**Title and Focus of Activity**: Flipped Classroom Learning for Cranial Nerves

*Examination, Innovation*

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**Course Information:** Neuromuscular Physical Therapy; 4 units; fall of the second year; occurs after neuroscience (which includes neuroanatomy), exercise physiology, fundamentals of Physical Therapy, anatomy, Biomechanics, Musculoskeletal Physical therapy, and Pathology. Students take concurrently with Cardiopulmonary and Neuromuscular Pathology.

**Learning Activity Description:**

Context: Prior to this scheduled activity, students are instructed to read the chapter in their textbook (Lundy-Ekman, 2012) on cranial nerves and review notes on cranial nerve function covered in neuroscience. In addition, a lecture describing cranial nerve function and how to examine cranial nerves, that was provided in class in previous years, is posted for the students to review. (This lecture is no longer delivered by professor to class; hence the “flipped” component.) When the students come to class an in-classroom activity on cranial nerves occurs to facilitate class participation and learning in a “flipped” style. This assignment is given mid-way through the fall semester after their first mid-term exam.

Purpose: The purpose is to facilitate clinical application of didactic information on cranial nerves to described case studies and quiz questions. The format requires interaction of students and engages them in active learning with practical application of material.

Preparation:

* Students prepare for activity ahead of time by reading background information in their textbooks and reviewing a lecture posted on cranial nerves.
* On class day the students (30 in the class) pick a slip of folded paper from a bag. The bag contains slips of 3 different colors of paper numbered 1-10 on each color. The students then sit with the other students in their “group” determined by their paper color. Once seated in their groups, the students are asked to determine who is first in their group by referring to the numbers.

The Questions:

* One question for each student (30) is presented on a PowerPoint slide to the entire class (see Appendix A).
* The questions are in multiple choice, short answer and case study format and ask questions about cranial nerve function, clinical testing, impairment and pathology.

# Come to the board and write all cranial nerves in order.

# Describe a clinical presentation (case scenario) when assessment of cranial nerves is warranted.

# Name at least 4 muscles controlled by the oculomotor nerve

# Besides eye muscle innervation, what other functions does CN III have?

# Case Study: A 61 year old female with a history of an R acoustic neuroma presents with R sided facial paralysis and the inability to close her right eye. Which Cranial nerve is likely affected and what may this condition be called?

# The temporalis, medial and lateral pterygoid, and masseter muscles are innervated by which of the following?

## a. Trigeminal nerve, V

## b. Glossopharyngeal nerve, IX

## c. Accessory nerve, XI

## d. Facial nerve, VII

## The facial nerve innervates which of the following?

## a. Muscles that close the eyes, move the lips, and produce facial  expressions

## b. Sternocleidomastoid and trapezius muscles

## c. Masseter, pterygoids, and temporalis

## d. Both a and b

## Which reflex (es) involves the optic and oculomotor nerves?

## a. Pupillary

## b. Consensual

## c. Accommodation

## d. All of the above

# Describe the pupillary reflex

# Describe the consensual reflex

# Describe the accommodation reflex

# What are the three sensory branches of the trigeminal nerve? How can they be tested?

# Case Study: A 78 year old male trips and falls down the steps. He reports the mechanism was visual impairment. Which muscle enables eyes to look downward and inward and which cranial nerve innervates this muscle?

# Case Study: This 35 year old male is unable to abduct his left eye and complains of diplopia following a mild stroke. Which cranial nerve is affected?

# What symptoms would manifest after a complete lesion of the vagus nerve?

## a. Compromise of both the gag reflex and the swallowing reflex; decrease in salivation

## b. Atrophy of the ipsilateral tongue

## c. Difficulty speaking and swallowing, poor digestion, asymmetric elevation of the palate, and

## hoarseness

## d. Paralysis of the ipsilateral sternocleidomastoid and trapezius muscles

## Which two cranial nerves are myelinated by oligodendroglia instead of Schwann cells and are therefore more vulnerable to diseases like MS?

##

1. Which cranial nerve that carries sensory information does NOT travel through the
 thalamus?

## a. Trigeminal nerve, V

## b. Glossopharyngeal nerve, IX

## c. Olfactory, I

## d. Optic, II

## 18. Which cranial nerve innervates the Tensor tympani muscle-within auditory system which dampens ossicular chain to protect inner ear from loud sounds?

## a. Vestibulocochlear, VIII

## b. Olfactory, I

## c. Facial, VII

## d. Trigeminal nerve, V

## Case Study: A 50 year old female reports dysequilibrium, tinnitus, impaired hearing and dizziness following recovery from the shingles. Which cranial nerve is likely affected?

## Which cranial nerve(s) carry only sensory information?

## Which cranial nerve(s) carry only motor information?

## Which cranial nerve(s) carry mixed sensory and motor information?

## Which cranial nerve(s) have parasympathetic innervation?

## What condition appears present in the left eye of this person and which cranial nerve is likely responsible?

## Which cranial nerves are connected to the medulla?

## a. I, II

## b. II, III, IV

## c. V, VI, VII and VIII

## d. IX, X, XI, XII

# How can cranial nerve XI be tested?

# How are results interpreted?

# Reading this number would test which cranial nerve? (picture on slide showing number that is colored to test for color blindness)

# When testing cranial nerves, your patient’s tongue deviates toward the right when asked to stick out her tongue. Which cranial nerve is most likely affected?

## a. Right CN V

## b. Left CN IX

## c. Right CN XII

## d. Left CN XII

# 30. What term describes difficulty speaking? Name all cranial nerves that contribute  to normal speech production.

###  a. Dysarthria; CNs V, VII, X, & XII

###  b. Dysphagia; CNs V, VII, X, & XII

###  c. Dysarthria; CNs III, V, XI, & X

###  d. Dysphagia; CNs II, VII, IX, & XI

The Activity:

* The first person in the first group (has #1 on their teams color slip) has the opportunity to “take” or “pass” the first PPT question posted on the screen. If they pass the question it goes to the next person in their respective group with the next number. If that person can’t answer the question anyone else in the group has a chance but for less points.
* The second, third and fourth teams follow the same instructions. The class, in their four teams, continue to rotate through all 30 questions/cases and is scored on performance.
* The students are instructed NOT to have any books, phones or notes present on their desk to make the activity reflective of their current knowledge. When it is their turn they are instructed to make sure it is an individual effort until “passed” to another member of the team. The instructor monitors to be sure there isn’t discussion within teams when answering questions.

Scoring:

* If the first person in the group to receive the question answers correctly, their team receives 5 points; if the question gets “passed” to the second person and they answer correctly their team receives 3 points; if the first and second teammates miss the question but it is answered correctly by a third team member the team is awarded 1 point.
* The game continues until all class members originally receive one question (30 questions).
* When all 30 questions have been answered the total score is tallied and one team is declared the winner. A prize is awarded to the winning team. Once the “prize” was a hard copy of the questions with answers to study for the final. (We do not provide hard copies in class.)

Application/Assessment

* Following the activity, students participate in a cranial nerve lab where they practice completing a cranial nerve screen on each other.
* Students have final exam test questions on cranial nerves to assess knowledge.
* During their final practical exam each student must test at least one randomly assigned cranial nerve and be able to describe a normal/abnormal finding on a simulated patient.

Time for student to complete the activity: Preparation for activity before class: 2 hours; Class time completion of the activity: 90 minutes

Readings/other preparatory materials:

Lundy-Ekman L. *Neuroscience: Fundamentals for Rehabilitation,* Fourth Edition. Philadelphia, PA, W.B Saunders, 2012; Chapter 14.

Learning Objectives:

1. As part of the Tests and Measures portion of a physical therapy examination, the student will successfully perform a screen of cranial nerves on a simulated patient.
2. When provided with a description of a simulated impairment involving the function of one or more cranial nerves, the student will correctly describe the impairment and the correct corresponding cranial nerve.
3. The student will be able to describe all cranial nerves and their function(s).
4. The student will describe which cranial nerves are sensory, motor, mixed and/or have involvement with the ANS.

Methods of evaluation of student learning:

5 multiple choice questions on cumulative final exam; each worth 2 points.

One component (worth 20 points) of final practical exam scored by the following rubric:

**Student is able to correctly test cranial nerve function (10 points total)**

 Provides appropriate instructions to simulated patient (5 points)

 Correctly assesses described cranial nerve function (5 points)

**Student is able to correctly identify normal/abnormal function (10 points total)**

Student correctly describes how normal function will appear (5 points)

Student correctly describes pathology and how it would present (5 points)

**Total 20 points total (built into score of final practical exam)**

*1 point deducted when minimal cues needed to complete*

*2 points deducted if student requires moderate cues to complete*

*3 points deducted if student requires maximum cues to complete*

*0 points if student is unable to perform with maximum cues*