**Title and Focus of Activity:** Variables that Affect Practice and Learning (VAPAL) Case Presentation

*Linking foundational and clinical sciences*

**Contributor(s):** Clare C. Bassile PT, EdD, [ccb2120@cumc.columbia.edu](mailto:ccb2120@cumc.columbia.edu)

Columbia University-Program in Physical Therapy

**Course Information**: Movement Sciences; 2 Units; Spring Semester of DPT first year.

The students are concurrently enrolled in: Neural Sciences, Procedures (basic transfers, bed mobility and gait instruction), Therapeutic Exercise (general principles for flexibility, strengthening (open & closed chain), aerobic conditioning) Pathology, and K & B II (gait).

**Learning Activity Description**

Context: During the course, the stages of learning are covered in detail (action, movement and neuromotor processes level) along with separate lectures on the variables that affect practice and learning. After this section of the course is completed, students present their cases as described here.

Purpose: The students should fully understand and demonstrate how one would employ a particular VAPAL during the execution of an activity based intervention with a patient example. The activities are those that they are learning in their procedures course (concurrent course).

VAPAL Case Presentation:Groups of students will each be given a patient case for which they will develop an intervention program illustrating a particular variable of practice and learning (VAPAL). The group will demonstrate the intervention program to the class on a specified day. The intervention should only address the specific task that each case is requested. It is **not** to be a comprehensive plan of care.

Sample Case for Contextual Interference

[*A sample case is provided at the end of the document, but instructors can create a patient case that is applicable to student level. All tasks emphasized are ones that require intervention for the patient is not independent. Therefore, the instructor can vary the level of assistance/guarding required.]*

Pt is a 25 year old right hand dominant graduate student with dx of MS. Admitted to acute care hospital for IV steroid treatment 2° exacerbation.

HPI: 2 days prior to admission, while studying for finals, pt noticed tingling in Left LE and Left UE. Symptoms progressively worsened over next two days and also now included weakness/clumsiness of both left extremities. Pt spoke with neurologist who suggested admission.

PMH: dx of MS 3 years ago. Symptoms at that time included optic neuritis and weakness in Right LE. Pt recovered post treatment with IV steroids. Since that time, no admissions.

SH: single graduate student in cell biology. Spends long hours in lab, standing and preparing cultures and slides. Pt lives in the elevator accessible apartment. Family lives on west coast.

Exam appears WNL except for:

ROM: SLR bilaterally to 80° and DF to neutral bilaterally

MOTOR: Right side appears 5/5

Left UE- weakness in scapula elevation, protraction, shldr flex/abd/ext (3-), elbow flex/ext (3), wrist & finger flex/ext (3+)

Left LE- weakness in hip ext/flex (4), knee flex/ext (3), ankle PF (3-), DF (4)

Pt demonstrates + finger to nose and heel to shin on Left, positive intention tremor in Left UE & Left LE, decreased rapid alternating movement on Left.

OCULAR FUNCTION & SENSATION: appears intact and bil symmetrical

FUNCTION:

Bed mobility – independent

Transfers – Independent stand pivot transfers bed to chair & w/c to toilet, floor to stand/sit requires external support surface and supervision

Ambulation- with Straight Cane supervision required on level surfaces. Distance -150’ at a time. Gait- wide based, walking path is not straight but weaves in sinusoidal fashion. Patient exhibits excessive left hip, knee and ankle flexion during swing with ataxia and intermittent left genu recurvatum in midstance. Pt’s left UE held in flexion at elbow and fingers during ambulation. Cadence -90 steps/min at comfortable pace.

Stairs- with 1 handrail can ascend/descend 4-6”steps in single step fashion with supervision.

BALANCE:

Sitting- static without loss of balance, dynamic- loss of balance occurs when reaching beyond arm’s length anteriorly in midline and laterally on the left from floor to shoulder height

Standing- feet parallel- static without loss of balance, dynamic- loss of balance occurs when reaching >1/2 arm’s length anteriorly in midline and laterally on the left from shoulder to waist height. Pt unable to reach to floor without loss of balance.

Work on stair training with this patient demonstrating different levels of contextual interference (high vs. low). Provide a transfer task to assess generalizability.

The VAPAL included in the cases are:

1. Practice: amount/selection pressure/independent practice. Create a gait training activity for this patient which emphasizes independent practice and increased practice time. Determine what selection pressure you will emphasize and include it in your instructions to the patient.
2. Contextual Interference (see case below): Work on standing balance activities with this patient utilizing different levels of contextual interference (high vs. low). Provide a transfer task to assess generalizability.
3. Transfer of Training (Adaptive): Work on bed mobility (rolling & supine/sit and return) utilizing adaptive transfer of training principles. What specific parameters will you use to determine how you will increase the difficulty of task? How will you assess its effectiveness?
4. Transfer of Training (Part/Whole): Work on transfers utilizing part vs. whole transfer of training principles. How did you determine which part(s) to work on and how will you put set up the ‘part’ practice and whole practice? How will you assess its effectiveness?
5. Feedback (KR): Work on transfers while providing feedback utilizing knowledge of results to enhance learning. How will you deliver the frequency and timing? How will you assess its effectiveness?
6. Feedback (KP): Work on balance activities in standing while providing knowledge of performance feedback to enhance learning. How will you deliver the frequency and timing? How will you assess its effectiveness?
7. Feedback (Attentional Focus): Work on ambulation activities while providing extrinsic verbal cues (G. Wulf) to enhance learning. How will you assess its effectiveness?
8. Feedback (Manual Guidance): Work on ambulation with this patient and utilize the feedback principle - manual guidance. How will you deliver the frequency and timing? How will you determine its effectiveness?
9. Modeling: (using yourself) Work on bed mobility activities using yourself as the modeler. Highlight to the patient what she should be paying attention to. How will you assess its effectiveness?
10. Modeling: (using another patient) Work on bed mobility activities using another patient with similar sided stroke and impairments as the modeler. Highlight to the patient what she should be paying attention to. How will you assess its effectiveness?
11. Mental Practice: Create a session to enhance gait function in this patient utilizing mental practice. Determine the frequency of practice and other parameters for your patient to independently utilize mental practice while she is resting in her room. How will you assess its effectiveness?

Time for student to complete the activity: Students are required to prepare their patient case (group project) before class (1hr). They then present their patient case to the class (15min).

Readings/other preparatory materials:

Shumway-Cook, A., Woollacott M.H., *Motor Control: Translating Research into Clinical Practice 4th Ed*.), Philadelphia: Lippincott Williams & Wilkins, 2012 Chapter 2 p. 33-45.

Additional papers read by students as these topics are covered in class:

1. Kantak S, Winstein C. Learning-performance distinction and memory processes for motor skills: A focused review and perspective. *Behavioural Brain Research*. 2012;228:219-231.
2. Dayan E, Cohen, L. Neuroplasticity Subserving Motor Skill Learning. *Neuron*. 2011;72:443-454.
3. Bouwsema H, van der Sluis C, Bongers R. Changes in performance over time while learning to use a myoelectric prosthesis. *Journal of NeuroEngineering and Rehabilitation*. 2014;11:16

Identification of the variables

1. Nicholson D.E. (1996) “Motor learning” In CM Fredericks & LK Saladin (Eds*) Pathophysicology of the Motor Systems: Principles and Clinical Presentations* Philadelphia, FA Davis, pp.238 –254.

Attention

1. Wulf, G. Attentional focus and motor learning: A review of 15 years. *International Review of Sport and Exercise Psychology.* 2013; 6:77-104.

Practice (amount, spacing, power law)

1. Stafford T, Dewar M. Tracing the Trajectory of Skill Learning With a Very Large Sample of Online Game Players. *Psychological Science*. 2014;25:511 –518.

Practice Schedule/Contextual Interference

1. Akizuki K Ohashi Y. Changes in Practice Schedule and Functional Task Difficulty: a Study Using the Probe Reaction Time Technique. *Journal of Physical Therapy Science*.2013;25:827-831.

Transfer of Training

1. Wickens C, Hutchins S, Carolan T, et al. [Effectiveness of Part-Task Training and Increasing-Difficulty Training Strategies: A Meta-Analysis Approach](http://apps.webofknowledge.com.ezproxy.cul.columbia.edu/full_record.do?product=UA&search_mode=GeneralSearch&qid=14&SID=2CR15Y5gpAif73FMNVF&page=1&doc=3). *Human Factors*. 2013;55:461-470.

Feedback

1. Capio C, Poolton J, Sit C, Eguia K, Masters R. Reduction of errors during practice facilitates fundamental movement skill learning in children with intellectual disabilities. *Journal of Intellectual Disability Research*. 2013;57:295-305.
2. Winstein C, Pohl P, Lewthwaite R. Effects of physical guidance and knowledge of results on motor learning: Support for the guidance hypothesis. *Research Quarterly.* 1994;65:316-323.
3. Wulf G, Shea CH Principles derived from the study of simple skills do not generalize to complex skill learning. *Psychonomic Bulletin & Review*. 2002;9:185-211.

Modeling

1. Ashford D, Bennett SJ, Davids K. Observational modeling effects for movement dynamics and movement outcome measures across differing task constraints: A meta-analysis. *Journal of Motor Behavior*. 2006;38:185-205.
2. McCullagh P, Weiss M, Ross D. Modelling considerations in motor skill acquisition and performance: An integrated approach. *Exercise and Sport Sciences Reviews*. 1989;17:475-513.
3. Scully D, Newell K. Observational learning and the acquisition of motor skills: Toward a visual perception perspective. *J Human Movement Studies*.1985;11:169-186.

Mental Practice

1. Yaguz L, Nagel, Hoffman H, et al. A mental route to motor learning: improving trajectoral kinematics through imager training. *Behavioral Brain Research.* 1998;90:95-106.
2. Nilsen DM, Gillen G, Gordon AM. Use of mental practice to improve upper limb recovery after stroke: A systematic review. *Amer J Occup Therapy*. 2010;64:695-708.
3. Malouin F, Richards CL. Mental practice for relearning locomotor skills. *Phys Ther*. 2010; 90:240-251.

Learning Objectives:

1. Define the variables that affect practice & learning (e.g. practice amount, attentional focus, contextual interference, transfer of training (adaptive, part/whole), feedback (verbal, visual, manual), modeling, mental practice)
2. Discuss and employ the rules for using those variables in the acquisition of a motor skill.
3. Dramatize/illustrate the application of a particular variable of learning or practice to the relearning of a motor skill and analyze issues surrounding the use of the variable

Methods of evaluation of student learning:

**Rubric**

1. Oriented class to patient using ICF model (2.5 pts)

Only the members of your group know your case, so familiarize the class with the patient (diagnosis, problems, what activity(ies) your group chose to work on etc…)

1. Variable – description, definition, how it’s going to be used in this pt case (5 pts)

Make sure you only manipulate your variable, don’t do any of the other variables. There is no need for PowerPoint displays, but you’ll need to talk to the class and describe your variable and how you’re using it in your intervention.

1. Demonstration of intervention – appropriate manipulation of the variable (2.5 pts)

You’ll need to demonstrate so someone is playing the patient and someone is therapist. Props are encouraged.