12-1995

Effects of Rote Exercise, Imagery, and a Material-Based Occupation on Postural Control in Children Ages 3-9

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EFFECTS OF ROTE EXERCISE, IMAGERY, AND A MATERIAL-BASED OCCUPATION ON POSTURAL CONTROL IN CHILDREN AGES 3 - 9

by

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A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Science
Department of Occupational Therapy

Western Michigan University
Kalamazoo, Michigan
December 1995

ACKNOWLEDGMENTS

While the completion of my thesis may not have been timely, it certainly is "about time!!" Though my name is the only one listed as author of this paper, I must recognize those people without whom I may not have ever finished my graduate education. First, I would like to extend an enormous "Thank you" to the Sara Swickard Preschool for letting me interrupt their play-time and allowing a little havoc with a video camera. Next, to my thesis advisors, Cindee Peterson, Deb Hazel, and Dr. Robert White, who kept wondering if I was still planning on graduating, thank you for not forgetting about me. I would also like to extend my appreciation to Julie Scott of the University Statistical Computing Services for assistance with my data analysis.

My debt of gratitude includes also the occupational therapists from C.S. Mott Children's Hospital, especially Janet Santos, Angie Jordan, Denise (Pfiefer) Justice, Robin Mercer, and Beverly Boyd-Wolfe, who came to my rescue in a time of great need.

Finally, I would like to express my sincere gratitude and love to my parents, Bob and Jeanette; brother, Eddie; and husband, Mike, whose unconditional support and encouragement never waned during those trying months between fieldwork and now.

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Occupational therapy is based on the concept of enhancing motor, cognitive, sensory, and psycho-social performance through the utilization of purposeful activities. Purposeful activities are doing processes directed toward a planned or hypothesized end result, and can be naturalistic, simulated, or imagery-based (Nelson & Peterson, 1989). This study compared the effects of a material-based occupation, imagery-based occupation, and rote exercise on the quality and duration of maintaining prone extension in children aged three to nine. The quality of maintaining the posture was analyzed using the prone extension postural test (Gregory-Flock & Yerxa, 1984). Duration of prone extension for each child was measured in seconds.

An analysis of variance indicated that the difference between conditions for the quality variable was not statistically significant ($p = .1117$). The duration variable yielded differences which approached significance ($p = .076$).

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CHAPTER I

INTRODUCTION

Purposeful Activity in Occupational Therapy

Purposeful activities can be defined as " tasks or experiences, in which the person actively participates . . . and requires and elicits the coordination between one's physical, emotional, and cognitive systems" (Hinojosa, Sabari, & Rosenfeld, 1983, p. 805). These activities can take the form of activities of daily living, such as self-care and home management, as well as work and leisure. The use of activities to facilitate and promote health and well being is central to the goal of occupational therapy. This is evident in the Philosophical Base of Occupational Therapy which states the following:

> Man is an active being whose development is influenced by the use of purposeful activity. Using their capacity for intrinsic motivation, human beings are able to influence their physical and mental health and their social and physical environment through purposeful activity. Human life includes a process of continuous adaptation. Adaptation is a change in function that promotes survival and self-actualization. . . . Purposeful activity facilitates the adaptive process. Occupational therapy is based on the belief that purposeful activity (occupation), including its interpersonal and environmental components, may be used to prevent and mediate dysfunction, and to elicit maximum adaptation. Activity as used by the occupational therapist includes both an intrinsic and a therapeutic purpose (Representative Assembly Minutes, 1979, p. 38).

Purposeful activities serve four fundamental functions as treatment media for the occupational therapist (Kielhofner, 1992):

1. The first function is that through these activities the therapist can structure the environment in such a way that the patient may safely and successfully perform activities of daily living.

2. They provide a canvas in which environmental adaptations can be generated to increase the chances for successful performance; furthermore, in some patients technical devices are necessary to assist with performing daily activities.

3. Purposeful activities provide the opportunity for the patient to become a skilled operator of these devices in a naturalistic setting.

4. Having a patient engage in an activity, can facilitate problem solving and coping techniques within a "safe" environment. This enables the patient to practice actual situations he/she may encounter on his/her own, with the supervision of a trained occupational therapist.

These successful adaptations serve as self-reinforcing elements for each higher level of adaptation (King, 1978). Consequently, successful problem solving and coping techniques are learned, and further physical, emotional, and cognitive complications can be avoided. When utilizing activities, also known as occupations, as a therapeutic medium, the therapist must consider the activities' significance to the patient. The therapist must ascertain the interests and lifestyle of the patient. The role of the occupational therapist is to then coordinate this information into a gradable and

adaptable, goal-directed activity which is appropriate to the patient's level of physical, cognitive, and emotional functioning (Hopkins & Tiffany, 1988). Most importantly, it must require an active response by the patient (Kielhofner, 1992; King, 1978). According to Fidler & Fidler (1978), it is this active response or "doing" which is essential to promoting adaptation and well-being.

Purposeful Activity as a Performance Enhancer

Activities which a patient considers purposeful have a direct impact on their performance. Two theoretical models demonstrate this correlation. Nelson (1988) defines occupation as a dynamic process by which the environment and the person are interrelated and play a direct role in the performance outcome. Nelson's (1988) dynamics of occupation illustrates the relationship between occupational form and occupational performance. Occupational form is defined as all human and nonhuman elements of a person's environment, as well as the task or activity that needs to be completed. The occupational form is interpreted by the individual's developmental structure and through personal meanings associated with the occupational form. These elements serve to develop a purpose for producing a specific performance. The resulting occupational performance, actually completing the task or activity, influences the occupational form of subsequent occupations. According to this model, there are two modes through which adaptation can occur. One could occur when the performance itself affects the individual's developmental structure. Another could

occur as a result of the developmental structure assigning a sense of purposefulness to the form, prior to the completion of the performance (Nelson, 1988).

Kielhofner & Burke (1980) parallel the dynamics of occupation in their model of human occupation. According to this model, a person receives information regarding the environment during the input stage. This information serves to elicit a specific performance, otherwise know as output. The output then initiates the feedback loop to the individual regarding his/her actions and any alterations required to improve his/her performance. Throughput serves as the liaison between the environment and the performance. The throughput system allows for the development of a sense of purposefulness through the elements of volition, habituation, and performance. Volition is the highest element in this hierarchy, and serves to govern both habituation and performance. Volition is also considered the motivational element which is comprised of personal causation, interests, and valued goals. These three components of volition enable an individual to ascribe meaning and purposefulness to an activity or event. An impairment in any one of the elements of throughput will affect the ensuing performance (Kielhofner & Burke, 1980).

Since what a patient considers purposeful is designated by his/her volition, it is imperative to identify an individual's personal causation, interests, and goals—in other words, what motivates the person to act (Kielhofner & Burke, 1980). A person's motivation for performing an activity can arise from several factors. These factors include the positive feelings associated with sensory input and the resulting physical

movement, extrinsic factors (doing what others want the person to do), the desire to achieve improved health, attempting an activity to see if he/she can be successful at it, and the pursuit of an added purpose associated with the activity (Nelson & Peterson, 1989). A common thread in all these motivational factors is personal causation, or the individual's ability to affect his/her environment. DeCharms (1968) theorized that a person's primary motivational factor was being able to effectively produce changes in his/her environment. Consequently, by tapping into this intrinsic motivation, a therapist can not only interject purposefulness into an activity and improve performance outcome, but the therapist can also afford the patient a sense of empowerment (Burke, 1977).

Purposeful Activity as a Motor Learning Enhancer

Motor learning theorists attempt to define how individuals learn and retain motor skill acquisition, whereas occupational therapists focus their attention on rehabilitation and facilitation of developmental progression of motor control. Both, though, place a high level of importance on the relationship between the individual and his environment, in relation to motor skill acquisition (Gliner, 1985).

Purposeful activity within a motor learning frame of reference serves as the motivational component which unites the person and environment (Gliner, 1985). In fact, Gliner (1985) stated that the ecological approach of motor learning regards coordination as the "relationship between the actor and the environment, where neither

is subordinate to the other," (p. 30). In this approach to motor learning, the actor or person serves as the muscle organizing unit, whereas the environment assists skill development through affordances and structured media (Gliner, 1985).

An affordance is the natural interaction of the event on the person, or, rather, how the event is interpreted by the person - what it means to them. Structured media serve to provide additional information regarding the event, such as lighting, sound, temperature, and the overall tone. When a person begins the process of skill acquisition, he/she must learn how to organize muscle groups to perform the necessary action (Fowler & Turvey, 1978).

It is often difficult to integrate all the incoming sensory information while also concentrating on coordination of specific muscle groups necessary to elicit the desired movement; the complete skill must be divided into its sub-units such that there is a decrease in the degrees of freedom. Usually, individuals have the ability to limit these components subconsciously, and can focus attention on one aspect of the total skill. Through the process of trial and error, the person integrates all the components to perform the task successfully. As Fowler & Turvey (1978) stated in regards to motor skill acquisition, "a person learns to swim before one learns to swim skillfully" (p. 23).

Another important factor which impacts motor skill acquisition is development. Development progresses in a cephalocaudal and proximodistal direction. Rood's (1962) ontogenetic motor control sequence describes the steps through which a child develops the necessary building blocks for mobility and skill (Goff, 1986). This

sequence commences with supine withdrawal, rolling over, and prone extension. It then proceeds through neck co-contraction, prone on elbows, quadruped, static standing, and concludes with walking. Of these patterns, perhaps prone extension is the most influential. Prone extension is the first stability pattern upon which all others are based (Trombly, 1989). In prone extension, the child subconsciously prepares for weight bearing by strengthening his extensor muscles throughout the body. Once the child has mastered these elements, he/she is motorically prepared to delve into the areas of coordination and skill.

What motivates us to develop these motoric patterns? As infants, we do not consciously decide we would like to develop our muscles in a certain manner so that we may eventually walk. Instead, a child is motivated to explore his/her environment. This exploration can be viewed as the purposeful activity of an infant. Consequently, this innate desire to explore affords the development of motoric patterns.

Dual-Purpose Versus Single- and Non-Purpose Activity

Most occupational therapists will concede purposefulness in treatment media is necessary for successful adaptation. However, there is controversy regarding dual- and single-purpose activities and their effect on eliciting adaptive responses. A dual-purpose activity refers to activities in which the primary focus is on the activity itself and not on the motoric and cognitive processes involved. Assignment of a dual-purpose activity provides a meaningful activity for the person, as well as providing for

the physical movements required for completion. An example of a dual-purpose activity is donning socks. For a patient recovering from a stroke, independently donning socks may be a meaningful goal, which requires a specific pattern of movements for successful completion. In terms of children, a dual-purpose activity would more likely involve a playful situation. To facilitate trunk and neck strength and stability in a child with poor trunk control, a therapist could structure a game of scooterboard soccer in which the child must lie prone on the scooterboard and hit the ball into the goal with his/her hands. The focus of the child is on the game itself and trying to beat his/her opponent; the therapist's attention is focused on the quality and duration the child is able to maintain the prone position successfully.

There are three activity classifications by which dual-purpose can be achieved: (1) naturalistic, (2) simulated, and (3) imagery-based (Nelson & Peterson, 1989). Naturalistic activities are afforded by the individual and his/her environment. These are the activities in which the individual normally engages, which are shaped by his/her environment. For a secretary these may include desk activities such as typing, while for a child it might include playing "Cowboys and Indians" or kickball.

A simulated activity describes an activity structured in such a way that it represents the actual activity. It cannot truly be considered naturalistic, though, because it was structured by the therapist and the therapist was present. A patient-selected cooking activity, set up by the therapist in the occupational therapy kitchen, may contain the necessary structures to complete the activity and elicit a meaningful

adaptive response. However, the set-up of the kitchen and the concrete environmental affordances, (i.e., the arrangement of the appliances as well as the type of appliances and utensils utilized), will differ from what the patient has previously used to complete a cooking activity and therefore not render it naturalistic.

The last dual-purpose activity form is imagery-based; imagery refers to eliciting mental pictures associated with a specific activity with the presence of few if any physical supports for the activity. This may be useful for the therapist to formulate purposeful activities for the patient when materials available for therapy are limited.

The advantage to using a dual-purpose activity are numerous. First, it affords the movement required (Nelson & Peterson, 1989). It can also be designed to increase socialization. Dual-purpose activities can promote self-reinforcing behaviors such that the individual will continue with movements indicated in producing an adaptive response. By utilizing an activity with a dual-purpose, the therapist can promote intrinsic motivation and gratification.

This dual-motivation, which is inherent in all purposeful activities, is uniquely utilized in occupational therapy (King, 1978). The primary motivation is the activity itself, what it signifies to the patient and the significance of other objects, in the environment. The secondary motivation arises from the adaptation elicited via the activity. Both types of motivation are necessary for successful adaptation. However, if the activity does not match the volition of the patient, the patient may feel as if he/she is the "pawn" of the therapist, and adaptation will not be elicited (Burke, 1977).

Single-purpose activities, usually referred to as rote exercise, focus attention on movement, not activity. In rote exercise, an individual focuses attention on the repetition of a prescribed set of movements (Nelson & Peterson, 1989). For some individuals, exercise is a motivating and thus purposeful activity. Moreover, "purposefulness in exercise (as in most activities) may be, and frequently is, multidimensional" (Nelson & Peterson, 1989, p. 14). Trombly (1982) argued that exercise is a legitimate tool for therapists since it is goal directed and requires internal organization which results in "automatic activation of lower level circuits" (p. 467). She also states that postural adjustments are the only movements not attended to consciously, and that any movement, besides developmental motor patterns, is voluntary and thus goal directed or purposeful. Trombly feels exercise is, therefore, a meaningful, purposeful, voluntary activity for therapists to utilize in treatment.

Not all therapists agree that exercise can be considered a purposeful activity (King, 1978; Huss, 1981). King (1978) feels that exercise is a non-purposeful activity because it cannot be generalized, regardless of its repetitive nature. Thus it cannot elicit an adaptive response. Furthermore, she states that by consciously attending to the movement patterns, as is required with exercise, there cannot be a subconscious organization of the adaptive response. This lack of adaptation as a result of utilizing exercise as a mode of treatment has also be asserted by Huss (1981).

Application to Clinical Practice

Occupational therapy involves utilizating meaningful and purposeful activities to facilitate and promote health and rehabilitation (Bloch, Smith, & Nelson, 1989). As therapists, one of our focuses is on eliciting adaptive responses which can impact psychological, cognitive, and/or physical well-being such that it increases a person's level of independence. The key to developing an effective treatment plan is through the use of purposeful activities which are meaningful and purposeful to the patient.

An activity must to designed so it has meaningful goals for both patient and therapist. The goals of the patient and therapist may not necessarily be the same. For example, while engaging in the activity of balloon volleyball, the goal of the patient may be to accumulate more points than his/her opponent or to just have fun. The therapist's goal, however, might be to increase active shoulder flexion and improve dynamic standing balance and visual-motor skills. Both goals can be achieved through the use of the purposeful activity of balloon volleyball. The theoretical basis for designing such activities lies in Kielhofner and Burke's (1980) and Nelson's (1988) models of occupation. By illustrating the relationship between the person and his/her environment and its effect on performance, the components of these models provide guidelines for developing purposeful activities specific for an individual. By understanding the interactions within these models, a therapist is better able to develop a treatment plan unique to the patient and thus facilitate successful adaptive responses.

One aspect of both the models which is integral to producing adaptation is the

feedback loop. This allows for the therapist to continually re-assess the impact of the activity to integrate and generate adaptation and then grade the activity in response to the patient's performance. This feedback aspect provides for the necessary subconscious integration of sensory input so the patient can adapt responses to the environment and the activity to achieve appropriate adaptive responses. This theory was beautifully illustrated by an example given in Yerxa's (1967) Eleanor Clarke Slagle Lecture. She said,

> A year ago I helped evaluate a brain damaged client's function. She was asked to open her hand. No response occurred, except that she was obviously trying. Next she was moved passively into finger extension while the therapist demonstrated the desired movement. This time the client responded with increased finger flexion. In frustration she cried, "I know, I know." Finally she was offered a cup of water. As the cup was perceived, her fingers opened almost miraculously to grasp it.

Providing the occupational form of hand the client a glass, the therapist structured the environment in such a way that it afforded the desired movement. The therapist impacted her patient's performance by providing the therapeutic occupational form. This theory can be applied to therapists working with children. The theory required that the activity provide the "just right challenge" (Berlyne, 1969; Csikszentmihayli, 1975, 1979) by maintaining an environment which both challenged and motivated the child to attempt new skills without provoking frustration and failure. For most children, primary motivation is exploring their environment by means of playing. Consequently, play can be utilized as the meaningful and purposeful activity through which adaptive responses can be developed.

CHAPTER II

REVIEW OF THE LITERATURE

Role of Purposeful Activity in Occupational Therapy

Historically, one of occupational therapy's fundamental principles has been "the best type of remedial exercise is that which requires a series of specific voluntary movements involved in the ordinary trades and occupations, physical training, play, or the daily routine activities of life" (Baldwin, 1919, p. 5). Meyer (1922) reiterated this principle in stating that only through "active engagement" could individuals develop skills necessary for daily activities. These purposeful activities, referred to as occupations, serve as building blocks of the profession (Cynkin, 1974; Fidler, 1981; West, 1984). Consequently, there have been attempts to quantify the importance of purposeful activity to human existence and to define the role of purposeful activities in treatment through discerning the relationship between activity and performance.

Doing or purposeful activity is the primary means of developing and integrating "sensory, motor, cognitive, and psychological systems; serving as a socializing agent, and verifying one's efficacy as a competent, contributing member of one's society" (Fidler & Fidler, 1978, p. 305). Doing is a purposeful activity, directed toward attaining a particular goal (Fidler & Fidler, 1983; this is consistent with

Mosey's (1986) definition of purposeful activities in which physical and mental energy is "directed toward an intended or desired end result" (p. 227). Breines (1984) elaborated, stating "all activities requiring both mental and physical involvement in which occupational therapists and their patients engage collaboratively can be assumed purposeful activities, if they elicit choice and provoke development" (p. 544). Purposeful activities are directed toward planned or hypothesized end results; random activities are undirected and without predetermined goals (Mosey, 1981).

What truly defines purpose in purposeful activities is cultural and social relevance of the activity in conjunction with the individual's own needs and goals (Mosey, 1986). Burke (1983) and Evans (1987) both concluded that occupation or purposeful activity is motivated by intrinsic and conscious needs which are determined by cultural traditions to which the person was exposed during the socialization process. These intrinsic components influenced the volition of an individual and consequently what he/she perceived as meaningful (Kielhofner & Burke, 1980).

A fundamental characteristic of purposeful activities is that they require the active participation of the individual (King, 1978; Hinojosa et al., 1983). Reed and Sanderson (1983) contended that occupation or purposeful activity consisted of "activities or tasks which engaged a person's resources of time and energy" (p. 247). Action, both mental and physical, is what Clark (1979) also felt was the determininate of what constituted purposeful activity/occupation. Active engagement concentrated attention on the activity and thus allowed for the subcortical integration of sensory

input and effective adaptation (King, 1978). "Activity becomes purposeful when the nature of and participation with the activity/event facilitates meaningful responses for the nervous system" (Gilfoyle, Grady, & Moore, 1981, p. 135).

The benefits of purposeful activities are numerous. They promote health and the healing process to increase an individual's independence (Hopkins, 1978). Purposeful activities can provide the opportunity for persons to achieve mastery of their environment (Fidler, 1981; Hinojosa et al., 1983). Mastery is achieved through the formation of adaptive responses to sensory input, allowing the nervous system to perform more efficiently (Ayres, 1979). "Meaningful, purposeful activities provide a naturalistic context for motivating and supporting healthy movement" (Nelson & Peterson, 1989, p. 12). Engagement in purposeful activities can lead to an increase in life satisfaction (Gregory, 1983), while a disruption or deficit in the ability to perform purposeful activities can jeopardize a person's health (Kielhofner & Burke, 1980).

Purposeful activity and occupational therapy are unified through adaptation (King, 1978). Therapists utilize purposeful activity with patients to elicit an adaptive response. King (1978) ascertained four characteristics of adaptation. Adaptation must (1) require active participation of the person, (2) be supported by the environment, (3) involve subcortical organization of the input, and (4) be self reinforcing (King, 1978). These characteristics coincide with those of purposeful activities; only through purposeful activities can adaptation be facilitated (King, 1978).

The adaptive process is essential in that it permits individuals to modify

responses so they may successfully encounter new and everyday challenges (Phillips, 1968; White, 1974). Through this complex process, individuals can learn how to maintain a functional connection with their environment (Hamburg, Coelho, & Adams, 1974). King (1978) further emphasized the importance of this process in stating that the majority of adaptation occurs within the normal process of development. "If developmental adaptation does not take place normally in childhood, the adult will show various disabilities ranging, as an example, from mild motor planning problems to severe disabilities such as process schizophrenia" (King, 1978, p. 434).

In order to effectively and efficiently utilize purposeful activities in the therapeutic environment, the therapist must decide whether the activity will be "adapted to compensate for a functional deficit or to promote restoration" (Hinojosa et al., 1983, p. 805). Once this has been decided, the therapist must then select activities to facilitate the desired action. Selection can be achieved through activity analysis (Cynkin, 1979). This process begins with determining the integral components of the activity, which are those human and non-human elements necessary for the completion of the activity (Boyer, Colman, Levy, & Manoly, 1989). Nelson, 1980, referred to these elements as the occupational form. The form is defined as the physical, human, temporal, surround, and sociocultural characteristics of the environment in which the occupational performance is occurring (Nelson, 1980). By adjusting the materials (i.e., size, shape, texture, sequence of events, position of materials or patient, or interpersonal component), the meaningfulness and purposefulness can be changed,

thereby modifying the occupational performance (Hinojosa et al., 1983).

Activity analysis is a process which continues throughout the therapy process. Activities must continually be amended in gradations to elicit the desired performance. When a patient encountered difficulty with a task, the therapist should intervene to prevent unproductive frustration. Gliner (1985) suggested two options in this situation based on the theory of motor learning; first, the number of movable joints, degrees of freedom, can be decreased such that the patient can concentrate on one select movement to complete the task (Gliner, 1985); the other option would be to restructure the environment, or occupational form, to eliminate or reduce the frustrating component (Gliner, 1985). Both options innately employ activity analysis to determine how and what changes should be made.

Perhaps the most important factor in activity analysis is that "the therapist must be aware of both the limitations of the patient and demands that the task will place on the patient so that the patient can organize his/her musculature in compliance with the task" (Gliner, 1985, p. 32). While the physical and mental limitations of the patient may be evident, the demands of selected activities to remediate these limitations may not. Some activities themselves have inherent characteristics which can facilitate or deter progress (Boyer, Colman, Levy, & Manoly, 1989). Nelson, Thompson, and Moore (1982) concluded in their study of the affective responses of four selected activities, that these inherent characteristics in activities elicit specific, physical or mental, responses. Carter, Nelson, and Duncombe (1983) noted that imitative

activities evoked feelings of hostility and powerlessness in comparison to creative activities. Moreover, allowing an individual choice in an activity also affected performance (Hackman, Brosseau, & Weiss, 1976; Morris, 1966). Gliner (1985) suggested that when a person chose an activity it indicated that he/she assigned meaningfulness to it and that the activity would maintain his/her attention. In fact, when children who were overweight were given a choice of activities, their personal investment and motivation to participate increased (Mendonca & Brehms, 1983).

While it is important to utilize activities meeting treatment requirements, there is the possibility of overlooking the patient if too much emphasis is placed on the physical and mental characteristics of the activities. The therapist should verify whether these activities are meaningful and purposeful to the patient, to avoid treating the deficits and not the patient (Allard, 1964; Thibodeaux & Ludwig, 1988). "The challenge for occupational therapists today is to integrate theory with input from patients to create natural real-world occupations that the patients identify as practical to their lifestyles" (Hasse, 1995, p. 404). Occupational therapists assert purposeful activity enhances effort and performance by tapping the individual's motivation (Dutton, 1989); without attention to the meaningfulness of the activity for the patient, he/she may not be motivated to fully participate (Hesse & Campion, 1983). King (1978) explained that purposeful activities are inherently dual-purpose as they provide for intrinsic motivation as well as adaptation. Burke (1977) concluded that when selecting activities for treatment, special concern should be directed to the "patient's

willingness to participate, the value that is attached by the patients to participating in the activity, and the future use of skills that are developed in the process" (p. 254).

Meaningfulness or motivation to participate in an occupation is affected by four factors: (1) expectancy of success or failure, (2) internal versus external orientation, (3) belief in skill, and (4) sense of efficacy (Burke, 1977). These motivational components, also identified as volition, enact or initiate action and consequently have a direct impact on performance (Kielhofner, 1980). Volition is the subsystem providing the basis for all development, and the "urge toward exploration and mastery of the environment" (p. 575). Feedback, regarding the quality of the performance, impacts future motivation to engage in an activity (Kielhofner, 1980). In children, the volition system serves an important function in the acquisition of skills and is directly related to the adaptation of volition. In a child with sensory-integrative dysfunction, improvement in assimilating sensory experiences to produce successful behaviors must coincide with an increased efficacy, belief in skill, and "the capacity to value and experience pleasure from motor performances" (Fisher et al., 1991).

A person's interests, values, and goals, in conjunction with a belief that goals can be attained, also influence motivation (Burke, 1977). This belief, or personal causation, is an important component of volition and can determine if a person is intrinsically or extrinsically motivated. Personal causation is defined as the self initiated behavior of an individual with intent to produce an alteration in his/her environment (DeCharms, 1968). DeCharms (1968) contends individuals are primarily

motivated by the ability to effectively produce change. Active engagement in activities of daily living require that the person possess self-initiated and self-guided behavior (Burke, 1977). When a person feels he/she can no longer produce these changes in his/her life or perform valued activities or roles as a result of injury or deficits, a person can develop decreased independence and personal causation, and an external locus of control (Kielhofner & Burke, 1980). Consequently, the therapist must employ treatment strategies to facilitate the development of personal causation and an internal locus of control (Burke, 1977). This can be achieved through active engagement in activities that the person considers meaningful and purposeful and are matched to the individual's current level of cognitive, physical, and emotional functions (Burke, 1977).

Another option to encourage an internal locus of control is to provide the individual with choices (Burke, 1977). King (1978) affirms that when the patient chooses an activity, he/she is more motivated to complete the task and more willing to learn additional strategies for adapting to current limitations. Moreover, when the patient selects the task, he/she may already have developed strategies for completing the task (King, 1978). In fact, as previously mentioned, certain activities inherently evoke affective cognitive and sensorimotor responses (Llorens, 1981). Thus, when a patient is provided with a choice of activities, he/she is able to choose those which match his/her intrinsic purpose (Llorens, 1981).

The Role of Purposeful Activity in Children

Play is considered the primary occupation of children and serves as the preparation for adult work and leisure activities (Kielhofner, 1985; Pratt, 1989; Reed, 1984; Reilly, 1974). Florey (1971) states that play can "facilitate development in a number of areas (sensory, neuromuscular, and mental processes) and can also reflect a level of development in these areas" (p. 275). In adults, purposeful activities can be categorized into activities of daily living, work, and leisure. For children, purposeful activities assume the roles of play and academics and provide the basis for exploration, learning, practice, and mastery (Hopkins & Tiffany, 1988). Purposeful activities can be utilized to facilitate a child's development through maintaining a playful atmosphere, tapping the intrinsic motivation of the child, providing playful experiences which challenge but do not discourage the child, structuring the environment to facilitate play, and/or utilizing the child's imagination (Mack, Lindquist, & Parham, 1982). This study serves to examine this relationship within the context of children's ability to maintain a developmental posture.

Children need to achieve a sense of mastery over their environment, just as adults do (White, 1959). DeCharms (1968) contends that as infants we learn that certain processes can be controlled and consequently begin to cause changes in our environment. In order for children to achieve competence in their daily activities, they must have successfully mastered the core developmental components of "mobility superimposed on stability" (Stockmeyer, 1967; Illingworth, 1987). This integration

begins in childhood and continues throughout adulthood. If the lower level developmental skills, such as maintaining the anti-gravity positions of supine flexion and prone extension, are not mastered, further development is impaired (Ayres, 1978). Much in the same way that a disability prevents an adult from completing activities of self care, work, and leisure, a child may develop deficits in academics and play.

The success of a child within his/her occupation is further dependent upon proper sensory-motor integration (Ayres, 1972). Research by Ayres (1978) discovered there was a relationship between the inability to maintain prone extension and inadequate vestibular processing. These deficits were found to be prevalent in children with learning disabilities (Ayres, 1978). Moreover, lack of successful sensory integration may influence a child's self-confidence and self-efficacy (Ayres, 1972).

In order for an activity to generate the desired therapeutic outcome, we must first consider its meaningfulness and purposefulness to the patient (Burke, 1977). Fidler and Fidler (1978) stated that the differentiation between a purposeful and non-purposeful activity was whether it was goal oriented. The goal could be a physical by-product of the activity as well as something on the intrapersonal or interpersonal level. However, the goal had to be that of the person completing the activity and not only that of the therapist (Fidler & Fidler, 1978). Furthermore, purposeful activities elicit an adaptive response, or a "goal-directed behavior" (King, 1978, p. 434). In one example, the child's the goal may be to lift his/her head to play with a suspended toy, while the therapist's goal is to stimulate co-contraction and trunk stability in order to

facilitate the integration and organization of sensory input with motor output (King, 1978). In children, goal-directed behavior involves the incorporation of the traits of play: intrinsic motivation; attention to means rather than ends; organism, rather than stimulus, dominated; nonliteral, simulative behavior; freedom from externally imposed rules; and requiring the active participation of the player (Rubin, Fein, & Vandenberg, 1983).

Meaningfulness of a playful activity is dependent upon the intrinsic motivation of the child (Ellis, 1973). Intrinsic motivation is dependent upon a child's cognitive skills, such as imagination, as well as the motor skills necessary to explore and manipulate objects (Piaget, 1962). Florey (1969) recognized that to elicit the intrinsic motivation of a child, the therapist must not only select activities which match the child's cognitive ability, but also choose those which have significance for the child.

One method of developing these activities is to provide the "just right challenge" (Ayres, 1972). This involves maintaining an environment which both challenges and motivates the child to attempt new skills without provoking frustration and failure (Ayres, 1972). When an activity is purposeful, the nervous system responds with feedback to provide direction for subsequent movements. "Thus purposeful activity augments neural mechanisms and sensorimotor-sensory integration" (Gilfoyle et al., 1981, p. 135). Providing the "just right challenge" can enable the child to tap into his/her intrinsic motivation, which serves as the basis for a child's exploration and eventual mastery of his/her environment. Conway (1985)

empirically studied the effects of tapping the intrinsic motivation of children to promote the acquisition of writing skills in children with hearing impairments. The subjects were not given any instruction regarding writing methods, but rather were encouraged to express visually feelings, thoughts, or ideas. Conway concluded that this free writing environment, in which the children were given control of their writing experiences, gave them the means to "explore, discover, consolidate and refine their understanding of writing as a mode of communication" (p. 105). Children developed writing skills by writing or drawing what they perceived as words to describe various situations they experienced or imagined.

Added-purpose activities, in the form of goal-oriented tasks, can provide the context for motor skill development (Gentile, 1987). When motor skills are detached from their "everyday goal-oriented actions," they lose their meaning (Gentile, 1987). Consequently, even if the specific movement is performed repetitively, it may not be incorporated into the individual's movement patterns when performing everyday activities (Gentile, 1987). Added-purpose activities, therefore, can be utilized to facilitate and sustain motor skill development.

Adding Purpose to Activities

It has been noted previously that changing the occupational form of an activity, such that it becomes purposeful and meaningful to the individual, can impact the occupational performance. Active participation in goal-directed activities such as

crafts or games allows for efficient and effective subcortical organization of sensory input by diverting a person's conscious attention from movement patterns (King, 1978; Huss, 1981). While engaged in an added-purpose task, even focus on pain and discomfort can be averted (King, 1978; Heck, 1988). Meaning and purpose in an activity can be afforded in several modes. One option involves providing choice within or between activities. This allows the individual to feel a sense of empowerment regarding his/her treatment (Hasse, 1995). By providing choices, the person increases his/her motivation to initiate as well as continue with the activity (Gliner, 1985). Gliner (1985) contended that "selection of a task by the patient usually indicates that the patient knows at least approximately, the boundary conditions of the task or what will be required and may have existing strategies for carrying out a task" (p. 32). A study by Rice and Nelson (1988) concluded that providing choice increased the level of subject's participation in the subsequent activity.

Another method of adding purpose in activities entails the selection of activities which have characteristic intrinsic meaning and affective responses. Certain activities elicit, in general, a specific intrinsic or sociocultural sense of meaningfulness or evoke certain affective responses. The Osgood semantic differential and Affective Self-Report Checklist have been used as methods to ascertain how people evaluate different occupations and/or the environment in which the occupation was completed (Adelstein & Nelson, 1985; Boyer, Colman, Levy, & Manoly, 1989; Froehlich & Nelson, 1986; Kremer, Nelson, & Duncombe, 1984; Nelson, Peterson, Smith,

Boughton, & Whalen, 1988; Nelson, Thompson, & Moore, 1982; Rocker & Nelson, 1987; Steffan & Nelson, 1987). This served to demonstrate that affective response to an occupation can impact an individual or group's performance. When subjects in the studies by Kremer et al. (1984) and Boyer et al. (1989) completed occupations such as filing, cooking, and exercycling, they felt more confidence, higher self-esteem, and, overall, a more positive affect. Occupations which were more leisure oriented, such as working with clay and completing a craft activity, evoked feelings of increased playfulness and power, respectively. However, the subjects working with clay also noted feeling less confident and more helpless than when completing an occupation such as filing. Therefore, selection of specific occupations has a direct effect on a person's performance, either motoric or psycho-socially. The environment in which the occupation was completed can further provide motivation and meaning.

Perhaps the most utilized option for adding purpose to an activity entails adapting the occupational form of the activity. Even seemingly minor, but deliberate, changes in the form can produce significant differences in performance (Nelson, 1988). King (1978) considered altering the form or environment of the activity, the most effective means of eliciting a specific adaptive response. There are three avenues through which this can be accomplished: (1) add nothing, (2) use imagery, or (3) add materials which afford the desired activity (Nelson & Peterson, 1989). Adding nothing to the form, otherwise considered rote exercise, refers to the "repetitive pattern of movements in which the exerciser's focus in on the movement per se, as in

calisthenics" (Nelson & Peterson, 1989, p. 16). Trombly (1982) feels that exercise can be considered a "goal-directed activity" since it requires internal and subcortical organization to replicate the specific movement patterns. Furthermore, many individuals see exercise as an important and necessary aspect of their lives, (i.e., maintaining fitness, improving health, reducing stress). Consequently, exercise should not be considered a purposeless activity. Overall, though, added purpose activities via imagery or added materials can enhance a person's desire to commence and continue with an activity (Nelson & Peterson, 1989).

Nelson and Peterson (1989) found several additional benefits of employing these added purpose activities as opposed to therapeutic exercise. The added purpose occupations afforded the type of movement desired because it provided cues about what was expected of the individual and simulated the actual activity. Further, these activities encouraged social interaction with the use of social prompts such as group activities. The benefits for the patient, also, emerged more quickly and without the need for extrinsic rewards. Individuals also appear to prefer these activities, rather than rote exercise. When Zimmerer-Branum and Nelson (1995) provided subjects with a choice of activities, the subjects chose the material-based purposeful activity significantly more than the rote activity. Consequently, imagery and the addition of materials to an activity should be considered valuable tools to increase motivation, meaning, and performance.

Imagery-based Activities as a Method of Adding Purpose

The inclusion of imagery in an occupation, or activity, refers to the mental interpretation or visual picture of a verbal scenario, based on the meanings and feelings unique to the individual. Imagery need not be restricted to only those activities or events in which the individual has actually participated, but also allows for the anticipation of future activities or events (Denis, 1985). One benefit of utilizing imagery is that a person can elicit a physical response to objects not physically present (Denis, 1985). According to Hardy and Nelson (1988), imagery is one of four skills that can prove beneficial to motor performance. It can also serve to enhance kinesthetic memory (Denis, 1985). Sheikh (1983) concluded that "to the extent that one can construct vivid imagery and absorb oneself into its content, consequences are likely to result that are remarkably similar to those that result from the actual stimulus situation" (p. 30).

Mental practice is one method utilized by sports psychologists, physical therapists, and physical educators to enhance skill acquisition. Mental practice is defined as the "covert rehearsal of a physical activity in the absence of any observable muscular movements" (Denis, 1985 p. 6). Denis (1985) states that this method of imagery is particularly effective in the initial skill acquisition phase. Moreover, deRenne-Stephan (1980) stated that these visual images, when converted into goal-directed action patterns, can contribute to the development of a skill.

Empirical evidence of this association between imagery and skill was supported

by research conducted by Riccio, Nelson, and Bush (1990). Their study compared the effects of an imagery-based activity and a repetitive exercise condition. In the imagery condition, the subjects were asked to either imagine picking apples off a tree or picking coins off the floor. The exercise condition simply asked the subjects to repeat the movements of either reaching overhead or reaching to touch the floor. The results indicated that the imagery activity of picking apples elicited significantly more repetitions than did the exercise condition. While the condition of "picking up coins" did produce more repetitions and kept the subjects engaged for a longer period of time, it did not prove to be statistically significant. This study demonstrates that imagery may serve as a very useful tool to increase purposefulness for patients and therefore improve performance.

Material-based Activities as a Method of Adding Purpose

Material-based occupations are those in which materials are present in the environment to afford the specific movement or occupation. Gliner (1985) asserted that not only do environmental affordances provide support for the activity, but that "no skill can be conceived of without special reference to the immediate object; the environment must be included as the necessary support for the coordinated, skilled movements" (p. 30). Material-based activities also serve to provide feedback and gratification, which is more naturalistic and intrinsic than is found with rote activities (Nelson & Peterson, 1989). For instance, when a child is successful in a prone

scooterboard activity, the child may develop increased confidence to attempt other activities that may have previously been difficult. This success within the context of a material-based activity allows for intrinsic gratification and may provide reinforcement for subsequent activities. By eliciting intrinsic rather than extrinsic gratification, the patient achieves a sense of empowerment rather than performing to the expectations of others. The intrinsic motivation to compete or cooperate within a group can also be enhanced through a meaningful, material-based activity (Nelson & Peterson, 1989).

Several studies have demonstrated empirically the effectiveness of altering the occupational forms through the addition of materials to improve performance. Researchers Spangler and Marshall (1983) and Crisp and Sturmey (1988) have proposed the idea that purposeful activity or on-task behaviors in children can be facilitated by structuring the environment, such that it affords an array of goal-directed activities. In the study conducted by Spangler and Marshall (1983), the focus was on whether the purposeful activity level of boys with severe mental retardation could be improved. Purposeful activity referred to those on-task behaviors which provided for interactions between the boys and their environment, either human or material-based. The results supported the idea that by increasing the availability of objects which afforded the desired activities and providing structured activities, there was an increase in purposeful or interactive behaviors and a decrease in maladaptive behaviors. Crisp and Sturmey (1988) corroborated these results in their study with young adults with mental handicaps. In providing the subjects with materials which afforded purposeful

activity, such as craft items and an individual to provide occasional guidance, there was an improvement in the overall purposeful activity level of subjects.

Other researchers have studied the effects on specific variables of performance. Most studies have examined the effects of material-based activities, in comparison to rote movements in regard to the number of repetitions performed by subjects. In studies by DeKuiper, Nelson, and White (1993); Hsieh, Nelson, and Smith (1991); King II (1993); Lang, Nelson, and Bush (1992); Maurer, Smith, and Armetta (1989); Steinbeck (1986); and Yoder, Nelson, and Smith (1989), the material-based activity elicited significantly more repetitions of a movement pattern than did the rote activity. Maurer et al. (1989) also concluded that the subjects performed the activity for a longer duration when engaged in the material-based activity. Material-based activities have also been shown to produce an increase in heart rate at a given level of perceived exertion (Bakshi, Bhambhani, & Madill, 1991; Bloch, Smith, & Nelson, 1989; Kircher, 1984). Other benefits of utilizing material-based activities as opposed to rote exercise include increased upper extremity range of motion (Seitsema, Nelson, Mulder, Mervau-Scheidel, & White, 1993), better quality of performance (Yuen & Nelson, 1989), improved visuomotor skills (Licht & Nelson, 1990; Mullins, Nelson, & Smith, 1987), and eliciting a more positive effect (Miller & Nelson, 1987; Thibodeaux & Ludwig, 1988). Whether the direction of this empirical evidence was on the quality or quantity of performance, the motivation of the subjects as a result of applying a personal meaning to the occupation and having the objects necessary to perform the

occupation affected the overall performance.

Recently, several studies have examined the levels of purposefulness by comparing all three conditions: (1) imagery-based occupations, (2) material-based occupations, and (3) rote exercise (DeKuiper, Nelson, & White, 1993; Hsieh et al., 1991; Lang et al., 1992). In each of these studies, the subject population involved either adults or the elderly. Hsieh et al. (1991) concluded that there was a statistically significant increase in the number of repetitions performed by subjects during both the material-based occupation (picking up small balls with the non-hemiplegic hand and throwing them at a target) and imagery-based occupation (imagine picking up a small ball and throwing it at a target) than there was with the rote exercise condition. In the Lang et al. (1992) study, a comparison was made between the performance of elderly nursing home residents in a material-based occupation (kicking a balloon), in an imagery-based occupation (imagine kicking a balloon), and in a rote exercise condition. As in the Hsieh et al. (1991) study, significant differences in the number of repetitions were found between the material-based occupation and the rote exercise condition. However, no significant differences were noted between the imagery occupation and the rote exercise condition. This study was later replicated by DeKuiper and Nelson (1991) with a larger sample size and with elderly subjects of a higher functional level.

The number of repetitions, as well as the speed and vertical distance of the lower extremity movement, were quantitatively analyzed by Motion Analysis, Inc.

The results of this study supported the findings of Lang et al., with the material-based occupation eliciting a greater number of repetitions than either the imagery or rote condition. There were no significant differences in the speed or vertical distance of the lower extremity movement. The results of these three studies serve to further validate the premise that purposeful activity elicits greater performance than rote conditions in an adult or elderly population.

Applications for Clinical Practice

While these studies all furthered the foundation of occupational therapy, none examined the effects of meaningful and purposeful occupations on a child's skill development. Unlike the previous studies, the population for this study was children between the ages of three and nine. This study was designed to compare the effects of a material-based occupation (controlling a switch operated toy by maintaining prone extension), imagery-based occupation (imagine you are flying), and a rote condition on the duration and quality of maintaining prone extension. The purpose of the study was to test the following hypotheses:

1. The material-based occupation will elicit a greater duration and/or quality of maintaining prone extension than rote exercise will in children aged 3 to 9.

2. The imagery-based occupation will elicit a greater duration and/or quality of maintaining prone extension than rote exercise will in children aged 3 to 9.

CHAPTER III

DESIGN AND METHODOLOGY

Sample

Participants in the study consisted of 14 male and 8 female children between the ages of 3 and 9 years. The mean age was 5.5 years with a standard deviation of 1.6. These preschool and elementary school children were referred from a university occupational therapy teaching clinic and a university—based preschool. The children were screened, using a subtest from Ayres Clinical Observations, by either senior occupational therapy students or the principal investigator to assess duration of holding the anti-gravity prone extension posture.

Design

After receiving parental consent and child assent to participate, the subjects were then randomly assigned to three groups in a counterbalanced crossover research design. Each group participated in a rote exercise condition, an imagery condition, and a material-based occupation condition, in varying orders. Group 1 participated in the rote exercise condition first, followed by the imagery condition, and lastly by the material-based occupation condition. Group 2 received the imagery condition first,

the material-based occupation condition next, followed by the rote exercise condition. Group 3 received the material-based occupation condition initially, followed by the rote exercise condition, and finally the imagery condition.

Instrumentation

Initially, the degree and duration of prone extension were to be measured by using the Motion Analysis EV3D Modal Analysis System housed in the engineering department of the university. This system required that illuminated reflective spherical discs be superficially attached to the skin or clothing of the subjects at points of interest over joints and bony landmarks. A video camera continuously recorded the subject as he or she attempted to maintain the posture. Using the Motion Analysis computer program, light patterns from the sensors were sampled 60 times per second and converted into digital signals. These signals were then recorded as position coordinates, and thus the motion was analyzed.

However, this original method of analysis developed complications such that an alternate evaluation method was utilized. Four occupational therapists from a Michigan children's hospital reviewed the videotapes and rated each subject according to the prone extension postural test scale (see Appendix D) (Gregory-Flock & Yerxa, 1984). This standardized test evaluated prone extension using a qualitative scale of 0 to 2 for each component. The scale examined the following six components of prone extension: (1) assumes, (2) head, (3) upper trunk, (4) thighs, (5) knees, and (6)

maintains. Since it was difficult to assess the "assumes" component from the videotape, it was eliminated from the rating scale. Duration was evaluated in seconds, using a stopwatch. Prior to rating the videotapes of the subjects, the therapists evaluated 11 videotaped persons using the prone extension postural test and established interrater reliability of 98.1%.

Procedure

The conditions took place in an on—site university teaching clinic or in a university—based preschool. Each subject was asked to lay on his or her stomach on a mat. A video camera, operated by the researcher, was placed 3 feet from the subject to record his/her ability to hold the prone extension posture.

The three conditions were all prefaced by a standard set of verbal and demonstrative instructions. All of the subjects receiving the rote exercise condition were instructed as follows:

> Please hold this position (demonstration of the prone extension posture). Remember to keep your head, arms and legs off the mat. Hold this position for as long as you can without becoming tired. Stop when you feel tired or begin to feel uncomfortable. Ready? Begin holding the position now.

Instructions for the imagery condition were as follows:

> Imagine that you are flying like Superman. Remember to hold your head up so you can see where you are flying, and keep your arms and legs up so you can keep flying straight. Keep flying for as long as you can without becoming tired or feeling uncomfortable. Stop when you feel tired or uncomfortable. Ready? Imagine you are flying now.

In the material-based occupation condition, each child was offered the choice of playing with either a toy car or a radio. These toys had been adapted with mercury switches which were then attached, with velcro, to a headband. The child was then given the following verbal instructions:

> Here is a toy to play with. To make the toy move you need to lie on your stomach and hold your head arms, and legs off the mat. To keep the toy moving you need to hold this position for as long as you can without becoming tired. Stop if you begin to feel uncomfortable or tired. Ready? Begin playing with the toy.

One week elapsed between the presentation of each condition.

In each of these conditions, the quality and duration of holding prone extension was videotaped. The videotapes were then reviewed by four occupational therapists using the prone extension postural test (Gregory-Flock & Yerxa, 1984) to assess the quality and duration of maintaining prone extension for each subject.

CHAPTER IV

RESULTS

Once interrater reliability of the four therapists was established at 98.1%, each therapist individually reviewed and rated the subject videotapes. Of the 22 subjects videotaped, 7 subjects could not be rated for all three conditions due to technical videotaping errors. Consequently, the data for the remaining 15 subjects was utilized to complete a data analysis.

This sample size yielded an unequal distribution of subjects per group, with Groups 1, 2, and 3 containing 5, 4, and 6 subjects, respectively. The mean age for the remaining subjects (12 male and 3 female children) was 5.9 years, with a standard deviation of 1.6. Utilizing SAS version 608 (SAS Institute, Inc, 1982) and the general linear models procedure, it was determined there was no significant affect of sequence on subjects' scores. The data for the duration dependent variable were examined and found to be highly skewed to the right by one point. This outlier was substantially higher than all other scores in the image condition of the duration dependent variable. According to Buchner and Findley (1990), such an outlier may be omitted from the analysis to lessen the skewedness.

Derivation of mean squares and standard deviations for the duration variable were computed for each condition (see Table 1).

Table 1

Comparison of Means and Standard Deviations for Duration of Maintaining Prone Extension, Between the Material-based, Imagery-based, and Rote Exercise Conditions (N=14)

	Duration of Maintaining Prone Extension		After Square Root Transformations	
Variables	M	SD	M	SD
Material-based Occupation	25.9107	21.6600	4.7057	1.8793
Imagery-based Occupation	15.5893	12.0534	3.5939	1.6684
Rote Exercise	15.1250	16.5630	3.3512	2.0211

An analysis of variance (ANOVA) for a within subject counterbalanced crossover design was then conducted, with the results approaching significance [$F(2,4)= 2.06$, $p< .0525$]. Due to the slightly positively skewed distribution even after the outlier was removed, square root transformations were conducted to normalize the distribution (Buchner & Findley, 1990; Linton & Gallo, 1975). This yielded ANOVA results which again only approached significance [$F(2,4) = 5.24$, $p..0763$]. The second component of the data analysis involved the quality of maintaining prone

extension as assessed by the total scores from the prone extension postural test. A normal distribution of scores was obtained for all 15 subjects. Consequently, no variable transformations of the scores were required. The mean scores and the standard deviations of the independent variable conditions were then computed (see Table 2).

Table 2

Comparison of Means and Standard Deviations for the Quality of Maintaining Prone Extension Between the Material-based, Imagery-based, and Rote Exercise Conditions (N=15)

	Quality of Maintaining Prone Extension	
Variables	M	SD
Material-based Occupation	6.9333	2.2109
Imagery-based Occupation	6.6333	1.5115
Rote Exercise	6.9333	2.0884

The ANOVA for within subject design indicated an alpha value greater than .05 [$F(2,4) = 2.10$, $p<.1117$]. Since neither variable generated statistically significant results, no post hoc examinations were necessary.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

The "just right challenge" involves the skillful inclusion of treatment components within an environment which allows for successful completion of an occupational performance area for the child (i.e., play). From an occupational therapy perspective, this constitutes providing the "just right challenge" for the child during therapy (Fisher et al., 1991). Children who are engrossed in an activity tend to focus on the playful components rather than the overall outcome (Fisher et al., 1991).

One might assume that the quality of motor performance would decrease if children are participating in an activity which they find appealing and "fun." In this study the average scores on the prone extension postural test remained relatively consistent between the conditions (see Table 2). In fact, the mean scores of the material-based occupation and rote exercise were identical. This finding was corroborated by King, in her Eleanor Clarke Slagle Lecture (1978), when she stated that "the use of purposeful activities . . . such as play (where the goal is fun) focuses attention on the object or outcome and leaves the organizing of the sensory input and motor output to the subcortical centers where it is handled most efficiently and adaptively" (p. 433). The structure of the environment can also afford the specific

skilled movements of the person (Gliner, 1985). In as much as a glass full of juice affords picking up the glass and drinking, other purposeful activities can elicit desired movements without conscious attention to the specific performance components.

This ecological approach to motor learning, structuring a person's environment such that it affords a specific activity, coincides with occupational therapy's goal of using purposeful activity as means of adapting motor responses (Gliner, 1985; King, 1978). Consequently, the person's focus is directed to the outcome of the action, while the subcortical attends to integrating sensory and vestibular input (Gliner, 1985; Bundy, 1991). The therapeutic implications of this further substantiate the use of meaningful material-based occupations to facilitate increased motor performance in children.

Even though no statistically significant differences between conditions were noted in the duration of holding prone extension, there was a definite increase with the material-based occupation. The subjects, on average, maintained the anti-gravity position 10 seconds longer when engaged with the switch—operated toy than in either the imagery or rote exercise condition. This could be attributed to the intrinsic quality associated with a playful activity and the effect of choice (Fisher et al., 1991). Rice and Nelson (1988) discovered that adolescents who were mentally retarded were more likely to continue with an activity when provided with a choice within the activity. In this study, when the subjects were given the choice of which switch-operated toy they could use, they appeared to take more control of the activity. This was evident by the

subjects wanting to help place the reflective sensors and asking if the person operating the video camera was ready for them to begin.

The differences between the imagery and rote exercise conditions were parallel with those found in previous studies which examined the effects of material-based occupations, imagery, and rote exercise (DeKuiper et al., 1993; Lang et al., 1991). In both of these studies, no significant differences were noted between imagery and rote exercise. In Lang et al. (1991), it was suggested that performing the actual activity was more purposeful for the elderly subjects than imagining it. The use of imagery as a method of increasing motor performance in children is confined by their development. According to a study by Rapp and Schoder (as cited in Denis, 1985), children begin to use imagery as a form of mental practice of motor skills around 5 or 6 years of age. In their study, this was the age at which mental practice by means of imagery significantly improved performance over a control group. This suggests that the subjects 5-years-old and younger, in this study, may not have fully developed the necessary skills to effectively employ imagery as a method of improving motor performance. Therefore, the imagery condition was developmentally a "rote" condition for those subjects and thus yielded results as such.

Other differences between the conditions, which were not overtly measured, included quantity of verbalizations, affect, and social interaction. During the material-based occupation, the subjects increased their vocalizations with exclamations such as, "Hey, I'm making it (the toy car) move!", "This is fun," and "I'm making it run into

you." Verbalizations during the imagery condition were less than that of the material-based occupation, but were still present ("I'm flying all over the world"). The rote condition tended to elicit fewer vocalizations with increased mental concentration.

The lack of significant differences within subjects from the prone extension postural test may be the result of several factors:

1. The category of "assumes" was removed from the scale, in this study, due to the inability of the therapists to effectively assess it from the videotapes. Harris (1981) concluded that smooth assumption of prone extension was one of two components which accounted for 92% of total score variance.

2. While the test measured 5 components of prone extension, the range of scores for each component is relatively small, 0 to 2. Consequently, the test itself limits the amount of variability between scores.

3. Of the 15 subjects, 3 were below the age with which the prone extension postural test can be used with confidence.

Gregory-Flock & Yerxa (1984), when establishing reliability of this evaluation method, noted that "the occupational therapist may use the prone extension postural test with caution with 4-year-olds and with confidence in children 5 years and older."

The lack of statistical significance to support this study's hypotheses could have been affected by many confounding factors. One factor may be the wide range in ages of subjects. The motoric skills of a 9-year-old are substantially more advanced than that of a 4-year-old. Also, children 2 to 5 years of age are exploring their

environment and are egocentric in thought processes, while 6- to 12-year-olds are developing the cognitive process of cooperation and improving upon coordination skills (i.e., skipping, climbing, writing) (Biehler & Hudson, 1986). For the younger subjects, the set of directions presented at the beginning of each condition may not have had any meaning except "this is something new, what can I do/what does it do?"

Associated with the level of development is competition. During the data collection process, it was virtually impossible to videotape the subjects without peer observation (i.e., lack of space at data collection site). Consequently, with several subjects in the same room during videotaping, competition between subjects developed. Though each subject was instructed to "do your best" and competition was discouraged, it persisted amongst the older subjects. This skewed the data by applying a new set of meanings and interpretations to the conditions which had not been prescribed by the methodology.

Application to Clinical Practice

While the results of this study were not statistically significant, it does have implications for occupational therapists. Previous research studies have examined motor performance with the adult and elderly populations. This study suggests that the use of material-based occupations to afford specific motoric performances may also prove beneficial with children. However, special consideration of the child's developmental level must be taken when selecting a specific occupation.

The confounding factors discussed previously demonstrate the effect both the human and the nonhuman environment has on a child's performance. How the child perceives and interprets elements of the environment, such as the people around the child, the type or size of the room, and the objects available to the child, all impact the motivation of the child. As occupational therapists, consideration must be made to utilize and structure a child's environment such that successful adaptation of skills may emerge. As King (1978) stated, there are two goals of treatment: (1) that of motivating the individual to perform, and (2) that of adaptation. "But in dealing with humans we need to recognize that the double motivation of therapeutic activity may or may not need to be brought to the client's awareness, depending on age, cognitive function, and so forth" (King, 1978, p. 433).

Conclusion

This study illustrates that a material-based occupation affords a potential increase in maintaining prone extension in children aged 3 to 9. There was no statistically significant difference between imagery, a material-based occupation, and rote exercise with regard to duration and quality of maintaining the anti-gravity position. Consequently, this study did not support the hypotheses that imagery and a material-based occupation would elicit greater duration and/or quality of prone extension than rote exercise. Meaningful and purposeful occupations are used by occupational therapists to increase the motivation and performance of children.

However, support for this philosophical base of occupational therapy with children requires the replication of this study and further research with children.

Recommendations for Further Research

Further research and replication of studies with children are needed to substantiate the claim that imagery and material-based occupations increase performance. Future research endeavors should examine this concept in children with specific disabilities as well as those who are healthy. The populations should be gathered according to developmental levels. This could be accomplished by administering a pre-test such as the Peabody Developmental Motor Scales as a subject selection criterion. Another suggestion for research would be to compare the effects of choice on a material-based or imagery based occupation. Differences in a child's affect is another dependent variable which could be examined in relation to a material-based and an imagery based occupation. An examination of specific components of prone extension, such as elevation of either upper or lower extremities, in regards to imagery and material-based occupations could also be conducted.

Appendix A

Subject Distribution

Table of Random Numbers

22 17 68 65 84	68 95 23 92 35	87 02 22 57 51	61 09 43 95 06	58 24 81 03 47
19 36 27 59 46	13 79 93 37 55	39 77 32 77 09	85 52 05 30 62	47 83 51 62 74
16 77 23 02 77	09 61 87 25 21	28 06 24 25 93	16 71 13 59 78	23 05 47 47 25
78 43 76 71 61	26 44 90 32 64	97 67 63 99 61	46 38 03 93 22	69 81 21 99 21
03 28 28 26 08	73 37 32 04 05	69 30 16 09 05	88 69 58 28 99	35 07 44 75 47
93 22 53 64 39	07 10 63 76 35	87 03 04 79 88	08 13 13 85 51	55 34 57 72 69
78 76 58 54 74	92 38 70 96 92	52 06 79 79 45	82 63 18 27 44	69 66 92 19 09
23 68 35 26 00	99 53 93 61 28	52 70 05 48 34	56 65 05 61 86	90 92 10 70 80
15 39 25 70 99	93 86 52 77 65	15 33 59 05 28	22 87 26 07 47	86 96 98 29 06
58 71 96 30 24	18 46 23 34 27	85 13 99 24 44	49 18 09 79 49	74 16 32 23 02
57 35 27 33 72	24 53 63 94 09	41 10 76 47 91	44 04 95 49 66	39 60 04 59 81
48 50 86 54 48	22 06 34 72 52	82 21 15 65 20	33 29 94 71 11	15 91 29 12 03
61 96 48 95 03	07 16 39 33 66	98 56 10 56 79	77 21 30 27 12	90 49 22 23 62
36 93 89 41 26	29 70 83 63 51	99 74 20 52 36	87 09 41 15 09	98 60 16 03 03
18 87 00 42 31	57 90 12 02 07	23 47 37 17 31	54 08 01 88 63	39 41 88 92 10
88 56 53 27 59	33 35 72 67 47	77 34 55 45 70	08 18 27 38 90	16 95 86 70 75
09 72 95 84 29	49 41 31 06 70	42 38 06 45 18	64 84 73 31 65	52 53 37 97 15
12 96 88 17 31	65 19 69 02 83	60 75 86 90 68	24 64 19 35 51	56 61 87 39 12
85 94 57 24 16	92 09 84 38 76	22 00 27 69 85	29 81 94 78 70	21 94 47 90 12
38 64 43 59 98	98 77 87 68 07	91 51 67 62 44	40 98 05 93 78	23 32 65 41 18
53 44 09 42 72	00 41 86 79 79	68 47 22 00 20	35 55 31 51 51	00 83 63 22 55
40 76 66 26 84	57 99 99 90 37	36 63 32 08 58	37 40 13 68 97	87 64 81 07 83
02 17 79 18 05	12 59 52 57 02	22 07 90 47 03	28 14 11 30 79	20 69 22 40 98
95 17 82 06 53	31 51 10 96 46	92 06 88 07 77	56 11 50 81 69	40 23 72 51 39
35 76 22 42 92	96 11 83 44 80	34 68 35 48 77	33 42 40 90 60	73 96 53 97 86
26 29 13 56 41	85 47 04 66 08	34 72 57 59 13	82 43 80 46 15	38 26 61 70 04
77 80 20 75 82	72 82 32 90 90	63 95 73 76 63	89 73 44 99 05	48 67 26 43 18
46 40 66 44 52	91 36 74 43 53	30 82 13 54 00	78 45 63 98 35	55 03 36 67 68
37 56 08 18 09	77 53 84 46 47	31 91 18 95 58	24 16 74 11 53	44 10 13 85 57
61 65 61 68 66	37 27 47 39 19	84 83 70 07 48	53 21 40 06 71	95 06 79 88 54
93 43 69 64 07	34 18 04 52 35	56 27 09 24 86	61 85 53 83 45	19 90 70 99 00
21 96 60 12 99	11 20 99 45 18	48 13 93 55 34	18 37 79 49 90	65 97 38 20 46
95 20 47 97 97	27 37 83 28 71	00 06 41 41 74	45 89 09 39 84	51 67 11 52 49
97 86 21 78 73	10 65 81 92 59	58 76 17 14 97	04 76 62 16 17	17 95 70 45 80
69 92 06 34 13	59 71 74 17 32	27 55 10 24 19	23 71 82 13 74	63 52 52 01 41
04 31 17 21 56	33 73 99 19 87	26 72 39 27 67	53 77 57 68 93	60 61 97 22 61
61 06 98 03 91	87 14 77 43 96	43 00 65 98 50	45 60 33 01 07	98 99 46 50 47
85 93 85 86 88	72 87 08 62 40	16 06 10 89 20	23 21 34 74 97	76 38 03 29 63
21 74 32 47 45	73 96 07 94 52	09 65 90 77 47	25 76 16 19 33	53 05 70 53 30
15 69 53 82 80	79 96 23 53 10	65 39 07 16 29	45 33 02 43 70	02 87 40 41 45
02 89 08 04 49	20 21 14 68 86	87 63 93 95 17	11 29 01 95 80	35 14 97 35 33
87 18 15 89 79	85 43 01 72 73	08 61 74 51 69	89 74 39 82 15	94 51 33 41 67
98 83 71 94 22	59 97 50 99 52	08 52 85 08 40	87 80 61 65 31	91 51 80 32 44
10 08 58 21 66	72 68 49 29 31	89 85 84 46 06	59 73 19 85 23	65 09 29 75 63
47 90 56 10 08	88 02 84 27 83	42 29 72 23 19	66 56 45 65 79	20 71 53 20 25
22 85 61 68 90	49 64 92 85 44	16 40 12 89 88	50 14 49 81 06	01 82 77 45 12
67 80 43 79 33	12 83 11 41 16	25 58 19 68 70	77 02 54 00 52	53 43 37 15 26
27 62 50 96 72	79 44 61 40 15	14 53 40 65 39	27 31 58 50 28	11 39 03 34 25
33 78 80 87 15	38 30 06 38 21	14 47 47 07 26	54 96 87 53 32	40 36 40 96 76
13 13 92 66 99	47 24 49 57 74	32 25 43 62 17	10 97 11 69 84	99 63 22 32 98

*Table I is taken from Table XXXIII of Fisher, *Statistical Methods for Research Workers*, published by Oliver and Boyd, Ltd., Edinburgh, and by permission of the author and the publisher.

Appendix B

Parental Consent and Subject Assent Forms

Dear Parent or Guardian,

My name is Robin Lengel and I am a graduate student in the Occupational Therapy Department at Western Michigan University. I am conducting a study and am seeking your permission to allow your child to participate.

This study will look at the effects of three different play situations on the amount of time a child can hold a posture against gravity. The posture (prone extension) is a normal developmental posture which involves having the child lie on his/her stomach while holding their head, arms, and legs off the floor, like an airplane. After I explain how to hold the posture to the participant, he/she will randomly be placed in one of three situations. These situations consist of 1) asking the child to simply hold the posture as long as he/she can, 2) holding the posture while imagining he/she is "flying like Superman", and 3) playing with a switch operated toy while holding the posture.

The study will be conducted during February and March, 1993, in the Occupational Therapy Teaching Clinic at Western Michigan University. It will consist of three sessions, one per week, for approximately ten minutes per session.

Motion Analysis equipment housed in the Engineering Department at Western Michigan University will be used to accurately measure how long each child holds the prone extension posture. This requires attaching three small, light, reflecting sensors to your child at the beginning of each session and then videotaping the session. Due to the need for extreme accuracy of measurements, three small dots of permanent ink must be drawn on your child so the sensors may be attached in exactly the same place each session. I ask that you please do not wash these off. The videotape records the movement of the sensors, and when the tape is placed in the Motion Analysis equipment, the videotaped motions are analyzed and I receive a printout of the data.

To protect your child's identity, numbers will be assigned to each child and names will not be used when recording data. The videotape will be used for research purposes only, stored in a safe place, and erased at the completion of the study. Only myself and my research assistants will have access to the videotape.

Your child's participation in this study is voluntary. You may withdraw your child from participation at any time during the study.

If at any time you have questions, please feel free to call me. My telephone number is (616) 345-5004. Thank you.

Sincerely,

Robin Lengel

Consent

I have read and understand the proposed study. I agree to let my child, _____, participate in this study and be videotaped for research purposes only. I understand that I may remove my child from the study at any time. I have been offered a copy of this consent form.

_____ _____

signature of parent or guardian date

Dear Student,

My name is Robin Lengel and I am going to school at Western Michigan University to be an occupational therapist. I am working on a project for school and would like your help. Your parents have already given me their permission and now I need permission from you.

If you decide to help me, we will work together one day a week for three weeks for about ten minutes. We will work in the Occupational Therapy Teaching Clinic at Western Michigan University.

During our time together I will ask you to hold a certain position after I show you how to do it. For example, I might ask you to lie on your stomach while holding your arms, legs, and head off the floor, like an airplane. While holding that position I might ask you to play with some toys or imagine you are doing something. If your ever feel uncomfortable and want to stop, I will let you.

I would like to videotape us working together. The videotape will be kept in a safe place. This tape will only be used for my project and will be erased when my project is done. The only people who will see this tape will be me and those people helping me with my project. I will have to tape three small balls on you. I will need to put a little dot of ink on you where the balls go so that I can put them back on in the same place every session.

I would really like to have your help. Remember, if I ask you to do something that makes you feel uncomfortable, you may stop at any time. Thank you.

Sincerely,

Robin Lengel

Assent

I would like to participate in this project. I understand the activities I will be doing and that I will be videotaped. I understand that I may stop participating if I ever feel uncomfortable. My parents know that I will be in this study.

_____ _____

Witness signature Subject signature

_____

Date

Dear Deb Hazel,

My name is Robin Lengel and I am as graduate student in the Occupational Therapy Department at Western Michigan University. I am conducting a study examining the effects of play embedded occupation on the duration of holding the prone extension posture in children with learning disabilities.

I would like to ask your permission to conduct this study in the Occupational Therapy Teaching Clinic in February and March of 1993. The study will take three weeks with each subject meeting once per week for approximately ten minutes.

For this study I will first explain to the subject how to held the posture, after which he/she will be randomly placed in one of three conditions. These conditions consist of 1) asking the child to simply hold the posture as long as he/she can, 2) holding the posture while imagining he/she is "flying like Superman", and 3) playing with a switch operated toy while holding the posture.

Motion Analysis equipment, housed in the Engineering Department at Western Michigan University, will be used to accurately measure how long each child holds the prone extension posture. This requires attaching three small, light, reflective ball sensors to the child at the beginning of each session. Due to the need for extreme accuracy, a small dot of permanent ink will need to be placed on the child, so that the sensors are accurately placed during each session. Once the sensors are attached, each session with the child will be videotaped. The videotape records the movement of the sensors, and when the tape is placed in the Motion Analysis equipment, the videotaped motions are analyzed and I receive a printout of the data.

To protect each child's identity, a number will be assigned to each subject and names will not be used when recording data. The videotape will be used for research purposes only, stored in a safe place, and erased at the completion of the study. Only myself and my research assistants will have access to the videotape.

For this study I am looking for children between the ages of 6 and 10 years old, who are diagnosed as learning disabled. I will then conduct the portion of the Ayres Clinical Observations Assessment (see attached form) which identifies how long a child can hold prone extension. I am looking for children who can only hold the posture for ten seconds or less.

If you are willing to refer children who meet the above mentioned criteria, I will contact their parents and/or guardians and inform them concerning the specifics of the study. They are then free to choose whether or not they wish to have their child participate.

I look forward to hearing from you so that I may answer any questions you might have and confirm proper procedures of client referral and contact. If you choose not to participate, I thank you for the time you already spent.

Sincerely,

Robin Lengel
611 Regency Square, Apt. 305
Kalamazoo, MI 49008
(616) 345-5004

Office address: Western Michigan University
Wood Hall, Room 234
Kalamazoo, MI 49008
Office phone: (616) 387-3870

Dear Dr. Patricia Meinhold,

I am a graduate student in the Occupational Therapy Department at Western Michigan University. I am conducting a study which will compare the effects of rote exercise, imagery-based occupation, and material-based occupation on the duration of holding the prone extension posture in children. Prone extension is a normal developmental posture in which the child lies on his/her stomach while holding their head,arms, and legs off the floor. Normally children, ages 6 and above, can maintain this position for at least 20 seconds.

This study will be conducted during February and March, 1993, in the Occupational Therapy Teaching Clinic, located on the second floor of Wood Hall at Western Michigan University. It will consist of three sessions, one per week, for approximately ten minutes per session.

For this study I will first explain to the subject how to hold the posture, after which he/she will be randomly placed in one of three conditions. These conditions consist of 1) asking the child to simply hold the posture as long as he/she can, 2) holding the posture while imagining he/she is "flying like Superman", and 3) playing with a switch operated toy while holding the posture.

Motion Analysis equipment, housed in the Engineering Department at Western Michigan University, will be used to accurately measure how long each child holds the prone extension posture. This requires attaching three small, light, reflective ball sensors to the child at the beginning of each session. Due to the need for extreme accuracy, a small dot of permanent ink will need to be placed on the child, so that the sensors are accurately placed during each session. Once the sensors are attached, each session with the child will be videotaped. The videotape records the movement of the sensors, and when the tape is placed in the Motion Analysis equipment, the videotaped motions are analyzed and I receive a printout of the data.

To protect each child's identity, a number will be assigned to each subject and names will not be used when recording data. The videotape will be used for research purposes only, stored in a safe place, and erased at the completion of the study. Only myself and my research assistants will have access to the videotape.

For this study I am looking for children between the ages of 6 and 10 years old, who are diagnosed as learning disabled. I will then conduct the portion of the Ayres Clinical Observations Assessment (see attached form) which identifies how long a child can hold prone extension. I am looking for children who can only hold the posture for ten seconds or less.

If you are willing to refer children who meet the above mentioned criteria, I will contact their parents and/or guardians and inform them concerning the specifics of the study. They are then free to choose whether or not they wish to have their child participate.

I look forward to hearing from you so that I may answer any questions you might have and confirm proper procedures of client referral and contact. If you choose not to participate, I thank you for the time you already spent.

Sincerely,

Robin Lengel
611 Regency Square, Apt. 305
Kalamazoo, MI 49008
(616) 345-5004

Office address: Western Michigan University
Occupational Therapy Department
Kalamazoo, MI 49008
Office phone: (616) 387-2870

Appendix C

Prone Extension Postural Test
and Scoring Sheet

Protocol for Three Conditions

Rote Exercise Condition Instructions

" Please hold this position (demonstration of prone extension posture). Remember to keep your head, arms and legs off the mat. Hold this position for as long as you can without becoming tired. Stop when you feel tired or begin to feel uncomfortable. Ready? Begin holding the position now."

Imagery-based Condition Instructions

" Imagine that you are flying like Superman. Remember to hold your head up so you can see where you are flying and keep your arms and legs up so you keep flying straight. Keep flying for as long as you can without becoming tired or feeling uncomfortable. Stop when you feel tired or uncomfortable. Ready? Imagine you are flying now."

Material-based Condition Instructions

" Here is a toy to play with. To make the toy move you need to lie on your stomach and hold your head, arms, and legs off the mat. To keep the toy moving you need to hold this position for as long as you can without becoming tired. Stop if you begin to feel uncomfortable or tired. Ready? Begin playing with the toy."

Ayres Clinical Observations

10 - Cocontraction:

Arm and shoulders	Neck
3 - normal	3 - normal
2 - slt. defic.	2 - slt. defic.
1 - def. defic.	1 - def. defic.

11 - Postural background movements

3 - normal
2 - slt. defic.
1 - def. defic.

12 - Equilibrium reactions:

Prone	Quadruped	Sitting	Kneeling	Standing
3 - normal	3 - normal	3 - normal	3 - normal	3 - normal
2 - slt. def.	2 - slt. def.	2 - slt. def.	2 - slt. def.	2 - slt. def.
1 - def. def.	1 - def. def.	1 - def. def.	1 - def. def.	1 - def. def.

13 - Righting reactions:

Optical	Labyrinthine
3 - normal	3 - normal
2 - slt. defic.	2 - slt. defic.
1 - def. defic.	1 - def. defic.

14 - Protecive extension: 3 - normal, 2 - slt. def., 1 - def. defic.

15 - Schilder's arm extension posture:

Choreoathetosis:	Postural chgs. in arms:	Trunk rotation:	Head Resist.:	Discomfort:
3 - normal	3 - normal	3 - normal	3 - normal	3 - normal
2 - slight	2 - slight	2 - slight	2 - slight	2 - slight
1 - defin.	1 - defin.	1 - defin.	1 - defin.	1 - defin.

R/L differences: Arms raised R L ; Elbow hyperextension R L
Arms lowered R L ; Elbow flexion R L

16 - Prone Extension Posture: 3 - holds 20 or more seconds with moderate exertion.
2 - holds to 10 seconds, or 20 with great exertion.
1 - unable, or holds 0-9 seconds.

17 - Symmetrical TNR: quadrupedal, head flexed and extended
3 - no change in joint flexion or extension.
2 - slight change in joint position.
1 - definite change in joint position.

18 - Asymmetrical TNR:
(a) quad. position: 3 - no flexion on passive head turning.
2 - slight flexion on passive head turning.
1 - definite flexion on head turning.
(b) reflex inhibiting posture:
3 - can assume and maintain balance.
2 - can assume only with great difficulty.
1 - cannot assume.

19 - Flexed position supine: 3 - holds 20 or more seconds with moderate exertion or with slight resistance.
2 - holds to 10 seconds, or to 20 seconds with great exertion; or holds but unable to take resistance.
1 - unable; or holds 0-9 seconds.

20 - Postural insecurity (supine position):
3 - normal, 2 - slt. defic.

SUBJECT NUMBER	CONDITION I duration in seconds	CONDITION II duration in seconds	CONDITION III duration in seconds	

Appendix D

University Human Subject Institutional Review Board
Research Protocol Clearance Documentation

WESTERN MICHIGAN UNIVERSITY
HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD (HSIRB)
HUMAN SUBJECTS APPROVAL FORM

RESEARCH MAY NOT BEGIN UNTIL THE PROTOCOL HAS BEEN REVIEWED AND APPROVED BY THE HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD, WHICH MEETS ON A REGULAR MONTHLY BASIS. **PROTOCOLS MUST BE RECEIVED BY RESEARCH AND SPONSORED PROGRAMS AT LEAST SEVEN DAYS PRIOR TO A REGULARLY SCHEDULED MEETING IN ORDER TO BE ACTED ON AT THAT MEETING.** THE FORM MUST BE TYPEWRITTEN, **EXCEPT FOR SIGNATURES.**

PRINCIPAL INVESTIGATOR* Robin Lengel

DEPARTMENT Occupational Therapy

Office address: 234 Wood Hall Office Phone: 387-3870

Home Address: 611 Regency Square, Apt. 305 49008

Home Phone: 345-5004 (Zip Code)

PROJECT TITLE: Effects of Rote Exercise, Imagery, and Material-based Occupation on Postural Control in Children with Learning Disabilities

PROPOSED PROJECT DATES From January 1, 1993 To April 24, 1993

SOURCE OR POTENTIAL SOURCE OF FUNDING none

APPLICATION IS New X Renewal

Protocols for projects extending beyond one year from date of HSIRB approval must be submitted annually for renewal.

If this proposal is approved by the Institutional Review Board, the Principal Investigator agrees to notify the HSIRB in advance of any changes in procedures which might be necessitated. If, during the course of the research, unanticipated subject risks are discovered, this will be reported to the IRB immediately.

Robin Lengel 11-30-92

P.I. Signature Date

*If the Principal Investigator is a student, complete the following:

Undergraduate Level Research Graduate Level Research X

Faculty Advisor Cindee Q. Peterson, M.A., OTR Telephone 387-3872

Department: Occupational Therapy

Cindee Peterson 11-30-92

Advisor Signature Date

Rev. 8/92 All previous forms are obsolete and should not be used.

VULNERABLE SUBJECT INVOLVEMENT (Fill out if applicable)

Research involves subjects who are (check as many as apply)

1. __X__ Children (any subject under the age of 18) Approximate age 6-10 years
2. ____ Mentally retarded persons
3. ____ Mental health patients
   ____ Check if institutionalized
4. ____ Prisoners
5. ____ Pregnant women
6. ____ Other subjects whose life circumstances may interfere with their ability to make free choices in consenting to take part in research;

_____

_____

_____

(Describe)

LEVEL OF REVIEW

To determine the appropriate level of review, refer to WMU Policy Guidelines for categories of exempted research (Appendix B).

_____ Exempt (Forward the original application to the Chair of the Department for a cover letter, then forward to HSIRB Chair via RSP)

__X__ Subject to Review (Forward original application plus 8 copies to HSIRB Chair via RSP)

BLOOD PRODUCTS INVOLVED ☒ No ☐ Yes, attachment appended

If your research involves the collection of blood or blood products, then pick up and complete an addendum (HSIRB Collection of Blood and Blood Products Form).

PLEASE TYPE THE REQUESTED PROTOCOL INFORMATION ON THE FOLLOWING PAGES OR USE THE ELECTRONIC FILE AVAILABLE. You may attach additional sheets as necessary and reference the appropriate page.

ABSTRACT: Briefly describe the purpose, research design, and site of the proposed research activity.

Prone extension is a developmental posture needed to maintain positions against gravity for postural control. Normally children six years and older can maintain this posture for at least twenty seconds. Children with learning disabilities often have difficulty maintaining positions against gravity. The purpose of this study is to examine the effects of rote exercise, imagery and a material-based occupation on the duration of holding prone extension, in children with learning disabilities. A counterbalanced crossover research design with three conditions will be used. The Occupational Therapy Teaching Clinic at Western Michigan University will be the site of data collection. Subjects will be referred from the Occupational Therapy Teaching Clinic and from the Infant and Child Behavior Clinic.
(See Appendix A for protocol)

BENEFITS OF RESEARCH: Briefly describe the expected or known benefits of the research.

Inability to hold the prone extension posture is the result of poor head, neck, and trunk extensors. This may lead to difficulty in school because the extreme effort of the child to maintain an erect posture while sitting in the classroom may decrease his ability to attend to academic tasks. Therefore, therapists commonly work on increasing the strength of the extensors by working on increasing the duration of holding prone extension. The results of this study may show a relationship between using imagery and a material -based occupation, as compared to rote exercise, in increasing the duration of holding prone extension in children who have learning disabilities.

CHARACTERISTICS OF SUBJECTS: Briefly describe the subject population (e.g., age, sex, prisoners, people in mental institutions, etc.). Also indicate the source of subjects.

Subjects will be male and female students between the ages of six and ten years old. They will be referred by the clinic directors of the Occupational Therapy Teaching Clinic and the Infant and Child Behavior Clinic, both located at WMU.
(See Appendix B for source referral letters)

SUBJECT SELECTION: How will the subjects be selected? Approximately how many subjects will be involved in the research? (Attach advertisement for subjects [Cover letters used in survey research are equivalent to advertisement. Scripts are equivalent in oral solicitation procedures].)
Approximately 30 subjects will be needed for this study who meet the following criteria; children with recognized learning disabilities who have ben referred to the Occupational Therapy Teaching Clinic and the Infant and Child Behavior Clinic, between the ages of six and ten years old who cannot hold the prone extension posture for ten seconds (as measured by the Ayres Clinical Observations, see Appendix C). Participation will be voluntary and subjects may stop at any time.

RISKS TO SUBJECTS: Briefly describe the nature and likelihood of possible risks, or discomfort (e.g., physical,psychological, social) as a result of participation in the research.

Prone extension is a normal developmental posture and is a common posture strengthened in occupational therapy treatment. There are minimal risks to the subjects and each subject may leave the study at any time if he or she feels any physical or emotional discomfort.

PROTECTION FOR SUBJECTS: Briefly describe measures taken to protect subjects from possible risks, or discomfort if any.

Subjects will be watched closely for any signs of fatigue, physical discomfort (flushing, pallor, stress as evident by facial expressions), and emotional discomfort. Subjects will also be reminded to stop holding the posture if they begin to feel uncomfortable or tired.

CONFIDENTIALITY OF DATA: Briefly describe the precautions that will be taken to ensure the privacy of subjects and confidentiality of information. Be explicit if data are sensitive. Describe coding procedures for subject identification numbers.

To protect each child's identity a number from a random number table will be assigned to each subject, and names will not be used when recording data. Each number will then be randomly assigned to the three conditions. The videotape will be used for research purposes only, stored in a safe place, and erased at the completion of the study. Only myself and my research assistants will have access to the videotape. (See Appendix D for random number table)

INSTRUMENTATION: Questionnaires, interview schedules, data collection instruments, should be identified. Attach a copy of what will be used in this project. Coding sheets for video-tape or audio-tape data collection procedures required.

The degree and duration of prone extension will be measured using the Motion Analysis EV3D Modal Analysis System which is housed in the Engineering Department of WMU. This system requires illuminated reflective discs be superficially attached to the skin or clothing of the subjects at points of interest over joints and bony landmarks. A videocamera continuously records the subject as he/she attempts to maintain the posture. Using the Motion Analysis computer program, light patterns from the sensors are sampled 60 times per second and converted into digital signals. These signals are then recorded as position coordinates and thus the motion is analyzed. (See Appendix E for coding sheets)

INFORMED CONSENT: For further information on writing consents (assents not covered), see the book Informed Consent by T.M. Grundner, on reserve at Waldo Library. Attach a copy of the informed consent and assent (if applicable). Each subject should also be given a copy.
See Appendix F and G for consent and assent forms.

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: December 3, 1992

To: Robin Lengel

From: M. Michele Burnette, Chair M. Michele Burnette

Re: HSIRB Project Number 92-12-07

The Human Subjects Institutional Review Board will consider your application for the approval of the research project entitled "Effects of rote exercise, imagery, and material-based occupation on postural control in children with learning disabilities" at its next meeting on **December 9, 1992.** The review will be considered under full review conditions.

Although each member of the Board will have a copy of the approval application, it is often desirable for the principal investigator to attend the meeting of the Board to provide verbal clarification of issues which arise. Attendance is not required for consideration, merely highly recommended. If you decide to attend the meeting, you must contact Joanne Kolean-Burley in the HSIRB office, telephone number 387-5926. The approximate time of your review is 8:25 a.m. The meeting will be held in the Minority Affairs Conference Room, A-wing, second level, Ellsworth Hall.

Thank you for the timely manner in which you made your submission.

xc: Peterson, OT

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: December 9, 1992

To: Robin Lengel

From: M. Michele Burnette, Chair M. Michele Burnette

Re: HSIRB Project Number 92-12-07

This letter will serve as confirmation that your research protocol, "Effects of rote exercise, imagery, and material-based occupation on postural control in children with learning disabilities" was reviewed by the Board. The protocol will be approved once the following revisions are made:

1. Please provide a description of a revised procedure for recruiting subjects in which potential subjects/parents/guardians receive information about the study and contact you, rather than you obtaining names of subjects and contacting them, or in which contacts receive a release to divulge clients' names.
2. Please revise the parent consent form so that the signature line appears on the same page as the description of the study (you might try changing the font).
3. Please revise the parent consent form so that it includes a description of how the sensors are attached to the child (e.g., "taped to the surface of the skin").
4. On the parent consent form, please revise the statement concerning withdrawal from the study so that it reads as follows: "You or your child can withdraw consent to participate at any time during the study."

Please submit the above changes in your protocol to HSIRB, A-221 Ellsworth Hall. Approval may be granted after the changes are received by the Board.

If you have any questions, please call Joanne Kolean-Burley in the HSIRB office, telephone number 387-5926

xc: Peterson, OT

Date: *December 9, 1992*

To: *M. Michele Burnette, Chair*

From: *Robin Lengel*

Re: *HSIRB Project Number 92-12-07*

At meeting of the Human Subjects Institutional Review Board on December 9, 1992, I was advised to make several minor changes to my source referral letters and to both my consent and assent form. Enclosed are the following documents with their respective revisions:

1. *On the source referral letters I have changed the second to last paragraph such that Dr. Meinhold and Deb Hazel will now refer potential subjects and their parents to me, rather than having myself contacting parents.*

2. *In regards to the consent form, I have amended the word* ***attached*** *to* ***taped*** *when referring to how the sensors will be placed on each child. Furthermore, I have added "You or your child" when referring to who may initiate withdrawal from the study. The font of the consent form was also changed so that it now fits entirely on one page.*

3. *On the assent form the only revision was that I added how I could be reached (provided my phone number).*

I hope these revisions are satisfactory and I look forward to hearing from you soon. Thank you for reviewing my proposal.

Sincerely,

Robin Lengel

611 Regency Square, #305
Kalamazoo, MI 49008
(616) 345-5004

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: December 18, 1992

To: Robin Lengel

From: M. Michele Burnette, Chair M. Michele Burnette JKS

Re: HSIRB Project Number 92-12-07

This letter will serve as confirmation that your research protocol, "Effects of rote exercise, imagery, and material-based occupation on postural control in children with learning disabilities" has been approved after full review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. ´You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: December 18, 1993

xc: Peterson, OT

Date: *January 21, 1993*

To: *M. Michele Burnette, Chair*

From: *Robin Lengel*

Re: *HSIRB Project Number 92-12-07*

I am writing to inform you that I would like to amend the title of my master's thesis so that it no longer would include the term "learning disabilities." Instead the title would read: "Effects of Rote Exercise, Imagery, and Material-based Occupation on Postural Control in Elementary School-Aged Children." Everything else in my study would remain the same (subject selection, methods, precautions, confidentiality, etc...) and the removal of the words will not alter the focus of the study.

If you should have any questions or comments, please feel free to call me at (616) 345-5004. Thank you.

Sincerely,

Robin Lengel

Robin Lengel
611 Regency Square, #305
Kalamazoo, MI 49008

Advisor: *Cindee Q. Peterson, M.A., OTR*
Occupational Therapy Department

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: January 29, 1993

To: Robin Lengel

From: M. Michele Burnette, Chair M. Michele Burnette

Re: HSIRB Project Number 92-12-07

This letter will serve as confirmation that the revisions to your research protocol, "Effects of rote exercise, imagery, and material-based occupation on postural control in children with learning disabilities" have been approved by the HSIRB.

xc: Peterson, OT

Occupational Therapy Department

Kalamazoo, Michigan 49008-5051
616 387-3850

WESTERN MICHIGAN UNIVERSITY

Date: *April 16, 1993*

To: *M. Michele Burnette, Chair*

From: *Robin Lengel*

Re: *HSIRB Project Number 92-12-07*

Dear Ms. Burnette and HSIRB Committee,

Due to some unforeseen difficulties with acquiring subjects for my study, I will be changing my subject population to normal preschool children. The criteria for selection is simply any preschool child. I have contacted Ms. Nancy Crowell, assistant director of the Sara Swickard Preschool, and she has agreed to allow me to conduct my study at her facility. She has also agreed to contact parents of children who attend the preschool in regards to participating in my study. This change in subjects and site of data collection will in no way change the format of my data collection or the purpose of my study.

I have also been advised, by a practicing occupational therapist who works with children, to increase the number of reflecting sensors taped on each child to six or seven. The purpose of the increase in the number of sensors is to help me to objectively determine if any specific components of the prone extension posture are affected by the various conditions. This will also aid in monitoring whether a child substitutes or compensates one movement or body position in order to "appear" to be holding the selected posture.

All other aspects of my study will remain the same; the purpose, benefits, confidentiality of data, and instrumentation. If you have any questions regarding these changes, I can be reached via the Occupational Therapy Department at 387-3850 or at home at (616) 345-5004. I thank you for your time and cooperation.

Sincerely,

Robin Lengel

Robin Lengel

611 Regency Square, #305
Kalamazoo, MI 49008
(616) 345-5004

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899
616 387-8293

WESTERN MICHIGAN UNIVERSITY

Date: April 18, 1994

To: Robin Lengel

From: M. Michele Burnette, Chair

Re: HSIRB Project Number 92-12-07

This letter will serve as confirmation that the requested changes to your research protocol, "Effects of rote exercise, imagery, and material-based occupation on postural control in children ages 3-9" have been approved by the Human Subjects Institutional Review Board.

xc: Peterson, OT

Date: *April 27, 1993*

To: *M. Michele Burnette, Chair*

From: *Robin Lengel*

Re: *HSIRB Project Number 92-12-07*

I am writing to inform you that I would like to amend the title of my master's thesis so that it correctly identifies the population of my study. In a prior letter I was seeking permission to change my subject population to include preschool children, as a result of difficulty ascertaining enough elementary school-aged children. This necessitates a modification to the title of my study such that it reads: "Effects of Rote Exercise, Imagery, and Material-based Occupation on Postural Control in Children Ages 3 - 9." Everything else in my study would remain the same (subject selection, methods, precautions, confidentiality, etc...) and the removal of the words will not alter the focus of the study.

If you should have any questions or comments, please feel free to call me at (616) 345-5004. Thank you.

Sincerely,

Robin Lengel

Robin Lengel
611 Regency Square, #305
Kalamazoo, MI 49008

Advisor: *Cindee Q. Peterson, M.A., OTR*
Occupational Therapy Department

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: May 7, 1993

To: Robin Lengel

From: M. Michele Burnette, Chair M. Michele Burnette

Re: HSIRB Project Number 92-12-07

This letter will serve as confirmation that the changes to your research project entitled "Effects of rote exercise, imagery, and material-based occupation on postural control in children ages 3-9" have been **approved** by the Human Subjects Institutional Review Board. You may continue to implement the research including the changes, as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you continued success in the pursuit of your research goals.

xc: Peterson, OT

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