn more effectively from picture stimuli, involving a high level of symbolic awareness, than stimuli

that could be acted upon, requiring a lower level of symbolic awareness.

Conversely, this study may support the notion that a lower level of symbolic awareness demands the use of objects that may be acted upon as the subjects with the most severe impairments fared better these stimuli.

The importance of action raises questions about the potential of abstract stimuli to adequately represent the actions depicted in real events. The symbolic awareness needed to decode stimuli and infer the cause and effect relationships that are not made available by simulations may contribute to the differential effect of using symbolic representations when compared to real event participation.

The Potential Effect of Differences Among Stimuli in the Possibility to Detect Cause and Effect Relationships in the Event

Real events provide goal-oriented cause and effect relationships. The cause and effect relationships observed in representations of events may not be goal oriented, but simply observed by the change in an object's position. For example, the goal of pouring water from a cup is not possible when using a dynamic representation to simulate pouring. But, an observable effect of the simulated action of pulling a tab may be observed by the change in the cup's position.

The effect of observable goal-oriented cause and effect relationships is discussed in Elizabeth Slackman's (1985) investigation of event structure. She revealed that preschoolers remembered actions that had a greater degree of causal effect on the environment better than those experienced in temporally organized events. Real events provide a greater degree of causal effect on the

environment than do the sequences of object actions provided in a representational event.

Given Slackman's (1985) research, the goal-oriented cause and effect relationships provided by real events may be more beneficial to learning than representational events. However, the potential value of observable goal-oriented cause and effect relationships in real events for learning should be substantiated by further research that compares learning in real and representational event contexts.

The Potential Effects of Differences in the Quality of Tactile Input Provided by the Nonverbal Physical Interaction with the Environment

Real and dynamic representational event contexts differ in the quality of tactile-kinesthetic information provided by the event. Differences can be observed in the perceived changes in resistance provided by the event and the likeness of the simulated action to the action used to effect change in a natural situation.

The importance of resistance is described in Affolter's (1991) work. Affolter states that we all need changes in resistance to verify the existence of our surroundings and our own existence. That is, changes in resistance allow children to explore the environment in relation to their own bodies providing information about the surrounding environment and the child's own body. Changes in resistance can be experienced in all events, but to a lesser degree in representational event contexts. For example, in a representation of a pouring event a tab is pulled to change the orientation of a cup to simulate pouring. This

event incorporates only a few changes in resistance. The initiation and continuation of the action is met with limited resistance. When the action is complete, a large change in resistance stops the child from continuing to pull the tab. In a real pouring experience, a multitude of changes in resistance are encountered. Resistance is provided when the cup is grasped and a change in resistance is perceived when lifting the cup and continual changes in resistance are perceived through the change in bodily orientation to position the cup for pouring. Changes in resistance will also be perceived as the cup is emptied. The multiple changes in resistance may provide a clearer picture of the cause and effect relationships between bodily movement and the observed outcomes or goal of the event (Affolter, 1991).

Virtual environments provide just minimal changes in resistance from acting on simulated objects that are acted upon, yet they have been found to promote learning (Cromby, Standen & Brown, 1996). Although these environments may not provide changes in resistance when interacting with simulated objects, they do provide multiple changes in resistance through changes in bodily orientation that result from movement. These changes in bodily orientation may provide some support for the relation of bodily movement to the effects experienced within the environment and thereby promote learning. The potential differences between the real and virtual events in perceivable changes of resistance is not dwelled on here because virtual environments were not compared with learning in real events in the present research, and they are not typically used in pedagogical and clinical intervention work.

Differences in the quality of tactile kinesthetic input are not confined to differences in the resistance provided by the event, but also in the use of simulated versus real action. The use of simulated action, as it is described in this investigation, does not appear to have been the focus of any study to date. However, if the distancing hypothesis is valid for all types of symbolic representations, not just visual ones, then it may be hypothesized that learning from a simulated action event may be influenced by how similar it is to a real action event. Undertaking comparative research on the use of real and representational stimuli would be helpful. It would aid in determining to what extent the widespread use of representational stimuli in contemporary intervention and pedagogical practices is justified.

Comparison of the Potential Effectiveness of Real Versus Representational Events

Although some pictorial stimuli can be more like real events than others, controlled studies are not available that show if they impact learning in the same way for typically developing children. The bit of data we do have suggests that “hands on” activities (which includes tactile-kinesthetic, auditory, and visual input) are more helpful to learning than auditory and visual input alone, even for adults (Rowe, 2003), and especially for children with special needs (Latham & Stockman, 2002).

The studies also suggest that clinical intervention that relies just on the auditory and visual modalities, or distance senses, may be less effective than learning from bodily participation in natural events, which rely on multimodal input

that includes tactile-kinesthetic experiences. Studies have not addressed the efficacy of using dynamic pictorial stimuli (e.g. pull-tab/interactive books or interactive worksheets) that may be acted upon to effect a causative change in the environment. However, we do know that visual input that is connected to self-action in real events does not yield the same verbal and nonverbal learning outcomes as looking at a video representation of the same event (Stockman & Latham, 2002; Latham & Stockman, 2002).

Still we do not know if using the more accessible 2-dimensional dynamic picture representations, which allows for some tactile-kinesthetic experience in the event, is beneficial for learning. Therefore research is warranted. Research also is needed because the effectiveness of using visual representational stimuli that focuses on auditory and visual input is not consistent, but seems to be child dependent (e.g. Oslwang, Bain, Dunn, & Cooper, 1983).

Oslwang, Bain, Dunn, and Cooper (1983) stated that the use of representations may be more beneficial than the use of objects, which could be acted upon, when learning nouns and verbs. Four language impaired children between 23 to 40 months, all with a mean length of utterance between 1.0-1.5, were individually seen in a clinical setting 3 times a week.

Ten target nouns and ten target verbs were taught using the alternating treatment design. Five nouns and five verbs were taught using picture stimuli for the picture identification condition, and five nouns and five verbs were taught using object manipulation stimuli in the object manipulation condition. These authors set out to answer two questions. The first one concerned the

effectiveness of therapy itself, which was tested by including a treatment versus no treatment condition. It was shown that all of the children produced the target words more often than the control words. These findings supported the efficacy of intervention when compared to learning from passive environmental stimulation.

The second question focused on the differences between the two treatment conditions, i.e., picture identification or object manipulation, and on whether these differences affected single word learning in some way. The evidence for which condition was the most efficacious teaching practice for teaching nouns and verbs was variable. Participants 1 and 2 had greater success in the object-manipulation teaching condition. Participant 3 learned equally well in both conditions, whereas Subject 4 appeared to learn better in the picture-identification teaching condition.

The investigators suggested that the reason for this variability had to do with different learning styles. The first two participants, who were observed to have the greatest degree of language impairment, appeared to learn best in the object manipulation condition. Participant 3 appeared to function equally well in both conditions, and was reported to be the least impaired. The higher language function of this participant suggests that he had the capacity to perceive the appropriate stimuli in both conditions. This result highlights the fact that both passive and “hands-on” modes of presentation can be effective in different teaching situations depending on the children’s skill levels.

The researchers also analyzed the data in a third way. They compared the production of nouns and verbs across the two conditions. Subject 1 and 2, the most severe subjects, learned both nouns and verbs better in the object manipulation condition than in the picture identification condition. Subject 1 and 2 acquired nouns with greater success than verbs in both conditions.

In sum then, the existing research suggests that children are not limited to interactions with real objects in real events to acquire knowledge about their environment. It appears that children can learn a variety of concepts from the use of toys, pictures, and other event simulations (Rose, Attree, Brooks, Parslow, Penn & Ambihapahan, 2000; Olswang, Bain, Dunn, & Cooper, 1983; Froyen, 1985). There is even limited empirical evidence for the effectiveness of using representational stimuli to gain a functional understanding of an event (Cromby, Stranden & Brown, 1996). However, support for learning through pictures in tasks such as labeling (Olswang, Bain, Dunn, & Cooper, 1983), suggests that representational stimuli may be more effective for learning nouns than verbs for some children.

Despite what appear to be potential benefits of using symbolic media for intervention, there seems to have been little controlled research on the efficacy of using representations as a teaching/learning medium for young children. A comparative analysis of real and representational events would be helpful. Such a research focus would help us to understand if and how representational media may be used to teach verbal and nonverbal concepts.

Purpose of the Study

This study investigated whether the use of representational systems are as effective for teaching as real events. Despite the practicality of using pictures in clinical work, empirical research has provided limited support for the use of representational 2-dimensional stimuli. However, the use of representational stimuli, especially those forms that involve action and therefore a variety of sensory input, seems intuitively to be more effective. For example, the effectiveness of simulated virtual reality environments might prove to be useful, but virtual environments are not yet technically feasible to use in educational and clinical settings. In contrast, dynamic pictorial representations of events provide simulated action events in a more accessible teaching medium. A dynamic pictorial representation is a picture or 2-dimensional model of an object or objects that can be acted on to effect a change in the appearance or location of the object(s). But it is unknown whether even this kind of visual representational medium is as effective for stimulating learning as participation in real events.

The potential advantages of learning from real events could be minimized or offset by the relatively large processing load attributed to the competing sources of input encountered in real events. Tomasello and Kruger (1992) lend some support to the notion that information processing load can be influenced by competing sources of input. Specifically, the authors observed when mothers provided a verbal label to their young children within an event. Tomasello and Kruger's observations of parent and child interactions revealed that the mothers' verbal models referred more frequently to impending actions or to completed

actions than to ongoing actions. Impending models elicited more responses than either the completed or ongoing action conditions. The presentation of a verbal stimulus in the ongoing condition, or while the child was participating in the action, was the least likely to elicit a response. These findings suggest that the complexity of a real event may be modified to decrease processing load by manipulating the timing and complexity of sensory input, namely verbal (auditory) input. Nonetheless, the conflicting information regarding the ability to process complex sensory stimuli by children with clinical impairment (Luchow & Shepard, 1981) warrants further investigation.

The differential usefulness of both real and simulated/representational events has been supported by some empirical evidence. But, little seems to be known empirically about the impact of the multimodal sensory input available during real events on verbal and nonverbal learning relative to the efficacy of using dynamic pictorial representations of events. The purpose of this study was to determine whether verbal and nonverbal learning is differentially affected by using real versus representational event contexts with young typically developing children.

Research Questions

The main purpose of this study was to determine whether typically developing preschoolers who participate in a novel event using real objects differ from those who participate in the same event using simulated actions on a dynamic pictorial representation of the event.

Hypotheses

Given that real events presumably benefit young children's verbal and nonverbal learning more than representational events, the following hypotheses were tested:

1. Typically developing preschoolers who participate in a real event are better able to verbally express and comprehend nonverbal components of an event (by labeling, recognizing, and describing the interactions involved in an event) than a comparable group of preschoolers who participate in an event by using simulated actions on dynamic pictorial representations of objects.
2. Typically developing preschoolers who participate in a real event are better able to nonverbally re-enact the event than a comparable group of preschoolers who participate in an event by using simulated actions on dynamic pictorial representations of objects.

The following secondary hypothesis was also tested:

Verbal scores would improve in both groups after the children's independent participation in either the real or simulated event.

CHAPTER II

Method

The present investigator attempted to demonstrate the differential effect of two teaching conditions on learning new words and the action sequence in novel nonverbal event. The two teaching conditions involved participation in an event that used either real objects or simulated representations (pictures and a model) of real objects in a juice-making task. This study followed the methodology developed, and applied in previous studies (Stockman & Latham, 2002; Latham & Stockman, 2002).

Participants

Description of Participants

With human subjects approval (Appendix A), informed consent was obtained (Appendices B & C) from the parents of 14 children who participated in this study. The participants included 8 females and 6 males in the age range of 3.7 to 4.8 years ($M = 4.5$; $SD = .38$). See Table 1 for a description of participant characteristics. Three of the participants attended The Christian Childcare Center, 5 attended The Spartan Child Development Center, 4 attended Kidzone, and 2 participants were in home day care settings in the greater Lansing area.

Table 1

Participant Characteristics

Participant	Gender	Age (years:months)	Language Standard Score (PLS-3)	Race/ Ethnicity
1	M	4.6	111	Caucasian
2	M	4.4	108	Asian/Pacific
3	M	4.5	113	Asian/Pacific
4	M	4.8	116	Caucasian
5	F	3.7	107	Caucasian
6	F	3.8	106	African American
7	F	4.6	103	Caucasian
8	F	4.7	103	Caucasian/Hispanic
9	F	4.2	107	Caucasian
10	F	4.0	105	Caucasian
11	F	4.8	88	Caucasian
12	F	4.7	86	Caucasian
13	M	4.8	110	Caucasian
14	M	4.8	111	Caucasian
F:8, M:6		mean: 4.5 SD: .38	mean: 105.29 SD: 8.58	

The participants met both general and specific criteria for participating in this study, as described next.

Participant Selection Criteria

General criteria.

Information regarding whether a child fit the general criterion of this investigation was obtained from the parent questionnaire (Appendix D), the teacher questionnaire (Appendix E), the Preschool Language Scale-3 (Zimmerman, Steiner, & Pond, 1992), and the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). These criteria required the children to exhibit:

1. Ages in the range of 3.7 to 4.9 years
2. Normal language development as measured by the PLS-3 (Zimmerman, Steiner, & Pond, 1992)
3. Normal non-verbal intelligence as measured by the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983)
4. Middle Class Social-Economic Status as determined by the federal poverty guidelines formula
5. Native English speech
6. Normal Hearing
7. Normal motoric and sensory-motor development
8. Normal visual acuity (correctable visual impairment)

Task- specific criteria.

Information regarding the child's ability to participate in the juice-making event was obtained from answers to questions on the parent questionnaire (Appendix

D). The specific criteria required that the children:

1. had never participated in making orange juice using an antique juice press according to parent report.
2. had no known allergies to orange juice according to parent report.
3. demonstrated a level of symbolic awareness allowing them to simulate an action without a representation of the object present.

The two groups of 7 children each, were matched on:

1. Age, within three months
2. Gender
3. Language scores with no more than a 5 point difference on the PLS-3
4. Reported family income and parent education levels that fell within the guidelines for middle class socioeconomic status
5. Level of symbolic representation the child was able to demonstrate on the criterion-referenced measure allowed the child to simulate a familiar action with an imagined object (appendix F).

Matching was used to ensure that independent groups were balanced on all the above criteria. To ensure groups were matched on language level their standard language scores were compared statistically. A two-sample t-test revealed no significant differences $t(11) = .09, p < .93$.

Age differences between the two groups were also compared statistically. A two-sample t-test revealed no significant differences $t(11)=0.0$, $p<1.0$.

Participant Selection

Teachers initially screened participants at the preschools. The teachers completed a standard form (see Appendix E). This form required checking the appropriate box to answer questions regarding visual acuity, hearing acuity, known impairments, socioeconomic status, and parent's educational level.

Screening of language.

The children who passed the initial screening were then tested by the investigator using the Preschool Language Scale-3. This test, which examines auditory comprehension and expressive language skills, was used to determine whether language skills were age appropriate. The auditory-comprehension section of the test examined the children's understanding of common vocabulary items including prepositions, colors, verb recognition, noun recognition, ability to make inferences, and pronouns. The production section included items that assessed expressive skills such as semantic relations, development of syntax, and phoneme development. The children were required to point and/or label stimulus pictures, recall colors, and follow directions. All participants in this study had age appropriate performances. The PLS-3 outcomes were corroborated by the investigator's informal observations of the children's use of multiword utterances in a natural play environment.

Screening of nonverbal symbolic representation.

The investigator used a symbolic screening procedure that was compiled from information provided by 3 sources (Appendix F) to assess the child's level of symbolic representation. The test materials consisted of a toy banana, a line drawing of an apple, a picture of a boy jumping, a hairbrush, a doll, and a washcloth. First the children were tested on their ability to label a toy and a picture of an object. Then the children were asked to label the picture of the verb. A series of other actions were then requested using the remaining stimuli. The children were asked to brush their hair, wash the baby, and pretend to brush their own teeth. All of the participants chosen for this study were able to do all of these tasks, including imagined action without use of another object.

Screening of intelligence.

The investigator also administered a nonverbal screening test of intelligence. All participants scored within one standard deviation of the mean on the face recognition and hand movement subtests of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). The face recognition and hand movement subtests were used as they were the only nonverbal subtests that were appropriate for pre-school aged children.

Participant Assignment to Treatment Conditions

Among the 14 participants selected, 7 matched pairs were identified. The children were tested and matched on age, gender, level of symbolic representation, and language level. The participants within the matched pairs were then randomly assigned to one of two treatment conditions: The real event

participation group (real group) or the simulated or represented event participation group (representational group). The two groups did not differ significantly on age, $t(11)=0.0$, $p<1.0$, language level, $t(11)=0.09$, $p<0.93$, or level of symbolic representation (all children demonstrated the same symbolic level).

After being assigned to the “real” or “representational treatment condition, the children were taught and tested individually in a designated room on the daycare/home/pre-school premises. Each child was exposed to a single task condition. The investigator administered instruction to both participant groups.

Description of Experimental Tasks

The teaching task aimed to facilitate children’s learning of two novel words and how to do a nonverbal task. Participants in each group were taught to make juice using either a real antique juice press or its visual replica. This task was assumed to be novel because parents reported that their child had no previous experience with making orange juice. The use of an antique juice press also ensured that the task would be a novel experience for the child. The real juice press and its visual replica were unique objects not likely to have been encountered by these children. The stimuli used for the real and representational groups differed, as described next.

Description of Stimuli

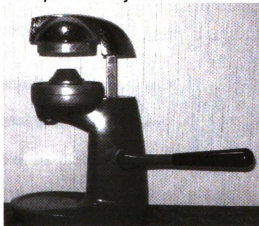
Description of real event stimuli.

The following objects were used in the real event condition:

1. Antique reamer/juicer (see Figure 1)

2. Two oranges
3. A child safety knife to cut the oranges (a butter knife)
4. A glass measuring cup to catch the juice produced by the reamer
5. A cup

Figure 1. *Picture of antique reamer/juicer*



The reamer, pictured in Figure 1, was chosen as a novel object due to its unfamiliarity to most people, specifically children, in its form and function.

Description of representational/simulated event stimuli.

The dynamic pictorial representation of this object and event was comprised of:

1. A moveable replica of the antique juice press made from foam board (see Figure 2), with the same coloring and approximate movements of the real juice press.

The size of the replica did not represent the exact scale of the real object. It was smaller, much lighter (1.7 oz), and flat. The reamer was not free standing, unlike the original. The action was

performed with the object is laying on a flat surface instead of in an upright position.

2. Two line drawings of oranges, which were colored orange, represented the oranges used in the real event.
3. Child safety scissors.

The scissors were used to cut the paper representations of the oranges so they would fit into the opening provided by pushing the foam handle of the model reamer.

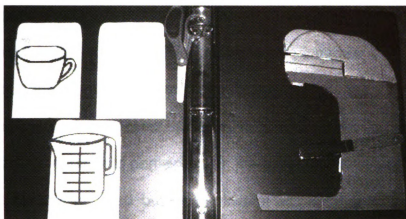
4. A schematic line drawing of a measuring cup.

The drawing was positioned on the model of the juice press in way that simulated catching the juice, if it were possible to produce juice using this object.

5. Line drawings of a cup made from white poster board.

The poster board cup was used in a reconstructive play activity where the child pretended to pour juice from the “measuring cup” into the replica of the cup. Each participant disposed of the poster board replica of the cup after use.

Figure 2. *Picture of the model/representation of the antique reamer/juicer*



Description of the Teaching Event

The teaching event typically consisted of the following sequences of actions involved in making and drinking orange juice in both the real and simulated event conditions.

The Nonverbal Sequence of Actions

In the teaching event, each participant in both groups was manually guided to:

1. Reach for, and place, 2 oranges or picture of oranges directly in front of self on the table.
2. Place the measuring cup or picture of measuring cup on the base of the juice press or 3-dimensional pictorial model of the press.
3. Grasp the child-safe knife (butter knife) or scissors in one hand and one orange or picture of an orange in the other hand.
4. Cut the orange in half.

5. Place a half on the antique manually operated juice press or model.
6. Push down on the handle of the juicer to squeeze the juice from the orange half into the glass-measuring cup below or to make the top go down.
7. Repeat steps 5 through 7 for the remaining 3 halves.
8. Pour or pretend to pour juice into a glass or picture of a cup.
9. Drink or pretend to drink the juice.

The second time the child participated in the event the same sequence of actions were typically followed, but the participant was not manually guided throughout the event. Manual guidance was only provided to complete an initiated action or to correct a sequence of actions.

The investigator inadvertently deviated from this procedure most often by placing the measuring cup on the base (step 2) at inconsistent times for both the real and the representational groups. This inconsistency may have impacted the nonverbal scores of 5 children from the real group and 4 scores from children in the representational group.

The group using the interactive picture to portray this event used appropriately colored schematic line drawings that represented oranges, and scissors to cut them in half. They followed the identical steps as the real event group, except that the pouring and drinking of the juice were carried out using “pretend play” to simulate the actions in the absence of juice. At no time did the representational group have experience with the real objects.

The Verbal Input

During the teaching event, the novel noun and novel verb were spoken an equal number of times during the juice making event. The nonsense noun and nonsense verb were both spoken prior to the pressing of each orange half and then again after the action was done. The novel verb was not spoken at the same time as an action was done. In the teaching event the novel noun and novel verb were presented 8 times, given that 2 oranges were used creating four halves to be pressed. Altogether the two nonsense words were spoken in isolation a total of 16 times throughout the session (the session consisting of both the guided and nonverbal tasks).

During the presentation of the words prior to the action, the noun was given first and the verb was given immediately before the action was initiated. The nonsense verb was again given after the action was completed and the object name was then given with a pointing gesture prompt. The following order of operations was typically followed to decrease variability in the delivery of the nonsense words:

1. After the participant put one orange half down on the table, the examiner pointed to the antique juice press and said /pak/ in isolation.
2. The child then put an orange half in the juice press and the examiner said /kaɪp/ in isolation.
3. The child pushed the reamer closed then opened the press again and the investigator again said /kaɪp/ in isolation.

4. The child removed the orange half and the experimenter pointed to the juice press and said /pak/ in isolation.
5. Steps 1 through 4 were repeated for each of the 3 remaining orange halves

Administration of the Task

The same directions were given verbally to each child in both groups for the manually guided event. The instructions to each group were:

“Hello, my name is Mrs. Luce and we are going to make juice. I need you to be very quiet while we are playing. I am going to say just a few words while we play. I want you to try your hardest not to talk until after we are done playing. I am going to sit right behind you, put my arms around and move your hands with my hands instead of using words to tell you what to do. So sit down right here and we will play making juice.”

After these instructions were given, the child was manually guided through the juice-making task. No words were spoken during the task except for two strategically delivered nonsense words: /kaɪp/ to describe the action of pushing the lever on the juicer and /pak/ to describe the juicer. Children were randomly selected to participate in either the real or representational event.

After the teaching trial, the children were asked a series of questions to evaluate verbally what they had just learned (Verbal 1). Then children were asked to reenact the juice-making event on their own. The event reenactment

was used to evaluate the effect of the two different event contexts on non-verbal behavior. The children in both groups were asked to reenact the event without direct guidance from the experimenter. The following directions were given:

“Now I want you to try making the juice by yourself. Do all the steps in the right order as best you can. If you can’t remember what to do or need help with something I will help by putting my hands over yours again. Now it’s time to play making juice.”

After the independent reenactment of the juice making task, the participants in both groups were again asked to respond to the same set of questions that followed the initial training session (Verbal 2).

In both the manually guided event and the event reenactment, the child’s behavior during the event was recorded using a Sony high 8 digital camcorder. The video camera was placed on a tripod in front of the test table in the participants view. The camera was adjusted throughout the session by the investigator, but could not be adjusted during the event. The inability to adjust the camera while the investigator was interacting with the child made it difficult to view those interactions that took place out of the camera’s view. The recording did not provide a clear picture of the child’s movements for some participants. The teaching and testing were done in one sitting that usually lasted 20 minutes. All tasks were administered in the child’s daycare/preschool setting or home. Caregivers typically were not present during testing with two exceptions. One child from each group had a caregiver present during the test and teaching task.

The test tasks were administered in the same location as the teaching condition for all participants. The testing conditions, which included the types of test tasks, presentation order, and scoring criteria, were the same across all participants in both teaching conditions. The investigator administered the teaching and testing tasks.

Altogether, three tasks were used to evaluate what participants had learned. They included the verbal measure used after the guided teaching event (Verbal 1), the verbal measure used after the independent event reenactment (Verbal 2), and the non-verbal measure of event reenactment. Verbal 1 was administered immediately after the manually guided event was completed. The nonverbal test (the event reenactment) was completed after the verbal 1 test task was completed and further direction was given. Verbal 2 was completed immediately after the event reenactment was done.

Description of Verbal Measures

The verbal assessment consisted of 12 questions (Appendix G), which were given to participants in each experimental group. These probe questions were subdivided into 3 content groups and administered in the following order: (a) confrontational naming/labeling, (b) recognition, and (c) direct questions regarding the event content. The questions were presented in this order for all participants. All questions and video stimuli used to elicit word recognition in each test condition were the same across all participants. However, the stimuli used to test the child's verbal knowledge differed depending on the teaching condition. The participants in the real group were asked to label the real antique

juice press whereas the participants in the representational group were asked to label a pictorial model of the juicer. The stimuli used in the teaching task was the same stimuli used to elicit a response to the test task, with the exception of the recognition task. The same video images were presented to both the real and representational event group during the recognition task.

The confrontational naming / labeling task.

The first 3 questions of the verbal measure focused on the children's ability to name the objects needed to do the event. Each group was asked to label an orange, the antique juicer (referred to as /pak/), and the action of pulling down the handle of the juicer to squeeze the orange (referred to as /kaɪp/).

The questions were the same for each group, but the stimuli used to elicit responses differed depending on the group assignment. To elicit a label for the two nouns the participants in the real event participation group were shown a real orange and asked "What is this?" They were then shown the juice press and asked the same question. To label the verb each child in the real group watched the investigator perform the action (/kaɪp/) on the real juice press. The children were asked the question while the action was being demonstrated.

The participants in the representational event participation group were shown a colored line drawing of an orange and asked to label it. The model of the antique juice press, which had been used in the representational event teaching task, was used to elicit the novel word /pak/. The investigator then demonstrated the action of pulling down the handle on the representation of the

antique juice press while asking the questions to elicit the response /kaɪp/ for each child in the representational group.

Each child, regardless of group assignment, was prompted to give a verbal answer to each of these questions. If the response was not loud enough for recording purposes, the participant was asked to repeat the answer with a verbal prompt.

The participants did not receive credit for close phonetic representations for the novel noun or novel verb. If the participant changed his/her answer without prompting from the clinician he/she did receive credit for the correct production.

Novel word recognition or identification task.

After labeling the objects used in the event the participant was instructed to stand in front of a television so he/she could watch the TV monitor. Each participant in both groups watched a looped segment of videotape of the same person performing /kaɪp/ with the real juice press /pak/, as well as 3 other actions involving objects that had nothing to do with the juice making event. The child was then instructed to point to the portion of the screen that showed /kaɪp/ using the question "Which is kaɪp?". Another looped action sequence involved the same person demonstrating/pantomiming 4 different actions without objects in 4 quadrants on the same screen. The participants were again asked, "Which is kaɪp?". Four still pictures were then presented on the screen. One of them was a picture of /pak/ and the other 3 were objects not related to the event.

The investigator prompted each participant to look at all of the pictures before choosing. If a response was changed before the loop was over the last response was taken.

Answering direct questions about the event content task.

The children's awareness of the actions and cause and effect relationships that made up the event were evaluated in questions 7 through 12 of the verbal measure (see Appendix G). Children from each group were asked the same questions. The questions had been modified from Stockman & Latham's (2002) protocol (see Appendix G), in the same order.

The answers to these questions were scored and assigned point value, according to the accuracy of the response (see Appendix G), by the impartial judges. Verbal and nonverbal answers were taken, but fewer points were given for nonverbal gestures than for verbal responses.

Verbal 1 versus verbal 2.

The verbal measure taken after the event reenactment (verbal 2) utilized the same protocol (see Appendix G) as the verbal measure obtained after the manually guided event (verbal 1). The same methodology for administration and scoring were used for both verbal 1 and verbal 2. The differences between verbal 1 and verbal 2 were in the timing of the administration and the child's previous experience with the questions. Verbal 1 always preceded verbal 2 in administration and scoring. Verbal 1 also provided no previous experience with the questions given to test verbal knowledge of the event. Verbal 2 was administered and scored after verbal 1 for all participants. Therefore, the

participants in both groups had previous experience with the questions asked when verbal 2 was administered.

Description of the Nonverbal Measure

The non-verbal measure was taken after the teaching task and the first verbal test task were performed. The nonverbal measure required each child to do a set of actions, sequenced in the appropriate order (see Appendix H). Each action, performed in the correct order, was worth one point. The child received a score of zero for the performance if help was needed from the investigator to initiate an action or aid in appropriate sequencing of the re-enactment. Though, intervention from the investigator was not allowed (for scoring purposes) in the initiation of an action, the participants were not penalized if the investigator helped to complete an action. Sixteen nonverbal actions within the event were tested on this nonverbal measure, for a possible total nonverbal score of 16.

Data Analysis

Scoring the Data

Two speech language pathologists from the mid-Michigan area made judgments of verbal and nonverbal performance from randomly selected video taped recordings. To insure investigator bias was not introduced during scoring, all testing trials were videotaped and scored by judges naive to the purpose of the study. When clear recordings were not available, the investigator wrote down the children's responses. The investigator's records supplemented the nonverbal scores given by the judges.

A maximum of 19 points were possible on both verbal 1 and verbal 2 when responses were pooled across labeling, recognition, and answering direct questions regarding event content tasks. Participants could score a maximum of 16 points on the nonverbal measure.

Statistical Analysis

Independent sample t-test values were used to assess the significance of group differences on the verbal and nonverbal measures. The Mann-Whitney values were used to test significant differences between groups and between verbal measures within the same group.

CHAPTER III

Results

In this study, the effect of event participation on verbal and nonverbal learning was investigated. Specifically, it aimed to determine if there was a difference in a child's ability to describe an event depending on whether real or representational stimuli were used to participate in a juice-making event. Because each child participated in the same event twice, the effects of repetition of the event on verbal scores could be described.

Statistical Significance

Although the gold standard of empirical studies has been set at $p < .05$, in some cases probability has been set slightly higher when small sample sizes and pilot data are used. Given the exploratory nature of this investigation statistical significance was set at a level of $p < .10$. Significant differences, using this criterion, are denoted with an asterisk (*).

Verbal Results

Between Group Comparisons

The total scores obtained from the verbal 1 and verbal 2 test tasks were used to determine whether preschool children who participated in a real event differed in their ability to verbally express and comprehend components of an event from those who participated in a representational or simulated event. The participants' total scores for the verbal 1 and verbal 2 test tasks are shown for the real and representational groups in Table 2. The mean scores for the two groups

were compared on each verbal task separately as shown in Table 2. Table 3 shows the results of the statistical analysis.

Table 2

Verbal 1 and Verbal 2 Scores With Descriptive Statistics

Real Group			Representational Group		
	Verbal 1	Verbal 2		Verbal 1	Verbal 2
Subject 1	12	13	Subject 2	8	8
Subject 3	9	8	Subject 4	5	8
Subject 5	8	10	Subject 6	8	8
Subject 7	8	11	Subject 8	7	9
Subject 9	13	13	Subject 10	6	10
Subject 11	10	12	Subject 12	6	5
Subject 13	10	10	Subject 14	7	8
Mean	10.0	11.0	Mean	6.7	8.3
SD	1.9	1.8	SD	1.1	1.5

Table 2 shows that scores were consistently higher in the real event group than the representational event group. The mean scores for the event group also reflect higher scores on both verbal 1 and verbal 2 for the real event group when compared to the mean scores of the representational event group.

Table 3

Two Sample *t* (independent groups) Results For Difference Between Representational and Real Group Verbal 1 and Verbal 2 Scores

Verbal 1			Verbal 2		
df	t	p	df	t	p
9	3.93	.003*	11	3.33	.007*

Table 3 reveals significant differences between the mean scores of the real group and the representational group for both verbal 1 and verbal 2 scores.

The scores of the real group were significantly higher than those of the representational group on both verbal measures.

Within Group Comparisons

The total scores obtained from the verbal 1 and verbal 2 test tasks differed before and after the children reenacted the event on their own. These scores were used to determine whether preschool children's verbal scores significantly improved after participation in the event a second time. The mean scores for the two verbal measures were compared separately for each group.

Table 3 shows that the means were lower for verbal 1 than verbal 2 in the real group (cf. 10.0 & 11.0) and the representational group (cf. 6.7 & 8.2). The difference between verbal 1 and verbal 2 scores were significantly different for the representational group, $t(10)=-2.04$, $p=0.068^*$, but not for the real group, $t(11)=-1.00$, $p=0.34$. Refer to Table 2 for scores.

Verbal Item Analysis

An item analysis was done to determine if some tasks contributed to between group differences more than others. The total score on the verbal 1 and verbal 2 measures were pooled across three separate tasks for each group of participants. These tasks consisted of confrontational naming, word recognition/comprehension, and answers to direct questions regarding the event content. Questions 1, 2, and 3, on both measures, tested confrontational naming skills. To assess confrontational naming skills participants were asked to label objects or actions related to the event. Questions 4, 5, and 6 were used to assess word recognition/comprehension through pointing to a video image of the

novel noun and verb that were presented. The last 6 questions (questions 7 thru 12) aimed at assessing the participant's understanding of the event and the purpose of the tasks comprising the event.

Additional analysis was done to determine if the participant's performance on various categories or classes of tasks contributed differentially to group differences. Each group's verbal 1 and verbal 2 scores were used to calculate the probability of significant differences between groups. The point values awarded for specific responses varied from question to question, therefore the mean accuracy score for each question (verbal 1 and verbal 2) were compared for each subgroup of questions (see Appendix I). Table 4 gives the descriptive statistics computed from the mean accuracy score for each question (see Appendix I) for each group.

Table 4

Descriptive Statistics for Each Group of Questions Pooled Across Verbal 1 and Verbal 2 Mean Accuracy Scores

Real Group				Representational Group			
	Mean	Median	SD		Mean	Median	SD
Confrontational Naming (n=6)	40.5	21.4	47.3	Confrontational Naming (n=6)	26.2	14.3	18.9
Recognition (n=6)	73.8	85.7	18.9	Recognition (n=6)	65.5	71.4	21.4
Answers to Questions About Event Content (n=12)	60.4	60.7	30.7	Answers to Questions About Event Content (n=12)	34.9	34.7	23.3

Note: n=the number of observations/questions on which the statistical analysis was based.

The mean, median, and standard deviations for the mean accuracy scores calculated for each task revealed differences between groups. The mean accuracy scores were based on a 100% accuracy scale (% of accuracy was reduced by incomplete or incorrect answers) and the standard deviations were large. Although the means were higher for all tasks in the real event condition, the significance was decreased because of the large score variance. Significance was determined by comparing the median scores given in Table 4. Table 5 shows the results of the Mann-Whitney Test for all 3 item analyses (confrontational naming, recognition, and answers to direct questions regarding event content).

Table 5

A Task Analysis Between the Real and Representational Groups' Mean Accuracy Scores

Task	W	p
Labeling	41.00	0.81
Recognition	44.50	0.39
Answers to Questions About Event Content	189.00	0.05*

Analysis of the real and representational groups' verbal 1 and verbal 2 scores revealed that confrontational naming and recognition, scores did not differ significantly between the two groups. But the scores of the real group were significantly higher than the representational group on answering direct questions regarding event content, $W=189.00$, $p=0.05^*$.

Nonverbal Results

Nonverbal responses were scored using a standard measure modified from the protocol used in Stockman and Latham (2002) and Latham and Stockman's (2002) studies (See Appendix H). A form was given to judges who were naïve to the purpose of this study. The appropriate action, in the order the action was to take place, was included on the protocol with the point value to be given for each observation. The judges then viewed a videotape of each participant and scored the response on the protocol. This protocol assessed the child's ability to initiate the behaviors needed to complete the event in the same order as the guided event in which they had just participated. Due to the motoric complexity of some of the tasks the judges were asked to determine only if the child initiated the correct action sequence, and not if the child completed each scored task independently. The judges were unable to give accurate scores for four participants due to video quality/objects placed out of camera range. This may have affected 3 children in the real group and 1 in the representational group. In these situations, observations made by the investigator during the teaching and testing session, were used to determine the participant's total nonverbal score. In both cases if the child initiated the action at the correct time in the event he/she was given a point. If the child did not initiate the action, or initiated action out of order, the participant was given a score of 0 for that step and then guided through the appropriate step. The participants were also guided through steps that they initiated, but could not complete without assistance, and given a point for that task. Judgments made across sixteen actions were used to

obtain the total score (See Appendix H). The total nonverbal scores and their means and standard deviations are given in Table 6.

Table 6

Nonverbal Scores, Means, and Standard Deviations for the Real and Representational Event Participation Groups

Real Group		Representational Group	
Subject 1	15	Subject 2	14
Subject 3	14	Subject 4	12
Subject 5	15	Subject 6	10
Subject 7	16	Subject 8	7
Subject 9	14	Subject 10	10
Subject 11	15	Subject 12	12
Subject 13	8	Subject 14	13
Mean	13.86	Mean	11.14
SD	2.67	SD	2.34

Table 6 reveals that the mean score for the real event group is higher than the mean score for the representational group. The individual scores of the participants in the real event group are also higher than the scores reported for the representational event group, with one exception.

Analysis of the nonverbal scores revealed a significant difference between the real and representational group, $t(11)=2.02$, $p<0.05$. The real group's scores were significantly higher than the nonverbal scores of those children who participated in the representation of the event.

Summary of Results

The results from this study revealed significant verbal and nonverbal differences between the two teaching conditions (i.e., real event participation

versus representational event participation). The participants in the real event condition did significantly better on both verbal measures (verbal 1 and verbal 2). A significant difference was also revealed between the two groups on the non-verbal measure. The group that participated in the real event tended to have higher nonverbal scores than those participating in the representation of the event.

Further analysis of the specific verbal tasks assessed in the verbal 1 and verbal 2 measures revealed that there were no significant differences between the real group and the representational group's ability to label or recognize the objects and actions used in the event. The real group, however, did have higher mean scores in both the ability to label and to recognize the object and action. The answers to direct questions regarding event content, which made up the bulk of the verbal score, were significantly different. The group that participated in the real event tended to do better on the event content questions.

It is concluded that learning novel verbal material is enhanced more by participating in a real event than participating in a representational or simulated event. Event reenactment, or nonverbal learning, is also enhanced when children participate in a real novel event versus acting on a dynamic pictorial representation of the event.

CHAPTER IV

Discussion

The difference between learning conditions is clinically relevant, particularly when one outcome condition turns out to be more effective than another. This study explored the ability of typically developing children to learn novel words, verbally describe an event, and reenact a novel sequence of actions. It was hypothesized that the children who participated in the juice-making event using real objects would receive more effective input than those who participated in a simulated visual representation of the same event. It was expected that the real event experience would allow children to more accurately answer questions and nonverbally reenact the event when compared to children who participated in a simulated event. The analysis did reveal significant differences between the real and representational groups on both verbal and nonverbal measures. This outcome supports the hypothesis that participating in real events with real objects aids in verbal and nonverbal learning.

Nonverbal Learning

Nonverbal knowledge of an event is crucial for the mapping of a verbal referent (Nelson, 1986). Piaget (1962, 1967), Affolter (1991), and Affolter & Bischofberger (2000) suggest that nonverbal interactions provide the conceptual basis for language learning. The significant differences found between groups on the nonverbal task lead to the conclusion that real event participation is beneficial to nonverbal learning and therefore language comprehension.

The differences between the two events in their respective sources of sensory input may explain why a real event may be more beneficial for learning than the representational event. The main differences between the two event conditions were (1) the amount of resistance experienced from moving in and touching the environment and consequently, (2) the participants' access to the cause and effect information available in the event, and (3) the participants' access to smell and taste input. Perceiving changes in resistance allow children to identify and explore the environment in relation to their own bodies. These changes in resistance also facilitate connections between the child's actions and the cause-effect relationships experienced within the context of an event (Affolter, 1991). The additional sensory input available through experiencing the smell and taste of the orange juice also provided additional connections for processing and recalling the real event.

The real event provided many opportunities to experience changes in resistance throughout the event. For example, the action of cutting through the orange required the child to exert a large amount of force to initially cut through the peel, then the resistance lessened as the child cut through the orange. Cutting the representation of the orange provided little change in resistance as the paper was the same consistency all of the way through, and the changes in resistance experienced by operating the scissors were present even when the paper orange was not being cut. Therefore, there was little change in resistance due to the actual action of cutting the orange in the representation of the event.

Operation of the juice press also provided a difference in resistance between the two events. In the real event pulling the lever was met with increasing resistance, indicating that the press was doing work to meet the functional goal. But touching the representation of the press involved a smooth push and pull of the handle. In most cases, the presence of the paper orange did not increase the resistance by making the press “harder” to operate. The paper orange usually was positioned behind the moving parts of the model of the press.

The changes in resistance that were experienced in the real event, while the children were acting on the object, provided additional tactile feedback that should have increased the saliency of the action. The changes in resistance, experienced from touching the environment, may have provided an increased understanding of how the child’s own body related to the changes in the positioning and composition of the objects in the event.

The changes in resistance may have also contributed to the understanding of the purpose of each action, as the resistance related to the action of one object on another. For example, the model of the juice press did not provide a marked change in resistance when the paper orange half was in place, so the child had to *infer* that the press was squeezing the orange. In contrast, the real juice press provided increased resistance as the lever was pulled farther down, providing tactile and visual information concerning the purpose of the child’s action. In experiencing changes in resistance throughout the event the real group had the benefit of changing tactile input in relation to their own purposeful actions on objects. This changing tactile input may have

also contributed to the participants' ability to appropriately sequence and initiate actions in the event reenactment task, as marked changes were especially noted during the initiation and completion of many of the real event tasks. The representational group is not likely to have experienced marked changes in resistance, and therefore may have had a limited understanding of how their own actions related to the outcome of each task.

The complexity of the tactile stimuli encountered by typically developing preschoolers in the real event did not make the event reenactment more difficult, but aided in the accurate completion of the task. This finding refutes the argument made by Luchow and Shepard (1981) that reduction of tactile stimuli reduces processing load. In contrast, active participation in real multimodal events may aid in the integration of cause and effect relationships important to the construct of nonverbal referents.

Differences in the real and representational groups' ability to reenact the juice making event may also have been impacted by group differences in the ability to perceive cause and effect relationships (Slackman, 1985). The real event provided goal oriented causal relationships whereas the representational event required the children to remember a sequence of related actions/effects occurring over time. For example, the participants in the real event experienced the effect of pulling the handle on the juice press when they observed the juice falling into the measuring cup below. In contrast, the representational group observed that after an orange half was placed in the press the handle was pulled and the top of the juice press moved. The effect witnessed in the

representational event did not relate to the goal of the event. The goal had to be inferred from the temporal relationships of the actions (putting the paper orange in the top before pulling the handle). The ability of the participants in the real event group to reenact the event significantly better when they could rely on goal oriented causal relationships as opposed to the representational event that rely on the children's memory of a sequence of related actions (Slackman, 1985).

Verbal Learning

In addition to the integrated nonverbal referents real events provide, there are several possible explanations for the significant differences observed on the verbal measures. These include, but are not limited to, the distance of the objects used from reality, the inclusion of multiple sensory input modalities, and the ability to observe goal oriented cause and effect relationships.

However, the effect of real events may be dependant on the type of verbal task that is used (Olswang, Bain, Dunn & Cooper, 1983). Therefore, the effect of real versus representational event contexts was tested across 3 different verbal tasks.

Analysis of the 3 sets of tasks that were used to obtain the verbal scores produced unexpectedly varied results. Significant differences were not found on the labeling and recognition tasks. This outcome may be attributed to the relatively small number of questions that targeted the participants' ability to label and recognize the novel noun and novel verb. The significant group difference observed, therefore, had to be attributed to the children's answers to direct questions about the event content. This outcome may have been influenced

partly by the larger number of questions on the verbal inventory that tapped the participants' ability to answer questions about the sequence, goal, and specific components of the event. Each of the task components is discussed separately below.

Confrontational Naming Task

Significant overall differences were not found between the two groups on confrontational naming tasks, although further analysis did reveal some group differences on individual items. The difference between groups on the confrontational naming tasks was found in the participants' ability to label the orange. This was the only observable difference because labeling the novel noun and novel verb was almost equally difficult for both groups.

The representational group mislabeled the replica of the orange more often than did the real group mislabel the real orange. All participants who experienced the real juice-making event were able to identify the orange with 100% accuracy on both verbal measures. In contrast, the participants in the representational group responded with just 43% accuracy to the verbal 1 task and 57% accuracy to the verbal 2 task. This was the case even though all the participants had correctly identified a line drawing of a piece of fruit during the screening process. So this question was initially thought to be equally difficult for both groups.

Nevertheless, this unexpected group difference may be explained by a number of factors. Prior research suggests that multiple factors could have contributed to this outcome. They include previous event experience (Nelson,

1986), event knowledge (Slackman, 1985), importance of multiple input modalities (Stockman & Latham, 2001), the level of symbolic awareness (Kamhi, Catts, Koenig, & Lewis, 1984), and the distance of the representational stimuli from the real object (Sigel, 1971).

Since it is reasonable to assume that all the children who participated in this study had encountered oranges in their previous experiences, it is unlikely that lack of prior knowledge caused the difference. However, recognizing an orange in a novel context might not occur if the context cues needed to accurately label the visual representation of the orange are absent. Context cues, such as sensory input and representativeness of the object, were the largest differences between the teaching conditions for the two groups. The participants in the real group were exposed not only to the texture and smell of the orange during the teaching task, but they were also able to taste the orange juice. The participants in the representational group were exposed primarily to just visual cues of the representation of the orange. The children did not experience the smell, feel and taste of the orange. Touching the real orange also provided resistance throughout the event that the representation of the orange was not likely to provide. The oranges in the real group varied slightly in size, shape and color. Whereas the oranges in the representational group were a uniform size, shape and color. The visual predictability found in the representations of the oranges did not aid in the representational event participants' ability to label the orange.

All the sensory stimuli available in the real event may have given the context cues needed to label the orange. As oranges look similar to balls or other citrus fruits, the array of sensory stimuli available as well as witnessing the product or purpose of the event may have contributed to the real group's accuracy in labeling the orange. The lack of context cues available in the representational group may be the reason for its low scores on this task.

The participants in the representational group were more likely to label the orange during the second verbal measure than the first. This outcome may be due to the verbal input that participants obtained from the questions they were asked on the verbal 1 measure. The questions about the content of the event made reference to oranges and juice. All of the participants were also told they were going to play making juice before the teaching task and the event reenactment. It is clear that the participants in the representational group needed the context cues provided by the increased verbal input within the questions and repetition of the goal to correctly label the representation of the orange in the verbal 2 measure.

The most surprising outcome was revealed by analyzing the answers given by the same participants who incorrectly labeled the orange as a cookie or piece of bologna. They still reported that they drank juice when questioned later in the verbal measure. This inconsistency may point to the representational group's need to rely more on the verbal input provided by the questions than the analysis of their own experience.

The ability of some participants to produce the novel words presented in this study was also not expected. Previous research done by Stockman and Latham (2002) and Latham and Stockman (2002) using the same event, showed that none of the participants produced the novel words. The possible variables that may have contributed to this difference will be discussed next.

There were two variables that differed from Stockman and Latham's (2002) study and the present investigation, which may have impacted the children's ability to produce novel words. First, the complexity of the verbal stimuli used to present the novel words differed. Second, some of the participants in the current study produced the novel words during the teaching task, despite instructions to be silent during the teaching activity.

The impact of verbal stimulus complexity on language learning has been well documented (Messer, 1981; Ninio, 1985). In the present investigation the verbal stimuli used to teach the novel word was reduced to one word with a gestural counterpart. In Stockman and Latham's study a carrier phrase was used to teach the novel noun and verb. Although all of the children who participated in the current investigation were able to comprehend phrases far beyond the one word level, the reduced complexity of the verbal stimuli may have aided the children in mapping the word to the object and/or action. The complexity of the verbal stimuli should play an integral role in the lexical mapping process. For beginning learners, the words are more salient when they are stressed and presented alone, or they are not deeply embedded in the stream of speech (Messer, 1981; Ninio, 1985).

The imitation of the novel noun and novel verb by some of the children, though they were instructed not to talk during the teaching task, may have been another important factor in the participant's ability to produce the words. Imitation has long been used as a therapeutic tool to teach production of new words. Tomasello (1992), for example, argued that imitative learning involves not only mimicking the production but also learning the use of new linguistic forms. Imitative learning is defined here as the reproduction of the behavior of another with an understanding of what the other is doing and why he/she is doing it. All but one of the children who were able to produce the novel word(s) imitated the production of the word(s) during the teaching event.

Recognition

The second set of questions on the verbal measure tested the participants' comprehension of the novel noun and the novel verb. Although the two groups did not significantly differ the analysis of the implications of each groups performance is needed to better understand how event participation may affect verbal comprehension.

Both the real event group and the representational event group did well on the recognition task. The real group maintained an 85.7% mean accuracy across both verbal measures. The children who participated in the representation of the event were able to identify /pak/ with 71.4% accuracy on the first verbal measure and 85.7% accuracy on the second verbal measure.

The ability of the majority of the participants to comprehend the novel noun supports the hypothesis that noun learning may be less difficult than verb

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learning in any context. As children acquire nouns before verbs (Tomasello, 1992), these results are consistent with what is known about language development.

The groups' comprehension of the novel verb did not differ significantly, which was expected due to the outcome of Stockman and Latham's (2002) previous research (Latham & Stockman, 2002). Both groups ability to experience the event through multiple sensory modalities may have contributed to these results. Even though some sensory information was missing from the simulated action carried out by the children who participated in the representation of the event. The integration of tactile-kinesthetic information may have provided enough information to form a coherent referent for the verb in both groups (Stockman & Latham, 2002; Affolter & Bischofberger, 2000).

The timing of the auditory input that labeled the referent was also an important similarity between groups. Ambalu, Chiat, & Pring's (1997) work, which provided a basis for the methodology for labeling the action before onset and after completion, found that providing the label for a verb is most effective when given before and/or after the action takes place. Both groups were given the verbal referent before and after the action took place, which is the most effective input for comprehension, which may account for some of the similarities in both groups ability to recognize the novel verb.

As previously mentioned, verb comprehension was tested at multiple levels through the verbal analysis. The participants' ability to recognize the verb was tested on two separate tasks. The first task required the child to point to the

action /kaɪp/ being performed with the novel object /pak/ and the second task required the child to point to a pantomime of the action without the object referent. Though all of the children who participated in this study were able to perform actions with imagined objects, as well as identify a pantomimed action with an imagined object, the later task demanded a higher level of representational ability (McCune-Nicolich & Carroll, 1981). This higher level of representation would demand that the child would have a strong referent for the action. Both groups performed at the same accuracy level on the second verbal measure for this higher-level task, indicating that both groups were able to recognize the novel verb with limited context cues after participating in the multi-sensory teaching event.

Answers to Direct Questions About Event Content

The significant difference found between the real and representational event groups' ability to answer questions about specific components of the event support the hypothesis that children's ability to describe an event may be enhanced by participation in the real event. Though no one question seemed to effect this outcome, the children who participated in the real event were able to answer the questions with greater accuracy. This is supported by Bloom and Lahey's (1978) observations that using real objects increases the quality of a child's production.

The cause and effect relationships presented in the real event may have increased the real event participants' ability to answer questions regarding the event content (Slackman, 1985). These questions tested the participants'

comprehension of the observed cause effect relationships (goal-oriented or temporally organized) between the two events. Questions also considered locative information, which may have been confusing for the representational group due to the composition of the representation of the juice press (Sigel, 1971).

Comparison of Within Group Verbal Measures

The within group analysis did not reveal a significant difference between the performance on the verbal 1 and verbal 2 measures for the real event participants. This outcome was unexpected. However, a significant task difference was revealed for the representational group. In the discussion that follows, the results for the representational group are discussed first followed by the real event group.

Representational group.

The representational group's verbal score did improve significantly from the first to the second verbal test trial. The differences between the representational group's verbal 1 and verbal 2 scores may be explained by the priming effect of the questions in the verbal 1 measure. The questions asked in the verbal measures may have provided some of the information missing from the representation of the event, but did not provide additional information for the real event. For example, "When did you drink the juice?" may have given the child information about what they had "pretended" to drink, which was information not available in the event itself. Participants in the representational group were more apt to answer the verbal 2 questions correctly after questions containing

some cause and effect cues were given. The participants' reliance on the linguistic stimuli may lead to the assumption that language disordered children, who do not respond well to increased verbal stimuli (Affolter & Bischofberger, 2000) alone, may have increased difficulty with this task.

Real group.

The outcomes for the real group did not reveal significant differences on the verbal 1 and verbal 2 measures. This unexpected finding may be due to the quality of input provided by the first interaction. The input perceived in the real event included purposeful cause and effect relationships provided by observable outcomes as well as taste and smell input not available in the representational event. Therefore, the information provided by the questions asked on the verbal measure was not likely to add to the child's perception of the event reenactment. The multiple input modalities available may have also aided in a strong recollection of the event and thereby the more accurate verbal descriptions observed on both the verbal 1 and verbal 2 measures, not just the latter measure.

In conclusion, the available research clearly supports the findings of this study. The comprehension and description of events by typically developing preschoolers is influenced by the environment in which they learn. Given the results of this study, it can be argued that typically developing children have significantly better verbal and nonverbal performance when they participate in a real event as opposed to its dynamic pictorial representation.

Clinical Implications

Professionals in educational and clinical settings tend to use a symbolic or representational media to teach children language and nonverbal concepts as opposed to real events. This may be due in part to the accessibility of symbolic representations such as toys, pictures, and interactive dittos, pull-tab/interactive books and interactive computer software. Further benefits of using representational stimuli include ease of transport, low cost, and ease of reproduction/creation. These are important factors when limited time, space, and financial resources are common conditions that educators and clinicians face.

Although important, such factors ought to be secondary to what is required for efficacious intervention practices. The findings of the current study, in conjunction with evidence that children with language impairment have nonverbal symbolic deficits (Kamhi, Catts, Koenig, & Lewis, 1984; Affolter & Bischofberger, 2000), support the benefit of participating in real events for teaching and learning verbal and nonverbal tasks. Such findings should impact how therapy is conducted, especially when servicing a population with severe language impairments.

At the same time, the results of the present study do not imply that the use of representational stimuli has no place in language therapy. Rather, these findings suggest that representational stimuli may **not** be the most efficacious medium for teaching a new or novel concept in an unfamiliar event. The area of augmentative communication has long supported the use of a representational hierarchy for students with limited symbolic awareness when selecting a mode of

communication (Beukelman & Mirenda, 1998). This hierarchy promotes the use of real objects first, then miniature objects, followed by the use of partial objects, and eventually the use of pictures. The use of pictures also can be hierarchically organized according to their level of abstractness. The leveling or scaffolding of these stimuli allow clinicians to exchange the cumbersome stimuli, such as large objects, for more representational stimuli after comprehension and appropriate use of the less abstract stimuli is observed. The same process may also be effective in language therapy if the event is novel and the child has no internal referent for the objects and actions experienced in an event.

The results of this study also highlight the importance of nonverbal event comprehension rather than just a focus on vocabulary acquisition. Therapeutic goals that focus on outcomes such as increased single word vocabulary may have an overly narrow focus. This is because a child may produce a vocabulary term without comprehending its meaning and therefore the appropriate context for its use. Increased focus on event structure and nonverbal comprehension, such as the focus provided by participating in real events, should help to provide the nonverbal referents that are foundational for meaningful language use. Furthermore, the active participation in an event with clearly discernible cause and effect relationships may contribute to the use of more descriptive language and longer utterances (Nelson, 1986), both common goals in language therapy.

Children's ability to generalize information gained from a teaching event to every day encounters may also be promoted by the use of real event contexts. However, the long-range impact of using real events cannot be determined

without further research that explores the effect of using simulated events on verbal and nonverbal learning of children with clinical impairments.

Future Research

More research is needed on efficacious treatment practices, including what constitutes the ideal learning environments. The goal of all therapeutic practices is to deliver the most effective treatment possible so that function may be increased for the clients served. If current practices are not adequately challenged or supported, countless individuals may not receive efficacious intervention.

Further research may address several variables that may impact the evidence for the effectiveness of using real versus representational events. To understand the differential effect of using real as opposed to representational stimuli in intervention, future research should (1) expand the size of the participant samples used, (2) focus on different populations, (3) explore different types of events for teaching, and (4) determine the effects of different event contexts on long their memory and retrieval of newly learned information. Each of these potential areas for future research is discussed below.

Increasing the Sample Size

Future investigations should examine the use of real and represented events with a larger number of participants to account for the individual differences. It is well known that larger population samples increase the ability to generalize the findings to the population being studied. The ability to generalize

any significant findings of future research would contribute to the clinical relevance of the use of real and representational event participation.

Focusing on Different Populations

Investigating the differential effects of participating in real versus representational events on different populations is also needed to determine if group differences exist across age groups and across groups with differing levels of language function. Specifically, future research may compare older typically developing children to younger typically developing children. Such a comparison is needed to determine if children may be effectively taught novel information through use of representations, starting at a specific age or level of symbolic function. Comparisons of typically developing children to children with clinical impairments are also needed. Such investigations would assist in the additional discovery of the differential effects of real and representational event contexts on nonverbal and verbal learning between typically developing children and children with clinical impairments. The inclusion of clinically impaired children in future research is also needed to determine the efficacy of using real events versus representational events for clinical intervention.

The efficacy of using representational events in “at-risk” populations, such as economically disadvantaged children should also be investigated. It is known that Headstart preschoolers who do not have much experience with representations (full size replicas, picture books, or print media) have difficulty understanding that it is a symbol that represents a referent, even if the referent is known (Whiren, Soderman, Stein, & Gregory, 2002. For this reason, further

support for using real “hands-on” experiences may be needed to detour future use of unfamiliar “hands-on” representational stimuli.

Exploration of Different Types of Events for Teaching

Varied event types are also needed to determine if the results favoring the use of real events are task dependant. Variations should include the use of multiple real and representational events. Exploration of different types of representational events in comparison to real events is also warranted. Further investigation into the use of pop-up books, interactive worksheets, toys, and virtual environments are needed to determine if some representational events may be more effective for teaching than others, or as effective as real event participation. Specifically, the use of virtual environments compared to the use of real events may be targeted. The excitement caused by the use of this new and innovative technology, which touts increased safety as well as the ability to give students a larger array of experiences without leaving the classroom, may lead to use of such technology before its efficacy is determined.

Effects of Different Event Contexts on Long Term Memory and Retrieval

Future research should address the question of how knowledge acquired from participating in a representational event “carries over” into participation in functional event. Comparison of different representational event contexts to real event contexts is needed to determine if any representational for is as effective as a real event experience. The types of tasks should also be varied to include those that involve all the senses (hearing, vision, taction, smell, and taste) in comparison to those that focus just on the auditory or visual input. The goal of

such research would be to determine whether these different sources of sensory input have a differential effect on the ability to recall (retrieve) and describe events in the real world. “Carryover” or generalization of the information learned in an event to real world experience is the end goal of all pedagogical and clinical practice. Understanding how different real and representational events may affect the storage and retrieval of the knowledge acquired may provide clues to what to do in order to encourage generalization and use of learning.

Summary

In summary, the findings of the present study supported the hypothesis that typically developing preschoolers who participate in a real event are better able to learn from a novel event than preschoolers who participate in an event representation. But the secondary hypothesis was not supported. Surprisingly, the scores of the representational group, and not the real event group, improved significantly from verbal 1 to verbal 2. These differences in group outcomes may be explained by differences between the two events in their potential for the children to experience change of resistance, access to multimodal stimuli, and direct cause-effect relationships during verbal and nonverbal learning.

The results of the present study yielded promising outcomes, which suggest that participation in real events may be more advantageous to learning about events than participating in dynamic pictorial event representations. But, much more needs to be learned about how broadly such an outcome can be applied. The limitations of this exploratory research mean that generalization of the findings to a clinical population and to different types of teaching events

should not be done in the absence of further research. In an age and culture that value distance learning technology and strive to make it accessible, it is imperative that we investigate the efficacy of using all forms of representations for teaching and learning relative to real event experiences.

APPENDICES

APPENDIX A

HUMAN SUBJECTS APPROVAL

Human Subjects Approval

May 22, 2002

RE: IRB 02-338 CATEGORY: EXPEDITED 2-6, 2-7

APPROVAL DATE: May 20, 2002

**TITLE: THE EFFECTS OF REPRESENTATIONAL AND REAL EVENT
CONTEXTS ON VERBAL AND NONVERBAL LEARNING**

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete and I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the **UCRIHS approved this project.**

APPENDIX B

LETTER TO PARENTS

Letter to Parents

Dear Parent,

I am requesting permission for your child to participate in a language study. Your child will be given a free hearing screening, the Preschool Language Scale-3 (PLS-3), a language test, and the Kaufman Brief Intelligence Test (K-BIT). A checklist will be done to observe your child's level of symbolic play. All of this testing information will be used to see if your child meets the requirements of this study. You will be notified of the results of these tests. Finally, your child's teacher will be asked to fill out a questionnaire about his/her language, play, motor, and hearing skills.

If selected, your child will participate in an orange juice making activity. The study will take place during normal daycare/preschool hours, in a room at the school or daycare center. The activity will be done in 2 sessions, each lasting 10 to 20 minutes. The time of participation will be arranged to not disturb your child's normal schedule as much as possible. Your child will have the choice to participate. The children will be asked to participate, and they can refuse. He/she will be invited to participate one more time. If your child declines again, then he/she will not participate in the study. If your child does complete the study he/she will have a choice of an age appropriate puzzle, book or toy, as a reward for participation.

All interactions with your child will be videotaped. These tapes will be used to compare results of different teaching methods by students studying speech and hearing sciences. These videotapes will be available for viewing upon your request; otherwise they will be erased upon completion of this project. Your child's privacy will be protected to the maximum extent allowable by law.

If you have any questions about this study, please contact Carrie Luce at home (989) 227-0881, e-mail: wojcikca@hotmail.com or regular mail: 478 Communication Arts & Sciences, East Lansing MI 48824. If you have questions or concerns regarding your child's rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact – anonymously, if you wish – Ashir Kumar, M.D., Chair of the University Committee on Research Involving Human Subjects (UCRIHS) by phone: (517) 355-2180, fax: (517) 432-4503, e-mail: ucrihs@msu.edu, or regular mail: 202 Olds Hall, East Lansing, MI 48824. Attached is a consent form and survey. Please fill out each form and return it to me using the self-addressed envelope as soon as possible.

Respectfully,

Carrie Luce

APPENDIX C

PARENT CONSENT FORM

Parent Consent Form

Title of the Project: The effects of representational and real event contexts on verbal and nonverbal learning.

Investigators: Ida Stockman, PhD
Michigan State University
Communication Arts and Sciences
Department of Audiology and Speech Sciences
East Lansing, MI 48824

Carrie Luce, BA
Michigan State University
Department of Audiology and Speech Sciences
East Lansing, MI 48824

Consent Form

My Child _____ **CAN / CANNOT** participate
in the research project in his/her daycare/pre-school.

If consent is given, your child's privacy will be protected to the maximum extent allowed by law. Furthermore, if your child is injured as a result of his/her participation in this research project Michigan State University will provide emergency care if necessary. You will not be held responsible for any medical expenses as a result of this injury. All such medical expenses incurred by you as a result of this injury shall be paid by the investigators. Your child's participation in this research project will not involve any additional costs to you or your health care insurer.

Your ☐guardian☐ below indicates your voluntary agreement to allow your child to participate in this study.

(Signature of parent/☐guardian)

(Date)

APPENDIX D

PARENT QUESTIONNAIRE

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Parent Questionnaire

Parent Questionnaire

Name of Daycare/Preschool

Parent's Name: _____ Child's Name: _____

Child's Birthdate: _____ Child's Gender: Male Female

Child's Race/Ethnicity (circle as many as apply):

Caucasian/White African American Hispanic Native American

Asian Pacific

Other: _____

PLEASE CIRCLE ONE

- 1) Has your child ever, or is your child currently receiving speech/language therapy?

Has in the past Is seeing a speech therapist now No

- 2) Is English the primary language spoken in your home?

Yes No

- 3) Does your child have a hearing impairment?

Yes No

- 4) Does your child have any physical impairment?

Yes No

- 5) How would you describe your child's vision (with or without glasses)?

Good Questionable Poor

- 6) What range best describes the current yearly income for your household?

a) up to 37,500 b) 37,600 to 70,000 c) 70,100 to 160,000

d) 160,100 to over 200,00

- 7) How many people currently reside in your household?

a) 2 b) 3 c) 4 d) 5+

- 8) Is your child allergic to orange juice?

Yes No

9) Do you make fresh squeezed orange juice at home?

Yes

No

If you do make fresh orange juice at home, please answer the following:

1) How often do you make fresh squeezed orange juice:

Every day

1-3 times a week

Occasionally Rarely

2) What do you use to make fresh squeezed orange juice?

Juice press

Electric Juicer

Hand

Reamer

10) When child plays does he/she (circle all that apply):

- a. Stacks objects or groups.
- b. Plays with objects as they should be used (using a paintbrush to paint a picture).
- c. Pretends to feed him/herself with an empty spoon.
- d. Involves others in pretend play activities, such as feeding a doll or stuffed dog.
- e. Pretends to read books, mop the floor, or "drives" a toy car using the appropriate sounds.
- f. Pretends one object is another while performing an action (such as pretending a rock is a spoon and using the rock to pretend to feed him/herself).
- g. Uses part of his/her body to pretend to perform an action (such as brushing her/his teeth).
- h. Uses the appropriate movements to perform an action (such as hair brushing or hammering) without an object or use of a body part to represent the object.
- i. Is able to identify actions and objects in pictures and books.

THANK YOU!

I appreciate the time you have spent, and look forward to working with your child. **Please enclose this questionnaire and the consent form, with your signature, in the self addressed envelope provided at your earliest possible convenience.** If you have any comments or questions, please contact me at (989) 227-0881 or wojcicka@hotmail.com.

Thank you,

Carrie Wojcik Luce

APPENDIX E

TEACHER QUESTIONNAIRE

Teacher Questionnaire

Instructions: You are asked to provide information on the following categories on each child in your classroom. Please place a check (T) in the appropriate space indicating your judgment in that category. If you are uncertain about how to judge a category, place a question mark (?) in the space instead of a check. Please identify each child by number only so that anonymity may be assured until parental consent is obtained. You may be assured that all information provided will be kept confidential. Thank you for your cooperation.

Date: _____ **Name of School:** _____ **Teacher:** _____

[illegible]

G/N = Good/Normal N= No
Q = Questionable
P = Poor
Y= Yes

APPENDIX F

SYMBOLIC SCREENING TOOL

Symbolic Screening Tool

Stimulus Needed	<u>Examiner Prompt</u>	<u>Response</u> (circle or write in response)
toy/plastic banana	"What is this?"	Correct response : Banana Other response: _____
color line drawing of an apple (from Boardmaker software)	"What is this?"	Correct response: Apple Other response: _____
photograph of a child jumping	"What is happening in this picture?"	Correct response: jumping Other response: _____
brush, washcloth, toothbrush	"Show me how you brush your hair."	a) demonstrated appropriate action with appropriate object b) demonstrated appropriate action with the wrong object c) demonstrated the wrong action with the appropriate object
doll, washcloth, toothbrush	"Show me how you wash the baby."	a) demonstrated appropriate action on the appropriate object. b) demonstrated appropriate action on self/wrong object. c) Demonstrated the wrong action on the wrong object

n/a	"Show me how you pretend to brush your teeth."	a) performs action with body part substitution for the toothbrush b) performs action with "imagined" object, demonstrating appropriate grip, as if the object were there. c) did not perform the appropriate action.
-----	--	---

Note: This measure was compiled through information provided by research on development of symbolic play behaviors done by Casby (1991); McCune-Nicolich and Carroll (1981); and Ungerer, Zelazo, Kearsley, and O'Leary (1981).

APPENDIX G

RESPONSE FORM FOR VERBAL MEASURES

Response Form for Verbal Measures

Subject: _____

Treatment Condition (circle one): Verbal 1 Verbal 2

QUESTION	RESPONSE	2 PT RESPONSE	1 PT RESPONSE	0 PT RESPONSE	SCORE
1. What is this? (point to the orange)			Orange	No response Incorrect response	
2. What is this? (point to the juicer)			/ pak/	No response Incorrect response	
3. What is this? (demonstrate action)		/ kaɪp/		No response Incorrect response	
4. Which is / kaɪp / ? (video action with object)			Point to upper left portion of the screen	No response Point to wrong portion of the screen	
5. Which is / kaɪp/? (video action without object)		Point to upper left portion of screen		No response Point to wrong portion of the screen	
6. Which is / pak/?			Point to upper left portion of screen	No response Point to wrong portion of the screen	
7. Who made the juice?		Indicate self (verbal-correct- "me", "I did")	Indicate self (nonverbal- correct- point to self)	No response Incorrect response	

QUESTION	RESPONSE	3 PT RESPONSE	2 PT RESPONSES	1 PT RESPONSE	0 PT RESPONSE	SCORE
8. How did you make the top go down?			Semantic reference to process; must include action (/ kaɪp/) with object (/ pak/)	Reference to action with another apparatus (miming / kaɪp/ with hand movements)	No response No reference to action	
9. Where did you put the orange?		Locative + serial content (i.e. in / pak/, in the top of it,.....)	Locative content correct (i.e. in)	Nonverbal relevant response (point to juicer)	No response No locative content	
10. Why did you cut the orange?				Causal relationship Reference to overall action goal	No response No causal relations	
11. When did you drink the juice?			Temporal element (i.e. "finished") Specific	Temporal element General	No response No temporal element	
12. What did you drink?				Juice	No response Incorrect response	
TOTAL SCORE						

APPENDIX H

NONVERBAL MEASURE

NONVERBAL MEASURE

ACTION	1 PT RESPONSE	ALTERNATE 1 PT RESPONSE	0 PT RESPONSE	SCORE
1) Putting the glass measuring cup on the base of the juice press	Carries out the action unaided	Starts to move the measuring cup into position but needs assistance moving or positioning it.	Skips the step or needs total assistance	
2) Reaching for and placing the orange in front of themselves	Carries out the action independently	N/A	Skips the step or needs total assistance	
3) Grasp the child-safe knife in one hand and one orange in the other	Carries out the action independently with the appropriate grasp on both objects	Initiates action but needs assistance stabilizing the objects or obtaining an appropriate grasp on the objects	Skips the step or needs total assistance	
4) Cut the orange in half	Carries out the action independently	Initiates, but needs assistance cutting the orange	Skips the step or needs total assistance	
5) Place one half of the orange on the antique, manually operated juice	Carries out the action independently	Carries out action independently but needs assistance cutting through the orange	Skips the step or needs total assistance	
6) Pushing down the handle of the juicer	Carries out the action independently	Initiates action but needs assistance to obtain the desired effect, making the juice or making the top go down	Skips the step or needs total assistance	
7) Place a half of the orange on the antique manually operated juice press manually	Carries out the action independently	Carries out action independently but needs assistance positioning the orange	Skips the step or needs total assistance	

ACTION	1 PT RESPONSE	ALTERNATE 1 PT RESPONSE	0 PT RESPONSE	SCORE
8) Push down the handle of the juicer	Carries out the action independently	Initiate action but needs assistance to obtain the desired effect, making juice or making top go down	Skips the step or needs total assistance	
9) Grasp the child-safe knife in one hand and one orange in the other	Carries out the action independently with the appropriate grasp on both objects	Initiates action but needs assistance stabilizing the objects or obtaining an appropriate grasp on the objects	Skips the step or needs total assistance	
10) Cut the orange in half	Carries out the action independently	Initiates action but needs assistance cutting through the orange	Skips the step or needs total assistance	
11) Place one half of the orange on the antique manually operated juice press	Carries out the action independently	Carries out action independently but needs assistance with positioning the orange	Skips the step or needs total assistance	
12) pushing down the handle of the juicer	Carries out the action independently	Initiates, but needs assistance to obtain desired effect (making juice or making the top go down)	Skips the step or needs total assistance	
13) Place a half of the orange on the antique manually operated juice press	Carries out the action independently	Carries out action independently but needs assistance positioning of the orange	Skips the step or needs total assistance	

ACTION	1 PT RESPONSE	ALTERNATE 1 PT RESPONSE	0 PT	SCORE
14) Push down the handle of the juicer	Carries out the action independently	Initiates action but needs assistance to obtain the desired effect, making the juice or making the top go down	Skips the step or needs total assistance	
15) Pour the juice into the cup	Carries out the action independently	Initiates action but needs assistance grasping or lifting the measuring cup	Skips the step or needs total assistance	
16) Drink the juice	Carries out the action independently	N/A	Skips the step or needs total assistance	
TOTAL SCORE				

APPENDIX I

MEAN ACCURACY SCORES

Mean Accuracy Scores

Real Event Group Verbal 1percentage of accuracy for each question

Question 1 Scores	Question 1 % accuracy	Question 2 Scores	Question 2 % accuracy	Question 3 Scores	Question 3 %accuracy
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	1	100	0	0
1	100	0	0	0	0
average	100.00		14.29		0.00

Question 4 Scores	Question 4 % accuracy	Question 5 Scores	Question 5 % accuracy	Question 6 Scores	Question 6 %accuracy
1	100	2	100	1	100
0	0	0	0	0	0
1	100	0	0	1	100
1	100	0	0	1	100
1	100	2	100	1	100
1	100	2	100	1	100
1	100	2	100	1	100
average	85.70		57.14		85.71

Question 7 Scores	Question 7 % accuracy	Question 8 Scores	Question 8 % accuracy	Question 9 Scores	Question 9 %accuracy
2	100	0	0	1	33
2	100	1	50	1	33
2	100	0	0	1	33
2	100	0	0	1	33
2	100	0	0	2	66
2	100	0	0	1	33
2	100	0	0	2	66
average	100		7.14		42.43

	Question 10 Scores	Question 10 % accuracy	Question 11 Scores	Question 11 %accuracy	Question 12 Scores	Question 12 %accuracy
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	0	0	1	100
	1	100	1	50	0	0
	1	100	2	100	1	100
	0	0	0	0	1	100
	1	100	0	0	0	0
average		85.71		50		71.43

Real Group Verbal 2 percentage accuracy for each question

	Question 1 Scores	Question 1 %accuracy	Question 2 Scores	Question 2 %accuracy	Question 3 Scores	Question 3 %accuracy
	1	100	0	0	0	0
	1	100	0	0	0	0
	1	100	0	0	0	0
	1	100	1	100	0	0
	1	100	0	0	0	0
	1	100	1	100	0	0
	1	100	0	0	0	0
average		100.00		28.57		0

	Question 4 Scores	Question 4 %accuracy	Question 5 Scores	Question 5 %accuracy	Question 6 Scores	Question 6 %accuracy
	1	100	2	100	1	100
	0	0	0	0	0	0
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
average		85.714		85.71		85.71

	Question 10 Scores	Question 10 %accuracy	Question 11	Question 11 % accuracy	Question 12	Question 12 % accuracy
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	0	0	1	100
	0	0	1	50	1	100
	1	100	2	100	1	100
	0	0	0	0	1	100
	1	100	0	0	0	0
average		71.43		50.00		85.71

Representational Group Verbal 1 percentage of accuracy for each question

	Question 1 Scores	Question 1 %accuracy	Question 2 Scores	Question 2 %accuracy	Question 3 Scores	Question 3 %accuracy
	1	100	0	0	2	100
	0	0	0	0	0	0
	0	0	1	100	0	0
	1	100	0	0	0	0
	0	0	0	0	0	0
	1	100	0	0	0	0
	0	0	0	0	0	0
average		42.86		14.29		14.29

	Question 4 Scores	Question 4 % accuracy	Question 5 Scores	Question 5 % accuracy	Question 6 Scores	Question 6 %accuracy
	1	100	0	0	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	0	0	2	100	0	0
	0	0	0	0	0	0
average		71.43		71.43		71.43

	Question 7 Scores	Question 7 % accuracy	Question 8 Scores	Question 8 %accuracy	Question 9 Scores	Question 9 %accuracy
	0	0	0	0	3	100
	0	0	0	0	0	0
	2	100	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	1	50	0	0	1	33
	2	100	0	0	2	66
average		35.71		0.00		28.43

	Question 10 Scores	Question 10 %accuracy	Question 11 Scores	Question 11 %accuracy	Question 12 Scores	Question 12 %accuracy
	0	0	0	0	0	0
	0	0	0	0	1	100
	1	100	0	0	0	0
	0	0	1	50	1	100
	1	100	0	0	1	100
	0	0	0	0	1	100
	1	100	2	100	0	0
average		42.86		21.42		57.14

Representational Group Verbal 2 percentage of accuracy for each question

	Question 1 Scores	Question 1 % accuracy	Question 2 Scores	Question 2 % accuracy	Question 3 scores	Question 3 % accuracy
	1	100	0	0	2	100
	0	0	0	0	0	0
	0	0	1	100	0	0
	1	100	0	0	0	0
	1	100	0	0	0	0
	0	0	0	0	0	0
	1	100	0	0	0	0
average		57.14		14.29		14.29

	Question 4 Scores	Question 4 %accuracy	Question 5 Scores	Question 5 %accuracy	Question 6 Scores	Question 6 %accuracy
	1	100	0	0	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	1	100	2	100	1	100
	0	0	2	100	0	0
	1	100	2	100	1	100
average		57.14		85.71		85.71

	Question 7 Scores	Question 7 %accuracy	Question 8 Scores	Question 8 %accuracy	Question 9 Scores	Question 9 %accuracy
	0	0	0	0	3	100
	2	100	0	0	0	0
	2	100	0	0	0	0
	2	100	0	0	0	0
	2	100	0	0	0	0
	0	0	0	0	2	66
	2	100	0	0	2	66
average		71.43		0.00		33.14

	Question 10 Scores	Question 10 %accuracy	Question 11 Scores	Question 11 % accuracy	Question 12 Scores	Question 12 %accuracy
	0	0	0	0	0	0
	1	100	0	0	1	100
	1	100	0	0	0	0
	0	0	1	50	1	100
	1	100	1	50	1	100
	0	0	0	0	1	100
	1	100	0	0	0	0
average		57.14		14.29		57.14

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