Constraint Induced Movement Therapy: An Educational Module for Occupational Therapy Students

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CONSTRAINT INDUCED MOVEMENT THERAPY:
AN EDUCATIONAL MODULE FOR OCCUPATIONAL THERAPY STUDENTS

by

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This Scholarly Project Paper, submitted by Grant Basko and Tamira Ott in partial fulfillment of the requirements of the Degree of Master's of Occupational Therapy from the University of North Dakota, has been read by the faculty advisor under whom the work has been done and is hereby approved.

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Title Constraint Induced Movement Therapy: An Educational Module for Occupational Therapy Students

Department Occupational Therapy

Degree Master's of Occupational Therapy

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ABSTRACT

The literature indicates that approximately 730,000 Americans experience a new or recurrent stroke each year. There are approximately 4 million Americans living with some type of disability as a result of having suffered a stroke. Due to the high incidence of stroke related disability and associated economic costs; stroke rehabilitation is a health care priority. Even with early intervention only 10% of stroke survivors will recover completely, 25% recover with minor impairments, 40% experience moderate to severe impairments, 10% require care in a nursing home, and 15% die shortly after the stroke. Since the highest categories range from minimal to severe impairment, it is believed that CIMT would be a viable treatment option for these clientele still experiencing deficits. Thus, due to the high incidence of stroke in our country, this is a common area for OT to become involved with.

The purpose of this scholarly project was to develop a Constraint Induced Movement Therapy (CIMT) educational module for occupational therapy students at UND. A literature review was conducted using PubMed, Ebsco Host, and other online databases to determine viable populations and efficacy of CIMT. Resources included journals, textbooks, and online databases. In addition, a review of the UND OT Department curriculum was completed to identify where this additional information can be inserted.

The resulting product is an educational module for occupational therapy students that is divided into the following 4 units 1) Introduction to CIMT, 2) Role of OT with
CIMT, 3) outcome measures, and 4) Resources. The educational module is developed based on Malcolm Knowles Theory of Andragogy. This theory is applicable in the development and dissemination of information for the adult OT student learner. In conclusion, CIMT is a reemerging stroke intervention and is gaining national recognition and support as a viable treatment option. Literature indicates that up to 97% of chronic stroke patients experience substantial, significant, clinically meaningful gains after receiving CIMT. Therefore, it seems appropriate that students would benefit from exposure to this intervention within the academic setting.
CHAPTER 1
INTRODUCTION

According to the National Stroke Association (2007) stroke is the 3rd leading cause of death in America. More than 730,000 Americans experience a new or recurrent stroke each year (Wolf, Weinstein, Miller, Taub, Uswatte, Morris, et al. 2006). Additionally, up to 85% of these stroke patients experience hemiparesis, resulting in decreased quality of life and overall motor performance (Wolf, et al. 2006). Finally, stroke is the leading cause of disability in the United States and stroke-induced hemiparesis is the most frequent impairment managed by therapists (Page & Levine, 2007).

When an individual experiences a stroke, a portion of the brain is damaged and resultant symptoms usually include contralateral hemiparesis, which is weakness on the opposite side of the body from the affected hemisphere. Hemiparesis is a symptom that patients must possess to be considered viable candidates for Constraint Induced Movement Therapy (CIMT). CIMT is defined as a technique designed to promote increased use of a weak or paralyzed arm by restraining the unaffected limb (Morris, Taub, & Mark, 2006). Lastly, CIMT is gaining national recognition and support as a viable treatment option; however, the literature indicates that few occupational therapy (OT) schools contain information pertaining to CIMT within their coursework.
Therefore, the solution was the development and integration of an educational module for OT students that provides additional information pertaining to CIMT.

The educational module is divided into 4 units to distribute the material over a one-week period for three days and including, hands on practice. The units are: 1) Introduction to CIMT; 2) Role of OT with CIMT; 3) Outcome measure; and 4) Resources. The product also contains a terminology list, a PowerPoint, and 5 test questions that can be integrated into the unit examination.

The product was developed based on Malcolm Knowles Theory of Andragogy, which integrates the following five assumptions self-concept, experience, readiness, orientation, and motivation. Since the product is intended for occupational therapists, OT’s are the adult learners of this product. The student learning activities are also developed based on Malcolm Knowles Theory adult learning principles. Students are ready to receive additional information pertaining to CIMT at this point, as they are currently engaged in the physical dysfunction class and are receiving information regarding traditional stroke interventions.
Terminology

The following is a list of definitions that will be utilized throughout the scholarly project. The definitions are from the following sources: *Occupational Therapy Practice Framework: Domain and Process, Pathophysiology Concepts of Altered Health States* (7th ed.), *Stedman’s Medical Dictionary* (5th ed.), and Pedretti’s *Occupational Therapy Practice Skills for Physical Dysfunction*.

**Action Research Arm Test (ARAT)** – A practical test that measures upper extremity motor function in patients with stroke.

**Activities of Daily Living (ADLs)** – Activities that are oriented toward taking care of one’s own body.

**Affected Limb** – This is the limb that is affected by the injury.

**Bimanual Therapy** – Therapy that requires the use of both upper extremities.

**Cerebrovascular Accident** – The sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery to the brain. A stroke is also called a cerebrovascular accident or, for short, a CVA.

**Constraint Induced Movement Therapy (CIMT)** – A technique designed to promote increased use of a weak or paralyzed arm by restraining the unaffected limb. CIMT has been credited with speeding up cortical map reorganization.

**Cortical Reorganization** – Refers to the use of task specific activities in which the affected extremity is repetitively and functionally used. This in turn increases the size of the cortical area representing the limb.

**Dynamic Systems Theory** – Refers to dynamic interactions between client factors, the context, and the occupations that must be performed to enact the client’s roles.

**Education** – Includes activities needed for being a student and participating in a learning environment.

**Embolus** – A plug composed of detached thrombosis that occludes a blood vessel.

**Fugl-Meyer Assessment (FMA)** – A group of tests using a numbered scale to quantify motor recovery stages, which is based on the scales of Brunnstrom and Twitchell.

**Hemiparesis** – Weakness affecting one side of the body.

**Hemorrhagic Stroke** – A rupture of a blood vessel, hemorrhage into the brain tissue occurs, resulting in edema, compression of the brain contents, or spasms of the adjacent blood vessels. Most frequently fatal.

**Instrumental Activities of Daily Living (IADL’s)** – Activities that are oriented toward interacting with the environment and are often complex – generally optional in nature.

**Ischemic Stroke** – Arterial narrowing due to mechanical obstruction of blood flow usually caused by a thrombosis or emboli.
**Learned Nonuse** – A phenomenon in which the individual effectively forgets to use the affected or involved extremity because of the extreme difficulty coordinating movement after the onset of stroke.

**Modified Constraint Induced Movement Therapy (mCIMT)** – This is a shortened treatment regimen that is conducted for 3 hours or less per day.

**Motor Activity Log (MAL)** – A self-report interview used to assess how stroke survivors use their more impaired arm outside the laboratory.

**Motor Skills** – Skills in moving and interacting with task, objects, and environment.

**Neuroplasticity** – Is the brain’s ability to reorganize itself by forming new neural connections, which ultimately allows the brain to compensate for injury or disease.

**Non-Affected Limb** – This is the limb that is fully functional.

**Occupation-Based Activity** – Allows clients to engage in actual occupations that are part of their own context and that match their goals.

**Preparatory Activity** – Prepares the client for occupational performance. Used in preparation for purposeful and occupation-based activities.

**Process Skills** – Skills used in managing and modifying actions en route to the completion of daily life tasks.

**Purposeful Activity** – Allows the client to engage in goal-directed behavior or activities within a therapeutically designed context that lead to an occupation or occupations.

**Shaping** – Involves behavioral techniques that approach a desired motor outcome in small successive increments. Shaping techniques allow subjects to experience successful gains in performance with relatively small amounts of motor improvement.

**Task Oriented Approach** – Refers to occupational performance of motor recovery occur from a dynamic interaction of the person, environment, and the occupations that are being performed.

**Task Practice** – Practicing functionally based activities continuously.

**Thrombosis** – Clotting within a blood vessel that may cause infarction of tissues supplied by the vessel.

**Transfer Package** – Transferring gains made in the clinic to the home environment.

**Wolf Motor Function Test (WMFT)** – A lab-based test that focuses on arm function that involves 15 timed measures and 2 forced-based measures, which progress in complexity from engaging individual joints to the use of the total arm.

Chapter II presents the review of the literature regarding: stroke incidence rates, viable populations for CIMT; efficacy of CIMT; best practice guidelines for CIMT; theoretical framework description, role of OT with CIMT, and suggested methods to integrate it into the curriculum. Chapter III describes the methodology used to gather the information for the development of the educational module. Chapter IV is the
educational module for entry-level occupational therapists in its entirety. Chapter V is a
summary of the information and experiences gained from the project.
CHAPTER II

LITERATURE REVIEW

Introduction

According to the National Stroke Association there are approximately 4 million Americans living with some type of disability as a result of having suffered a stroke. Many individuals experience paralysis and paresis, which significantly affects roles and routines, including basic and advanced activities of daily living (Wolf, Winstein, Miller, Taub, Uswatte, Morris, et al. 2006). Due to the high incidence of stroke related disability and associated economic costs; stroke rehabilitation is a health care priority (Morris, Taub, & Mark, 2006).

According to Barbara Bates and colleagues from the VA and Department of Defense (2005), [as cited by Barclay & Vega, 2005] effective rehabilitation interventions initiated early after a stroke can enhance the recovery process and minimize disability. Therefore, early intervention allots the greatest possibility for functional recovery. However, even with early intervention, the National Stroke Association (2007) indicates that only 10% will recover completely, 25% recover with minor impairments, 40% experience moderate to severe impairments, 10% require care in a nursing home, and 15% die shortly after the stroke. Since the highest categories range from minimal to severe impairment, it is believed that constraint induced movement therapy (CIMT) would be a viable treatment option for these clientele still experiencing deficits
This belief is based on the fact that CIMT is typically initiated 6 months post stroke, due to the need for residual movements, which do not develop immediately.

While neurorehabilitation therapies are commonly used to treat individuals who have experienced a stroke, the need to employ evidence-based treatment strategies to ensure optimal outcomes and reimbursement continues to grow. Constraint Induced Movement Therapy is a technique that supports the use of traditional neurodevelopmental and motor recovery therapies, in which constraint of the non-affected upper extremity, combined with forcing the individual to continually use the affected upper extremity, work to improve function and performance.

Constraint Induced Movement Therapy continues to hold great promise as a neurorehabilitation approach that can be classified as a functional retraining procedure (Wolf, 2007, p.10). The National Center for Medical Rehabilitation Research has funded EXCITE (Extremity Constraint Induced Therapy Evaluation), which is a randomized clinical study. This 5-year study is supported by the National Institute of Neurological Diseases and Stroke and the results have been significant. “Up to 97% of our chronic stroke patients experience substantial, significant, clinically meaningful improvements. With CIMT, there is now more than hope” (Taub, 2007, p.3). It is estimated that 5-30 percent of chronic stroke patients would appreciably benefit from this evidence-based model (Wolf, 2007), yet only a limited number of qualified professionals and facilities offer such a program.

The problem is that currently the University of North Dakota’s Occupational Therapy program contains minimal information pertaining to CIMT within its
coursework. This limited academic exposure to CIMT may place entry-level graduates at a disadvantage. Since the research and support for CIMT is significantly growing, it seems appropriate that the students should, at minimum, obtain an introduction to this new rehabilitation approach in their coursework to add to their repertoire of innovative stroke interventions.

This scholarly project would like to propose a solution, which is the development of an educational unit for OT students that provides more information on CIMT. The literature review will present: 1) what CIMT is; 2) application of CIMT to occupational therapy; 3) description of proposed unit and; 4) methods to integrate it into the curriculum.

**Constraint Induced Movement Therapy**

Wolf (2007) presents constraint-induced movement therapy as: 1) forcing the use of the arm that has been affected by the stroke; 2) providing one-on-one training for as much as 6 hours per day over several weeks; and 3) using repetitive task practice and adaptive task practice (also called "shaping"). “Repetitive task practice refers to continuous efforts to execute movements that usually are repeated, for example, eating, grooming, or brushing teeth” (Wolf, 2007, p.2).

Since inclusion criteria for CIMT is quite rigorous, when compared to conventional stroke treatment, patients must be evaluated by trained professionals to determine if they are appropriate candidates. Viable candidates for CIMT must meet the following criteria (Morris, Taub, & Mark, 2006, Shaw, Morris, Uswatte, McKay, Meythaler, & Taub, 2005, Wu, Chen, Tsai, Lyn, & Chou 2007):
1. Relative hemiparesis
2. No serious cognitive deficits
3. Considerable nonuse of the affected limb
4. A score of 6 or better on the Wechsler Memory Scale-III
5. No balance problems that compromise safety
6. No excessive spasticity of the joints in the upper extremity
7. The ability to initiate wrist extension, thumb abduction, and extension of 2 additional fingers from a resting position

The CIMT protocol is consistent in the research literature; Fritz, Light, Clifford, Patterson, Bahrman, & Davis, 2006; Morris, Taub, & Mark, 2006; Page & Levine, 2007; Sterr, Elbert, Berthold, Kolbel, Rockstroh, & Taub, 2002; & AOTA Evidence Briefs, 2005, and is defined as:

1. Participants must agree to wear a splint/sling on the unaffected arm for 90% of their waking hours.
2. Participate in a training program for 6 hours per day, 5 days a week, for 2 weeks.
3. Participants must agree to use an activity log to track attempted tasks and progression.
4. Application of a transfer package for use within the home environment.

Currently, the CIMT protocol and intervention is not widely used by OT’s within the United States (U.S.), however, this type of stroke treatment is becoming more widely accepted with the physical dysfunction setting.

**Occupational Therapist Competency**

ACOTE (2007) requires that graduates, from an accredited OT program, must meet specific standards. As generalists, OT’s are trained in a wide variety of physical dysfunction interventions and are prepared to practice in emerging areas. OT’s are also trained to work with a wide variety of populations including stroke, cerebral palsy, and TBI, which make OT’s viable candidates for administration of CIMT. Additionally, OT’s must demonstrate superior oral and written communication skills, which are vital for proper implementation of CIMT. Ultimately, these are important skills for OT’s
utilizing CIMT, as they are necessary for proper documentation and communication with patient/family members pertaining to mitt usage and the home program.

Occupational Therapists’ (OT’s) assist stroke survivors in regaining their strength enabling them to engage in activities of daily living (AOTA, 2007). OT’s also recommend adaptive equipment, fabricate splints, evaluate home safety, and provide training to complete tasks, build strength and endurance, and teach compensation strategies. Wit, Putman, Lincoln, Baert, & Berman, et al. (2006) found that an occupational therapists training and focus on sensory and perceptual training, cognition, would be valuable clinical skills in the implementation of CIMT.

OT’s are trained to employ logical thinking, critical analysis, and problem solving because protocol varies with each client depending upon specific deficits. For example, OT’s must problem solve by grading activities for each client once a plateau has been reached. Thus, according to Gourley (2002) as gains are made, therapy progresses to functional activities. Gourley (2002, p. 3) also stated that:

“If someone does shaping all day and nothing functional, it is just exercise. What OT’s bring to this is their knowledge of purposeful activity and motor learning. It is about understanding activity, what it does to people, and how it motivates them.”

Finally, OT’s demonstrate knowledge and understanding of the structure and function of the human body, allowing them to understand the dysfunction associated with stroke. Therefore, this educational background prepares OT’s to provide practical CIMT intervention to individuals who have experienced a stroke.

“Simply forcing a person with hemiplegia to move his or her arm does not make the arm functional or lead to meaningful function, which is why OT can be an appropriate discipline to be involved in CIMT” (Gourley, 2002). According to AOTA, CIMT has
been associated with cortical reorganization by increasing the cortical map associated with learned behavior (2005). AOTA also states that CIMT is effective in improving impairments of dexterity, coordination, and strength. AOTA believes that CIMT is an effective treatment to restore use of the neglected upper extremity by restraining the non-affected arm. Overall, this lends support that the implementation of CIMT needs to be considered in the UND OT curriculum.

Proposed CIMT Educational Module

A review of the literature indicates that there is significant value to the occupational therapists role in the provision of CIMT. The purpose of the educational module is to expose OT students to CIMT in the academic setting, which will add to their understanding of innovative stroke interventions. The audience for this educational unit are the University of North Dakota OT students at both the Grand Forks and Casper sites. This educational module will not be a comprehensive guide to CIMT, which means that students will need additional training before implementing CIMT within practice. This module is meant only as an introduction to broaden students' awareness of other stroke interventions, familiarize the students with the intervention, and provide additional resources.

This educational module will follow best practice guidelines as established by Edward Taub, American Occupational Therapy Association (AOTA), National Stroke Association (NSA), and the American Stroke Association (ASA). It is designed to familiarize OT students with patient selection procedures and implementation of CIMT. It will be a compilation of literature that will be beneficial in the following areas:
1) Serve as a resource guide for entry-level practitioners.
2) Provide resource information on a possible area for specialization.
3) Promote the profession of occupational therapy within the physical disabilities setting.

The Constraint Induced Movement Therapy Educational Module for Entry-Level Occupational Therapy Students includes:

Introduction to Module
Terminology

Unit
I. Introduction to CIMT
   Definition of CIMT
   CIMT protocol
   Benefits of CIMT
   Limitations with CIMT

II. Occupational Therapy with CIMT
   Evaluation
   - Inclusion criteria
   - Exclusion criteria
   - Best practice guidelines/Intervention
   - Precautions
   - Documentation

III. Outcome Measures

IV. Resources

The educational module is divided into 4 units designed to be implemented over a one-week period for three days. Day one is comprised of Unit I and Unit II, which is an introduction to CIMT and the role of OT with CIMT. Unit I includes the risk and prevalence of injuries, team member descriptions, definition of CIMT, benefits of CIMT, CIMT protocol, and limitations with CIMT. Day two presents Units III and IV, which are the outcome measures and includes a list of resources for the student to expand his or her knowledge base. Day 3 allows for hands on practice of the CIMT protocol. This
Unit is presented to the student to ensure his or her understanding of CIMT. The teaching and learning strategies for this educational unit will include:

1. Hands-on learning experience and/or practice
2. Time will be allotted for students to process information
3. Material will be relevant to future areas of practice
4. Ample time will be allotted for questions and discussion

**Curriculum Integration**

The unit is designed specifically for the year two occupational therapy student. A review of the University of North Dakota's curriculum indicates that the best area to integrate this information is within the course OT 453 Physical Aspects of OT with the Maturing Adult. This is the course that currently focuses on preparing the student in the evaluation and treatment of individuals who have experienced a stroke. This will allow students to learn about CIMT in conjunction with traditional stroke treatments. Ultimately, emphasis will be placed on OT evaluation, planning, implementation of treatment, and treatment outcomes.

The other option is for the student to obtain the information through an independent study. Independent study of the educational module allows motivated, responsible students to study topics not included in the curriculum. The independent study will allow students to learn at their own pace and pursue studies at home or anywhere. Learning methods include a combination of activities appropriate to the student such as directed reading and hands on practice.
Theoretical Framework

Theoretical models provide support and structure and a foundation for the OT student upon which to develop and implement programs. Malcolm Knowles’s Theory of Andragogy is the theoretical basis of the product. Andragogy is defined as the methods or techniques used to teach adults (Dictionary.com, 2007). Since the product is intended for occupational therapists, OT’s are the adult learners of this product. In a discussion of Knowles' theory, Blondy (2007) stated the five assumptions of adult learners. These assumptions will be contrasted with the design of the product for occupational therapists.

1. Self-Concept: As a person matures, he or she moves from dependency of learning to self-directness. The education module is intended to provide educational information that occupational therapists can use to prepare themselves to understand the benefits and purpose of CIMT and the role of OT with CIMT. The module is based on current literature in the field and should be changed as new information and research arises.

2. Experience: Adults draw upon their experiences to aid their learning. The students have the prerequisite information of anatomy and neuroanatomy. This product is meant to build on this perquisite information with general CIMT information so that they can venture into this area and further their learning while working with this treatment intervention.

3. Readiness: The learning readiness of adults is closely related to the assumption of new social roles. The student is engaged in the physical disabilities course and is learning treatment interventions about stroke and related physical rehabilitation topics. The student is ready to learn additional new strategies.

4. Orientation: As a person learns new knowledge, he or she wants to apply it immediately in problem solving. Learning about CIMT at this level will allow them to understand the treatment intervention if they see it used on their Level I experiences. It also gives them base knowledge and resources.

5. Motivation: As a person matures, he or she receives their motivation to learn from internal factors. The interest in this area is his or her primary motivation.

This theory recognizes the individual’s prior knowledge, skills and accomplishments promoting an adult approach to learning while facilitating an interest to obtain additional knowledge. Consideration of these approaches to teaching will assist
the occupational therapy student to achieve acquiring the introductory knowledge in preparation for understanding the role of the OT in CIMT.

**Conclusion**

Due to the high prevalence rates of strokes, this is a common area for OT's to practice. Therefore, students must be exposed to all aspects of stroke treatment. The literature review has presented the efficacy of CIMT, the limitations of CIMT, the protocol, and the need for integration of CIMT within the UND curriculum. Ultimately, exposure to CIMT within school will prepare graduates to become more competent practitioners. Thus, this educational module will ensure that graduates from this program will possess entry-level competency for administration of CIMT.

The CIMT Educational Module is presented in its entirety in Chapter IV. Chapter III will present the methodology used in the development of this product. Chapter V will provide a conclusion of the entire project and process, limitations, recommendations and a proposal for how the project could be implemented.
CHAPTER III

ACTIVITIES/METHODOLOGY

The idea of developing an educational module began when the students were enrolled in the OT 453 Physical Aspects with the Maturing Adult. During this course, there appeared to be a limited amount of information pertaining to constraint induced movement therapy (CIMT). As a result, the authors began to question the need for additional information, within the course, pertaining to CIMT.

The development of the CIMT educational module began with an extensive review of current literature. The literature review included searching sites such as: Harley French Library, National Stroke Association, American Stroke Association, University of Alabama Birmingham, educational textbooks, AOTA, and various internet sources. The topics researched included: stroke prevalence, effectiveness of CIMT, CIMT protocol, OT’s role with CIMT, and best practice guidelines pertaining to the intervention. It was determined that a CIMT educational module would be beneficial for UND OT students and the researchers ultimately developed an educational module to present to the UND OT Department. A review of the UND OT Department curriculum was conducted to identify the best area of placement of the educational module.

Upon completion of the literature review, it was determined that CIMT is an area of practice that is regaining national support and recognition. The next step was the development of an outline to identify common issues found in the literature review.
These common issues include: efficacy of CIMT, viable populations, CIMT protocol, inclusion criteria, and standard versus modified treatment regimens. A review of the UND OT Department curriculum was conducted to identify the best area of placement of the educational module.

Malcolm Knowles Theory of Andragogy was chosen to design the product. The product is intended for occupational therapists, who are the adult learners. The five assumptions of the theory are: self-concept, experience, readiness, orientation, and motivation. The application of these five assumptions is presented in its entirety in Chapter II.

The educational module builds upon four teaching and learning strategies including:

1. Hands on learning
2. Adequate time for processing information
3. Relevant information for future areas of practice
4. Time for questions and discussion.

Overall, these strategies reflect the integration of Knowles five assumptions. For example, hands on learning relates to self-concept, as the students will be expected to be self-directed during individual activities. Additionally, since the information will be relevant for future areas of practice, the students are ready to receive the information at this time.

The educational module is divided into 4 units designed to be implemented over a one-week period for three days. Day 1 is comprised of Unit I and Unit II, which is an introduction to CIMT and the role of OT with CIMT. Unit I includes the risk and prevalence of injuries, team member descriptions, definition of CIMT, benefits of CIMT, CIMT protocol, and limitations with CIMT. Day 2 presents Units III and IV, which are
the outcome measure and resources for the student. Day 3 allows for hands on practice of the CIMT protocol. This is presented to the student to ensure his or her understanding of CIMT.
CHAPTER IV

PRODUCT

Introduction

As stated prior, the CIMT Educational Module is designed specifically for the year two occupational therapy student. The purpose of the educational module is to expose OT students to CIMT in the academic setting, which will increase understanding of innovative stroke interventions in the clinic. A review of the University of North Dakota’s curriculum indicates that the best area to integrate this information is within the course OT 453 Physical Aspects of OT with the Maturing Adult. This is the course that currently focuses on preparing the student in the evaluation and treatment of individuals who have experienced a stroke. Thus, this will allow students to learn about CIMT in conjunction with traditional stroke treatments. The other option is for the student to obtain the information through an independent study.

The CIMT Educational Module exposes OT students to the entry-level skills necessary for implementation of CIMT. It provides specific techniques that OT students can utilize as a resource when treating stroke patients. The product also contains a summarized inclusion criteria form that OT’s can utilize when determining patient appropriateness for CIMT. Due to the limited evidence-based research on OT treatment with CIMT, the CIMT Educational Module will familiarize OT students with current evidence-based practice guidelines.
Theoretical Framework

Theoretical models provide support and structure and a foundation for the OT student upon which to develop and implement programs. Malcolm Knowles’s theory of Andragogy is the theoretical basis of the product. Andragogy is defined as the methods or techniques used to teach adults (Dictionary.com, 2007). The product is intended to be used by occupational therapists, who are the adult learners of this product. In a discussion of Knowles' theory, Blondy (2007) stated the five assumptions of adult learners. These assumptions will be contrasted with the design of the product for occupational therapists in the following:

1. **Self-Concept:** As a person matures, he or she moves from dependency of learning to self-directness. The education module is intended to provide educational information that occupational therapists can use to prepare themselves understanding the benefits and purpose of CIMT and the role of OT. The module is a guide based on current literature in the field and should be changed as new information and research arises.

2. **Experience:** Adults draw upon their experiences to aid their learning. The students have the prerequisite information of anatomy and neuroanatomy. This product is meant to build on this perquisite information with general CIMT information so that they can venture into this area and further their learning while working with this treatment intervention.

3. **Readiness:** The learning readiness of adults is closely related to the assumption of new social roles. The student is engaged in the physical disabilities course and is learning treatment interventions about stroke and related physical rehabilitation topics. The student is ready to learn additional new strategies.

4. **Orientation:** As a person learns new knowledge, he or she wants to apply it immediately in problem solving. Learning about CIMT at this level will allow them to understand the treatment intervention if they see it used on their Level I experiences. It also gives them base knowledge and resources.

5. **Motivation:** As a person matures, he or she receives their motivation to learn from internal factors. The interests in this area are his or her primary motivation.

This theory recognizes the students’ prior knowledge, skills and accomplishments promoting an adult approach to learning while facilitating an interest to obtain additional knowledge. Use of this educational module combined with above mentioned methods of
teaching will assist the OT student to achieve each learning objective with the ultimate goal of acquiring an introductory understanding of CIMT.

**Product**

The CIMT Educational Module contains the following:

**Constraint Induced Movement Therapy Educational Module for Entry-Level Occupational Therapy Students**

Introduction to Module
Terminology

Unit
I. Introduction to CIMT
   Definition of CIMT
   CIMT protocol
   Benefits of CIMT
   Limitations with CIMT

II. Occupational Therapy with CIMT
   Evaluation
   Inclusion criteria
   Exclusion criteria
   Best practice guidelines/Intervention
   Precautions
   Documentation

III. Outcome Measures

IV. Resources

These topics will be presented in detail in the product. In order to understand CIMT protocol, students must build upon skills gained in gross anatomy, neuroanatomy, muscle function, and physical dysfunction.
CONSTRAINT INDUCED MOVEMENT THERAPY:

An Educational Module for Occupational Therapy Students

UND OT PROGRAM

Tamira Ott
Grant Basko
Advisor: LaVonne Fox, PhD, OTR/L
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INTRODUCTION TO MODULE

This Constraint Induced Movement Therapy (CIMT) Educational Module has been designed for you, the UND OT student. The module will:

1. Expose you to the entry-level skills and techniques necessary for implementation of CIMT
2. Serve as a resource when treating clients who have had a stroke
3. Present inclusion criteria that you can utilize when determining client appropriateness for CIMT.

Due to the limited evidence-based research on OT treatment with CIMT, this educational module will familiarize you with current evidence-based guidelines. The module begins with a terminology list to provide you with terms and definitions you will need in order to successfully understand the process of CIMT.

There are four units:

- Unit I Introduction to Constraint Induced Movement Therapy (CIMT)
- Unit II Role of Occupational Therapy with CIMT
- Unit III Outcome Measures
- Unit IV Resources
Theoretical Framework

Theoretical models provide support and structure and a foundation for the OT student upon which to develop and implement programs. Malcolm Knowles’s Theory of Andragogy is the theoretical basis of the product. Andragogy is defined as the methods or techniques used to teach adults (Dictionary.com, 2007). The product is intended for occupational therapists, who are the adult learners of this product. In a discussion of Knowles’ theory, Blondy (2007) stated the five assumptions of adult learners. These assumptions will be contrasted with the design of the product for occupational therapists.

1. Self-Concept: As a person matures, he or she moves from dependency of learning to self-directness. The education module is intended to provide educational information that occupational therapists can use to prepare themselves to understand the benefits and purpose of CIMT and the role of OT with CIMT. The module is based on current literature in the field and should be changed as new information and research arises.

2. Experience: Adults draw upon their experiences to aid their learning. The students have the prerequisite information of anatomy and neuroanatomy. This product is meant to build on this prerequisite information with general CIMT information so that they can venture into this area and further their learning while working with this treatment intervention.

3. Readiness: The learning readiness of adults is closely related to the assumption of new social roles. The student is engaged in the physical disabilities course and is learning treatment interventions about stroke and related physical rehabilitation topics. The student is ready to learn additional new strategies.

4. Orientation: As a person learns new knowledge, he or she wants to apply it immediately in problem solving. Learning about CIMT at this level will allow them to understand the treatment intervention if they see it used on their Level I experiences. It also gives them base knowledge and resources.

5. Motivation: As a person matures, he or she receives their motivation to learn from internal factors. The interests in this area are his or her primary motivation.
Objectives
The following are general objectives for this educational module. Each unit will have specific objectives as well. At the end of the CIMT Educational Module, the student will be able to:

1. Demonstrate oral, non-verbal written communication skills.
2. Employ logical thinking, critical analysis, and problem solving.
3. Apply skills learned in prior courses to practical situations.
4. Understand the terminology and interactions between clients and practitioners.
5. Understand and appreciate the role of CIMT in the prevention of disease and disability.
6. Be able to articulate to the consumer, potential employers, and the general public the unique nature and value of CIMT.
7. Understand the theories, models of practice, and frames of reference that are used with CIMT.
8. Demonstrate knowledge and understanding of the structure and function of the human body.
9. Demonstrate competency with administration of CIMT.
10. Advocate for clients and implementation of CIMT.
11. Demonstrate the ability to use safety precautions with clients during screening, evaluation, and intervention processes.
12. Demonstrate the ability to grade and adapt tasks related to performance areas and performance components for therapeutic intervention.
13. Document OT services to ensure accountability of service provisions and to meet standards for reimbursement of services.
14. Demonstrate competency with all outcome measures.

Materials Needed:

1. Supplemental packet
   a. Copies of CIMT Educational Module that are available on Black Board or at the instructors discretion.
2. Textbooks (previously purchased)
   a. Pedretti’s Occupational Therapy Practice Skills for Physical Dysfunction (2006, 6th ed.).
   b. Trombly & Radomski Physical Dysfunction with the Maturing Adult (2001, 5th ed.).
3. Various restraint devices
   a. i.e. oven mitts or towels
4. Student selected journal articles for discussion
TERMINOLOGY

The following is a list of definitions that will be utilized throughout the educational module. The definitions are from the following sources: *Occupational Therapy Practice Framework: Domain and Process, Pathophysiology Concepts of Altered Health States* (7th ed.), *Stedman's Medical Dictionary* (5th ed.), and Pedretti’s *Occupational Therapy Practice Skills for Physical Dysfunction*.

**Action Research Arm Test (ARAT)** – A practical test that measures upper extremity motor function in clients with stroke.

**Activities of Daily Living (ADLs)** – Activities that are oriented toward taking care of one’s own body.

**Affected Limb** – This is the limb that is affected by the injury.

**Bimanual Therapy** – Therapy that requires the use of both upper extremities.

**Cerebrovascular Accident (CVA)** – The sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery to the brain. A stroke is also called a cerebrovascular accident or, for short, a CVA.

**Constraint Induced Movement Therapy (CIMT)** – A technique designed to promote increased use of a weak or paralyzed arm by restraining the unaffected limb. CIMT has been credited with speeding up cortical map reorganization.

**Cortical Reorganization** – Refers to the use of task specific activities in which the affected extremity is repetitively and functionally used. This in turn increases the size of the cortical area representing the limb.
Dynamic Systems Theory – Refers to dynamic interactions between client factors, the context, and the occupations that must be performed to enact the client’s roles.

Education – Includes activities needed for being a student and participating in a learning environment.

Embolus – A plug composed of detached thrombosis that occludes a blood vessel.

Fugl-Meyer Assessment (FMA) – A group of tests using a numbered scale to quantify motor recovery stages, which is based on the scales of Brunnstrom and Twitchell.

Hemiparesis – Weakness affecting one side of the body.

Hemorrhagic Stroke – A rupture of a blood vessel, hemorrhage into the brain tissue occurs, resulting in edema, compression of the brain contents, or spasms of the adjacent blood vessels. Most frequently fatal.

Instrumental Activities of Daily Living (IADL’s) – Activities that are oriented toward interacting with the environment and are often complex – generally optional in nature.

Ischemic Stroke – Arterial narrowing due to mechanical obstruction of blood flow usually caused by a thrombosis or emboli.

Learned Nonuse – A phenomenon in which the individual effectively forgets to use the affected or involved extremity because of the extreme difficulty coordinating movement after the onset of stroke.

Modified Constraint Induced Movement Therapy (mCIMT) – This is a shortened treatment regimen that is conducted for 3 hours or less per day.

Motor Activity Log (MAL) – A self-report interview used to assess how stroke survivors use their more impaired arm outside the laboratory.
Motor Skills – Skills in moving and interacting with task, objects, and environment.

Neuroplasticity – Is the brain’s ability to reorganize itself by forming new neural connections, which ultimately allows the brain to compensate for injury or disease.

Non-Affected Limb – This is the limb that is fully functional.

Occupation-Based Activity – Allows clients to engage in actual occupations that are part of their own context and that match their goals.

Preparatory Activity – Prepares the client for occupational performance. Used in preparation for purposeful and occupation-based activities.

Process Skills – Skills used in managing and modifying actions en route to the completion of daily life tasks.

Purposeful Activity – Allows the client to engage in goal-directed behavior or activities within a therapeutically designed context that lead to an occupation or occupations.

Shaping – Involves behavioral techniques that approach a desired motor outcome in small successive increments. Shaping techniques allow subjects to experience successful gains in performance with relatively small amounts of motor improvement.

Task Oriented Approach – Refers to occupational performance of motor recovery occur from a dynamic interaction of the person, environment, and the occupations that are being performed.

Task Practice – Practicing functionally based activities continuously.
Thrombosis – Clotting within a blood vessel that may cause infarction of tissues supplied by the vessel.

Transfer Package – Transferring gains made in the clinic to the home environment.

Wolf Motor Function Test (WMFT) – A lab-based test that focuses on arm function that involves 15 timed measures and 2 forced-based measures, which progress in complexity from engaging individual joints to the use of the total arm.
UNIT I

INTRODUCTION TO

CONSTRAINT INDUCED MOVEMENT THERAPY
INTRODUCTION TO
CONSTRAINT INDUCED MOVEMENT THERAPY

At the end of Unit I, the student will be able to:
1. Understand the terminology and interactions between clients and practitioners.
2. Articulate a basic understanding of CIMT
3. Understand the benefits and limitations of CIMT

When an individual experiences a stroke a portion of the brain is damaged and resultant symptoms usually include contralateral hemiparesis, which is weakness on the opposite side of the body from the affected hemisphere. Hemiparesis is a symptom that clients must possess to be considered viable candidates for CIMT, as the unaffected limb is restrained, mandating usage of the impaired upper extremity.

CIMT is a rehabilitative technique used to treat patients who have lost motor function in a limb due to a stroke. Therapy focuses on restraining the non-affected limb, mandating usage of the affected limb for functional activities, which allows the brain to rewire itself and relearn motor skills lost to neurological injury. Studies indicate that CIMT is most effective when initiated at least six months after a stroke or in people who have already completed traditional rehabilitation (Fritz, Light, Clifford, Patterson, Behrman, & Davis, 2006, p. 825).

Recent studies of CIMT revealed that stroke patients can make gains in movement, strength, and coordination after months or even years following the injury (Taub, 2007), so it is an excellent option for survivors of a stroke that have reached a plateau with traditional interventions. It can significantly improve functional use of the
upper extremity and hand, which will increase quality of life for survivors of stroke (Fritz, George, Wolf, & Light, 2007), building upon neuroplasty, (Taub, Uswatte, King, Morris, Crago, & Chatterjee, 2006, Fritz, Light, Clifford, Patterson, Behrman, & Davis, 2006, Naylor & Bower, 2005, Page & Levine, 2007). **Neuroplasticity** is defined as the brain's ability to reorganize itself by forming new neural connections, which ultimately allows the brain to compensate for injury or disease (Steadman's medical dictionary, 2000).

During task specific activities, where the affected extremity is repetitively and functionally used, the size of the cortical area representing the limb increases (Szaflarski, Page, Kissella, Lee, Levine, & Strakowski 2006). This process is known as cortical reorganization, which is the premise that CIMT builds upon for rehabilitation. **Cortical reorganization** is illustrated in the image below, which demonstrates how the cortical area, representative of the abductor pollicis brevis muscle, increased in the affected hemisphere following CIMT intervention.

![Diagram of cortical area sizes before and after training](image-url)
According to Taub & Mark (2004) CIMT increases cortical reorganization and decreases learned nonuse. Sunderland & Tuke (2005) state that the guiding theory of CIMT is that impaired hand use is worsened by the learned non-use phenomenon, as presented on p. 14, because clients stop using their affected upper extremity. This ultimately leads to decreasing cortical representation of the impaired upper limb.

A major aspect of CIMT is overcoming the learned non-use phenomenon. According to Sunderland & Tuke (2005), the learned non-use phenomenon results when clients experience unsuccessful attempts to move the impaired upper extremity as a result of a right or left-sided CVA. Clients then compensate by relying solely on their unimpaired upper extremity for all activity. CIMT has been proven effective for reducing the learned non-use phenomenon by restraining the non-affected limb and having clients perform functional activities with the affected limb.

Bonifer & Anderson (2003) state that learned nonuse develops as a result of an upper motor neuron lesion that depresses the central nervous system and motor activity. Therefore, persons who have experienced a stroke or brain injury undergo unsuccessful attempts to move the impaired extremity, and ultimately compensate with the noninvolved extremity. Brogardh (2006) characterizes this phenomenon and how CIMT overcomes it in the diagrams presented on page 14. The first diagram illustrates how learned nonuse develops, and the second diagram demonstrates how CIMT is utilized to overcome this phenomenon.
Learned Nonuse (Diagram #1)
(modified from Brogardh, 2006)

- Injury i.e. Stroke
- Unsuccessful motor attempts resulting from nonfunctional use of arm
- Punishment occurs from inability to move arm correctly
- Masked ability: Pt stops moving affected extremity although movement is still possible
- Behavior suppression: results from inability to move affected arm correctly
- Less effective behavior strengthened
- Positive reinforcement: Pt is successful using only one arm.
- Compensatory behavior patterns: Pt uses non-affected arm for all activities.

Overcoming Learned Nonuse (Diagram #2)
(modified from Brogardh, 2006)

- Learned non-use
- Masked recovery of limb use: Function is returning, but body does not recognize it
- CIMT builds upon masked recovery by forcing pt. to use affected UE, which leads to increased motivation
- Positive reinforcement
- Affected limb use increases as motivational levels increase
- Further Practice
- More reinforcement
- Limb use in functional life situations
PROTOCOLS

Little-Hayes, Allgier, Klein, Reder, & Bur (2007) state there are two types of protocols for administration of CIMT:

1. **CIMT**: refers to restraining the unaffected limb while training the affected limb for three or more hours per day for two or more weeks (Little-Hayes, et al. 2007).
2. **Modified Constraint Induced Therapy (mCIMT)**: refers to restraining the unaffected limb for fewer than three hours per day (Little-Hayes, et al. 2007).

Current literature suggests that while mCIMT can produce positive benefits for survivors of stroke, the standard CIMT protocol has been proven more effective. However, both protocols incorporate the use of functional activities, which is more motivating to the clients. Gourley (2002) states that, “interventions are built around those activities that clients identify as most purposeful during an activity analysis. For example, if a client states they want to drink a cup of coffee, then the therapist fills the cup with varying amounts of water.” Therefore, if the OT does not incorporate function into the treatment it is only exercise. The protocols will be discussed in more detail in the intervention section in Unit II.

SUMMARY OF BENEFITS OF CIMT

- CIMT has been proven to produce greater improvements in movement and functional use of the impaired hands and arms in stroke clients than conventional care (Taub, 2007).
- A major benefit of CIMT is that it can be utilized in groups or individual therapy.
- According to Wolf (2007) CIMT builds upon the premise of brain plasticity (as discussed on page 12) and ultimately allows clients to regain lost functions.
following stroke.

Mark & Taub (2004) discovered that CIMT can double the cortical representation of impacted muscles after standard protocol, as new neuronal connections are established.

CIMT, in addition to stroke treatment, is appropriate for numerous populations including: Traumatic brain injury (TBI), spinal cord injury, hip fracture, cerebral palsy (CP), focal hand dystonia, phantom limb pain, and aphasia (Mark & Taub, 2004). Mark & Taub indicate that CIMT can produce positive outcomes for all of these populations (2004). Additionally, even though CIMT was originally developed to treat non-progressive illnesses associated with nonuse such as stroke, Mark & Taub (2004) discovered that CIMT can reduce learned nonuse with progressive diseases such as Parkinson's.

According to Brosseau, Wells, Finestone, Egan, Dubouloz, Graham, Casimiro, Robinson, Bilodeau, McGowan (2006), CIMT has been proven effective in reducing pain and spasticity, and increasing range of motion (ROM), muscle force, mobility, walking ability, functional status, physical fitness, and quality of life.

Little-Hayes, Allgier, Klein, Reder, & Bur (2007) found that CIMT can increase spontaneous use of the affected arm, bolster ADL independence, improve quality, speed, and dexterity of the upper-extremity use, and increase the ability to engage in bilateral upper extremity activities.
There have been numerous studies pertaining to the effectiveness of CIMT with stroke clients. Sunderland & Tuke (2005) summarized studies of CIMT, which are presented in the table below.

<table>
<thead>
<tr>
<th>Researchers</th>
<th># of Pt.'s</th>
<th>Time Since Stroke</th>
<th>Control Procedures</th>
<th>Treatment</th>
<th>Changes in spontaneous hand use</th>
<th>Changes in functional tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ostendorf Wolf (1981)</td>
<td>1</td>
<td>18 Months</td>
<td>Before-after comparison with 2 baseline assessments.</td>
<td>7 days of constraint</td>
<td>Self-report of increased use during constraint. Confirmed by video observation.</td>
<td>Improved dexterity during baseline and further improvement with constraint.</td>
</tr>
<tr>
<td>Sterr et al. (2002)</td>
<td>15</td>
<td>1-17 years after stroke or head injury</td>
<td>Before-after comparison and random allocation to 30 or 60 hours of shaping.</td>
<td>2 weeks of 90% constraint. 30 or 60 hours of shaping.</td>
<td>Substantial improvement in MAL*, greatest for those with 60 hours of shaping.</td>
<td>Trend toward greater improvement in the WMFT* for those with 60 hours of shaping.</td>
</tr>
<tr>
<td>van der Lee et al. (1999)</td>
<td>31</td>
<td>2 to 7 years</td>
<td>31 randomly allocated controls received bimanual* therapy. Single-blind assessment.</td>
<td>12 days of constraint for most activities. 60 hours of shaping.</td>
<td>Greater improvement in MAL* initially, but not significantly different from controls.</td>
<td>No change on the FMA*. Moderate improvement on the ARAT*, maintained at 1 year. Effect greatest for those with sensory loss.</td>
</tr>
</tbody>
</table>

* Indicates term is defined in terminology section.
SUMMARY OF LIMITATIONS OF CIMT

All stroke treatments have some limitations associated with them. The following are the limitations of CIMT:

- CIMT is not directly reimbursable, but as outlined earlier, is billable as a therapeutic exercise or neuromuscular reeducation.
- CIMT requires many resources and the training protocol may be strenuous for the clients.
- CIMT is not widely viewed by clinicians as a useful therapeutic intervention and is often considered unfeasible due to clients' concerns about the intensive treatment schedules (Brogardh, 2006).
- CIMT is expensive, as it requires high amounts of one-on-one treatment time. However, mCIMT requires less on-on-one treatment time with the therapist and is therefore more cost effective (Brogardh, 2006).
UNIT II

OCCUPATIONAL THERAPY

WITH CIMT
ROLE OF OCCUPATIONAL THERAPY WITH CIMT

Unit II presents the role of the occupational therapist with CIMT, inclusion criteria, and exclusion criteria. The following unit discusses best practice guidelines, the CIMT treatment schedule, repetitive task oriented training, application of a transfer package, physical restraint of the non-affected upper extremity, precautions, and documentation. At the completion of this unit, students will:

1. Understand the role of the occupational therapist with the provision of CIMT.
2. Be able to articulate to the consumer, potential employers, and the general public the unique nature and value of CIMT.
3. Understand the theories, models of practice, and frames of reference that are used with CIMT.
4. Demonstrate competency with administration of CIMT.
5. Advocate for clients and implementation of CIMT.
6. Demonstrate the ability to use safety precautions with clients during screening, evaluation, and intervention processes.
7. Demonstrate the ability to grade and adapt tasks related to performance areas and performance components for therapeutic intervention.
8. Document OT services to ensure accountability of service provisions and to meet standards for reimbursement of services.

The learning activity utilized within this unit is:

1. Student-led discussion of articles pertaining to CIMT.

ROLE OF OT

1. Occupational therapists are one of the primary providers of CIMT services.
2. OT’s are responsible for evaluating clients and determining what movements are difficult.
3. OT’s primary focus is functional use of the impaired upper extremity. One of the main components of CIMT is structuring the tasks and the environment to facilitate engagement with the impaired extremity.
4. Forcing a client to move his or her arm is not a functional activity and will not lead to meaningful outcomes. Therefore, the OT must emphasize functional activities throughout treatment.

5. In addition to these tasks, the OT has the role of coach and teacher.

EVALUATION

➢ **Inclusion Criteria:** A major role of OT with the implementation of CIMT is evaluating stroke clients to determine viability for treatment. According to Phillips and Roberts (2006, p. 795) in order to determine viable candidates for CIMT, OT’s must ensure that clients meet the following criteria:

1. First-time CVA.
2. CVA that occurred more than 1 year ago.
3. Not currently receiving therapeutic intervention.
4. A score of equal to or greater than 44 on the Berg Balance Test or limited balance requirements requiring an assistive device for mobility who have a full-time caregiver to assist with any balance issues. You can find more information pertaining to the Berg Balance Test in *Pedretti’s Occupational Therapy Practice Skills for Physical Dysfunction*, p. 814.
5. Ability to move the affected arm in a 45-degree shoulder flexion and abduction, 20-degree wrist extension, and 10-degree extension at metacarpal phalanges and interphalanges as determined by active range of motion.
6. No significant cognitive deficits as demonstrated by a Mini Mental State Examination score of at least 22 or another cognitive test. You can find more information pertaining to the Mini Mental Stae Examination in *Pedretti’s Occupational Therapy Practice Skills for Physical Dysfunction*, p. 602.
7. No preexisting co-morbidities that might interfere with mobility or function.
8. Limited spasticity (score 0 or 1) as measured by the Modified Ashworth Scale. You can find more information pertaining to the Modified Ashworth...
Scale in Pedretti’s *Occupational Therapy Practice Skills for Physical Dysfunction*, p. 412.

9. Ability to identify an individual who can assist with the home program.

➢ Exclusion Criteria

1. Too high or too low motor ability
2. Cognitive deficits that prevent adequate participation
3. Already high use of the affected arm

## Intervention

**Best Practice Guidelines**

As stated prior OT’s are responsible for evaluating clients and determining what movements are difficult. Once appropriate clients are selected, OT’s can begin the CIMT protocol. Progression is documented by clients’ performance on the Wolf Motor Function Test (WMFT), the Motor Activity Log (MAL), and the Functional Independence Measure (FIM). These assessments are administered both before and after treatment to determine a baseline and allow measurement of progression. Finally, students will follow written instructions for administration of these assessments.

The following CIMT protocol information was consistent in the research literature; Fritz, Light, Clifford, Patterson, Bahrman, & Davis, 2006; Morris, Taub, & Mark, 2006; Page & Levine, 2007; Sterr, Elbert, Berthold, Kolbel, Rockstroh, & Taub, 2002; & AOTA Evidence Briefs, 2005, and is as follows:

1. Clients must agree to wear a splint/sling on the unaffected arm for 90% of their waking hours.
2. Participate in a training program for 6 hours per day, 5 days a week, for 2 weeks.
3. Clients must agree to use an activity log to track attempted tasks and progression.
4. Application of a transfer package for use within the home environment (see page 27 for detailed description).
CIMT Treatment Schedule

- Therapists will customize CIMT techniques for each client depending on the severity of their deficit.
- Treatment time per day and overall duration of treatment will differ depending upon the severity of the impairment, which is summarized in the table below.

<table>
<thead>
<tr>
<th>Severity of Impairment</th>
<th>Treatment Hours Per Day</th>
<th>Duration of Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild to moderate</td>
<td>3</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Moderate deficits</td>
<td>3</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Moderately severe *</td>
<td>6</td>
<td>3 weeks</td>
</tr>
</tbody>
</table>

*6 hours of treatment per day for 3 weeks is the most common CIMT regimen.

Information adapted from Taub (2007)
Repetitive Task Oriented Training

♦ There are two types of training clients can receive, which include shaping and task practice.

➢ Shaping – This is based upon behavioral training, which involves grading activities according to the clients’ motor capabilities. Each activity begins with whatever movement is possible and is practiced for 30 seconds, ten times. Function is gradually added to the shaping regimen as movement capabilities return.

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>A box of several blocks is used for this task. The subject moves small wooden blocks from the table to the top of the box. The placement and the height of the box depend on the movements desired. For example, the box can be placed directly in front of the subject to challenge shoulder flexion and elbow extension or placed at the side to challenge shoulder abduction and elbow extension.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential shaping level of difficulty progressions</td>
<td>Distance: the box can be moved farther away to challenge elbow extension. Height: a higher box can be used to challenge shoulder flexion. Size of object: larger or smaller blocks can be used to challenge wrist and hand control.</td>
</tr>
<tr>
<td>Potential feedback parameters</td>
<td>Number of repetitions: number of blocks placed on the box in a given period of time. Time: time required to place a set number of blocks on the box.</td>
</tr>
<tr>
<td>Movements emphasized</td>
<td>Pincer grasp Wrist extension Elbow extension Shoulder flexion</td>
</tr>
</tbody>
</table>

Information adapted from Morris, Taub, & Mark (2006, p. 260)
Task Practice – This is less structured than shaping and involves practicing functionally based activities continuously for a period of 15 to 20 minutes, i.e. wrapping a present or writing.

**Task Practice Example**

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Subjects sit/stand at a table with three variously sized round objects including a tennis ball, golf ball, and marble in front of them. Subjects practice grasping and releasing these objects. Therapist times how long it takes subjects to release the various objects. Subjects are allowed to rest between attempts for the equivalent amount time required for release of each object.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusting difficulty/complexity</td>
<td>Release of items will be graded by decreasing the size of the object in hand (i.e. progression from a marble to a cotton ball, to a small pebble).</td>
</tr>
<tr>
<td>Suggested feedback</td>
<td>Increase number of items released in a 10 minute period. Time required for release of all objects is decreased. Quality of release (i.e. smooth coordinated release of items). Improvements in hand function in performing these tasks (i.e. thumb extension/opposition).</td>
</tr>
</tbody>
</table>

Information adapted from Bonifer & Anderson (2003)
The following is a comparison of shaping and task practice.

<table>
<thead>
<tr>
<th>Interaction Type</th>
<th>Definition</th>
<th>Used in Shaping</th>
<th>Used in Task Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback</td>
<td>Provides specific knowledge of results about clients’ performance on shaping trial.</td>
<td>Provided immediately after each trial.</td>
<td>Provided as global knowledge of results at the end of the entire task practice activity.</td>
</tr>
<tr>
<td>Coaching</td>
<td>Providing specific suggestions to improve movements. Aspects of this procedure are described as cuing and prompting.</td>
<td>Provided liberally throughout all shaping trials.</td>
<td>Provided throughout entire task practice session, though not as often as shaping.</td>
</tr>
<tr>
<td>Modeling</td>
<td>When a trainer physically demonstrates a task.</td>
<td>Provided at the beginning of shaping activity. Repeated between trials as needed.</td>
<td>Provided at the beginning of task practice activity.</td>
</tr>
<tr>
<td>Encouragement</td>
<td>Providing reward to clients to increase motivation and promote maximal effort. i.e. “that’s good, keep trying.”</td>
<td>Provided liberally throughout all shaping trials.</td>
<td>Provided throughout entire task practice session, though not as often as shaping.</td>
</tr>
</tbody>
</table>

Information adapted from Morris, Taub, & Mark (2006, p. 260)
APPLYING A TRANSFER PACKAGE
(Shaw, Morris, Uswatte, McKay, Meythaler, & Taub, 2005)

➢ The goal of CIMT is to transfer gains made in the clinic to the home environment.

This is accomplished through the use of a transfer package, which is utilized
to transfer gains made in the clinic to the home environment.

• A transfer package involves making the clients accountable for adherence to the
  requirements of therapy.

• In order to enhance adherence 3 techniques are employed:

  1. **Monitoring** – Requires clients to observe and document their own performance of target behaviors. This can be accomplished through the use of a home diary.

  2. **Problem Solving** – Clients are required to overcome problems by generating and selecting solutions. This is necessary so that clients do not have to remove their restraint whenever they encounter difficult situations at home. For example: a client that is unable to grasp a whole sandwich with the affected extremity may cut the sandwich into smaller pieces to avoid removing the restraint.

  3. **Behavioral Contract** – Formal written agreement that the client will use the more affected extremity for specific activities throughout the treatment regimen and at home. This contract is signed by the client, therapist, and witness on the initial day of treatment.

➢ The behavioral contract, monitoring, and problem solving interact and support one another.
Wearing the mitt while away from the clinic does not ensure that the clients will use the more impaired UE to complete ADL activities at home. Therefore, home skill assignment is utilized to challenge clients to perform ADLs within their home.

- Therapist guides clients to select 5 ADLs that the client believes are difficult to accomplish and 5 ADLs that the client perceives as easier to accomplish.
- Clients are instructed to complete these ADLs within a 30-minute session at home.

An alternative to home skill assignment is home practice.

- This requires clients to perform specific UE tasks with their more affected arm for 15 to 30 minutes. i.e. stacking cups.

A daily schedule of activities is utilized to help demonstrate improvements in daily activities, which often has the effect of motivating clients. i.e. making a sandwich yesterday took 30 minutes, but only took 25 minutes today.
• Time and length of rest periods when mitt is removed are documented to ensure mitt is worn for 90% of the clients’ waking hours.
• Specific shaping task practice is also documented so that clients can keep track of activities performed.
Physical Restraining of the Non-Affected Upper Extremity (Bonifer & Anderson, 2003)

- A protective safety mitt or sling is worn on the non-affected UE for 90% of the clients' waking hours to facilitate use of the impaired UE.
- However, a mitt is preferred, as this allows the client to have protective arm extension, which is necessary for safety in the event of a fall.
PRECAUTIONS
(Bowman, Taub, Uswatte, Delgado, Bryson, Morris, McKay, & Mark, 2006)

1. Skin integrity, i.e. burns and minor skin lesions associated with shear forces from the mitt.
2. Muscle atrophy, soreness, stiffness, and/or discomfort
3. Loss of range of motion
4. Loss of protective arm extension during a fall (this is only a concern when a sling is used as the restraint device)

➢ If any of the above are present, discontinue treatment immediately.
DOCUMENTATION

➢ CIMT can be billed as a neuromuscular reeducation or therapeutic exercise.

➢ Throughout the CIMT process, it is important that the following items are documented:
   • Document all assessment data from the initial evaluation.
   • Keep a signed copy of behavioral contract.
   • Manual muscle tests, grip/pinch assessments and goniometric measurements
   • Initial/ final FIM scores.
   • Difficulty of activities performed within the clinic and at home.
   • Total amount of time with and without restraint per day.
UNIT III

OUTCOME MEASURES
OUTCOME MEASURES

The following unit contains a detailed description of all outcome measures. Upon completion of this unit, the student will be able to:

1. Demonstrate competency with all outcome measures.

The learning activities utilized within this unit include:

1. Hands on practice.

CIMT Outcomes

The following assessments are necessary to determine efficacy of treatment and client progression. The assessment results set the clients baseline and identify the goals/outcomes for treatment. These are outcomes the therapist and client will work toward achieving.

➢ Wolf Motor Function Test (WMFT) (Phipps & Roberts, 2006 as cited in Pedretti’s Occupational Therapy Practice Skills for Physical Dysfunction)

- Standardized test to evaluate arm function.
- 15 motor items that examine contributions from the distal and proximal muscles of the arm.
- Tasks are sequenced from proximal to distal and gross to fine motor.
- Standard tasks such as lifting the forearm to the table, reaching for an object, or lifting a pencil are rated on a scale from 0 (does not attempt with the weaker arm) to 5 (movement appears normal and time to complete the task is measured).
- Administered before and after treatment as well as at a designated time following the intervention.
The Motor Activity Log (MAL) (Phipps & Roberts, 2006 as cited in Pedretti's Occupational Therapy Practice Skills for Physical Dysfunction)

- Purpose is to explore activities outside the clinical setting.
- Self-report, 30-item instrument administered in an interview format.
- Subjects rate their performance on each activity and emphasis is placed on performance of the activity at home.
- Administered 10 times throughout the course of intervention.
- Consists of specific activities such as turning on a light switch or opening a drawer.
- Amount of use of the involved arm is rated by the client from 0 (never used) to 5 (involved arm used the same as it was before the stroke).
- Quality of movement (how well) is also self-rated from 0 (not used) to 5 (normal movement).
Interview is used to determine specifically what the client wants to achieve from therapy. This in turn allows the therapist to ensure all activities are client centered.

Functional Independence Measure (FIM) (Adler, 2006 as cited in Pedretti’s Occupational Therapy Practice Skills for Physical Dysfunction)

- 13 motor and 5 cognitive items that are individually scored from 1 to 7.
- A score of 1 indicates complete dependence and a score of 7 indicates complete independence.
- Documentation consists of observing and recording what a person actually does.

### Functional Independence Measure Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>INDEPENDENT</strong></td>
<td>No Helper Required</td>
</tr>
<tr>
<td>(7) Complete Independence (timely &amp; safely)</td>
<td></td>
</tr>
<tr>
<td>(6) Modified Independence (device)</td>
<td></td>
</tr>
<tr>
<td><strong>MODIFIED DEPENDENCE</strong></td>
<td>Helper Required</td>
</tr>
<tr>
<td>(5) Supervision</td>
<td></td>
</tr>
<tr>
<td>(4) Minimal Assist (subject = 75% or more)</td>
<td></td>
</tr>
<tr>
<td>(3) Moderate Assist (subject = 50% to 74%)</td>
<td></td>
</tr>
<tr>
<td><strong>COMPLETE DEPENDENCE</strong></td>
<td></td>
</tr>
<tr>
<td>(2) Maximal Assist (subject = 25% to 49%)</td>
<td></td>
</tr>
<tr>
<td>(1) Total Assist (subject = 0% to 24%)</td>
<td></td>
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</tbody>
</table>
UNIT IV

RESOURCES
Resources

For additional information on CIMT students can access the following websites.

**American Stroke Association**
7272 Greenville Avenue  
Dallas, TX 75231  
Telephone: (888) 478-6753  
Website: www.strokeassociation.org

**National Stroke Association**
9707 E. Easter Lane  
Centennial, CO 80112  
Telephone: 1-800-787-6537  
Website: www.stroke.org

**The University of Alabama at Birmingham**
Birmingham, Alabama 35294  
Telephone: (205) 934-4011  
Website: http://main.uab.edu

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**Stroke Facts**

<table>
<thead>
<tr>
<th>Fact</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke is the 3rd leading cause of death in America</td>
<td>National Stroke Association</td>
</tr>
<tr>
<td>More than 730,000 Americans experience a new or recurrent stroke each year.</td>
<td>Wolf, Winstein, Miller, Taub, Usватte, Morris, et al. (2006)</td>
</tr>
<tr>
<td>Up to 85% of these stroke clients experience hemiparesis, resulting in decreased quality of life and overall motor performance.</td>
<td>Wolf, et al. (2006)</td>
</tr>
<tr>
<td>Stroke is the leading cause of disability in the United States and stroke-induced hemiparesis is the most frequent impairment managed by therapists.</td>
<td>Page &amp; Levine (2007)</td>
</tr>
<tr>
<td>Direct and indirect costs of stroke treatment total 35 billion.</td>
<td>Wolf, et al. (2006)</td>
</tr>
<tr>
<td>Loss of productivity and other factors total 15 million per year.</td>
<td>National Stroke Association</td>
</tr>
<tr>
<td>Risk factors for stroke include: hypertension, heart disease, diabetes, and smoking.</td>
<td>National Stroke Association</td>
</tr>
</tbody>
</table>
Increased age is a significant risk factor for stroke and a persons’ risk of dying if he or she does have a stroke increases with age.

Men are 1.25 times more likely than women to experience a CVA; however, women commonly experience strokes at an older age and thus have a higher mortality rate.

Strokes are classified as either ischemic or hemorrhagic.

Ischemic strokes are the most prevalent type of stroke, as they account for 83% of all cases. Ischemic strokes occur as a result of an obstruction within a blood vessel supplying blood to the brain.

The obstruction results from a blood clot (thrombus) or a fatty deposit (atheroma) due to atherosclerosis that breaks off, (becoming an embolus) travels through the blood stream, and lodges in an artery that supplies the brain.

17% of stroke cases are hemorrhagic, which are caused by a weakened blood vessel that ruptures and bleeds into the surrounding brain.

There are two types of weakened blood vessels that lead to a hemorrhagic stroke including aneurysms and arteriovenous malformation (AVM).

Years ago, it was believed that the human brain was unable to gain new neuronal connections following a stroke. However, a new phenomenon known as brain plasticity allows the brain to access undamaged neural pathways, which allows clients to regain functions following stroke.

The multidisciplinary team for stroke rehabilitation consists of the following professions: physiatrist, neurologist, rehabilitation nurse, dietician, social worker, neuropsychologist, case manager, speech-language pathologist, physical therapist (PT), and occupational therapist (OT).

<table>
<thead>
<tr>
<th>Team Members</th>
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<tbody>
<tr>
<td>The following is a list of possible team members you may be working with:</td>
</tr>
</tbody>
</table>

1. A **physiatrist** specializes in rehabilitation following injuries, accidents, and illnesses.

2. A **neurologist** specializes in the prevention, diagnosis, and treatment of stroke and...
other diseases of the brain and spinal cord.

3. A **rehabilitation nurse** specializes in helping people with disabilities; helps survivors manage health problems that affect stroke (i.e. diabetes) and adjust to life after stroke.

4. The **dietician** teaches survivors about healthy eating and special diets.

5. The **social worker** helps survivors make decisions about rehab programs, living arrangements, insurance, and support services in the home.

6. The **neuropsychologist** diagnoses and treats survivors who may be facing changes in thinking, memory, and behavior after stroke.

7. The **case manager** helps survivors facilitate follow-up to acute care, coordinate care from multiple providers, and link to local services.

8. The **speech-language pathologist** helps stroke survivors’ re-learn language skills.

9. The **physical therapist** helps stroke survivors with problems in moving and balance.

10. You, the **occupational therapist** help stroke survivors learn strategies to manage daily activities such as eating, bathing, dressing, writing, and/or cooking.
REFERENCES


CHAPTER V

SUMMARY

Overview

The purpose of this Scholarly Project was to develop and integrate an educational module for OT students to provide additional information on CIMT. The educational module is intended to be a valuable tool for the occupational therapy student and instructor. This educational module will expose students to a reemerging treatment area by providing ample lecture and hands on material. An extensive literature review was completed utilizing pertinent online databases and textbooks.

Information accumulated from the literature review guided the development of the educational module. The educational module was divided into four units to separate the primary areas of information and facilitate students learning. Malcolm Knowles Theory of Andragogy guided the development of the educational module.

Limitations

The educational module has some limitations. The first limitation is that this educational module is not all-inclusive, as it is only an introduction to the treatment. Additionally, there is a limited amount of occupational therapy literature pertaining to CIMT, with the majority of the research contained in physical therapy journals. Finally, occupational therapy instructors may be challenged to incorporate the educational module, due to the amount of class time the new information requires.
Implementation

The module will provide students with introductory knowledge pertaining to CIMT protocol. The educational module can serve as a resource for occupational therapy students when integrated within the OT 453 Physical Dysfunction course. If integration within the curriculum is not feasible, the educational module can be utilized as an independent study. Students can also use the module as a resource during their Level II Fieldwork or as an occupational therapy practitioner.

Conclusion

Integration of this educational module will provide students with additional learning opportunities that they otherwise may not receive. Exposure to CIMT within the academic setting may contribute to a better-rounded student and add to a student’s confidence upon graduation. Clients who have experienced a stroke will also benefit from students receiving exposure to CIMT within the academic setting, as they are familiar with another treatment that can be implemented once stroke survivors have reached a plateau with traditional interventions. Integration of this educational module will provide the University of North Dakota with the opportunity to offer the most current interventions to occupational therapy students. Lastly, effectiveness will be measured by student completion of the standardized course evaluation specifically in regard to the CIMT educational module.

Recommendations

Currently, the majority of the literature pertaining to CIMT is contained within physical therapy journals, which illustrates a lack of research and publication from an occupational therapy perspective. Therefore, it is recommended that more research
pertaining to CIMT be conducted by occupational therapists to illustrate that the profession is competent with provision of this intervention. Thus, future scholarly projects could emphasize the efficacy of occupational therapy with CIMT.
REFERENCES


