THE STAGES OF LEARNING
Distinct performance and performance characteristics change during skill learning
FITTS & POSNER’S MODEL

- Cognitive Stage
  - Performers characteristics are:
  - What should professionals do at this stage?

Continued
FITTS & POSNER’S MODEL

- Associative Stage
  - Performer’s characteristics at this stage are:
    - What should professional do at this stage?
FITTS & POSNER’S MODEL

- Autonomous Stage
  
  - Performer’s characteristics at this stage are:
  
  - What should the professional at this stage do?
GENTILE’S MODEL

- Initial stage (Getting the Idea of the movement)
- Later stage (fixation/diversification stage)
At the Initial Stage of Learning

Beginner needs to explore a variety of movement possibilities.
- trial & error
- self-discovery
- problem solving

Provide a practice that:
- Have the learner focus on achieving the action goal & allow the development of the basic movement.
- provide a practices where regulatory and nonregulatory characteristics can be discriminated
Regulatory versus non-regulatory conditions

- Provide practices that provide opportunities to discriminate regulatory from non-regulatory conditions?
  - Characteristics in environment which directly influences the movement required to reach a goal are regulatory conditions.
    - Speed of throwing arm
    - Height of tennis net in serving
  - Characteristics in environment that do not directly influence the movement required to reach a goal are non-regulatory conditions
    - Color of the ball
    - Playing on grass versus clay in serving
- At end of this stage the learner has developed a movement coordination pattern that allow some action goal achievement.
At the Latter Stage of Practice

- Performer is able to adapt the movement to any performance situation.
- Performer increases their consistency in achieving their goals.
- Person increases their economy of effort in performing the movement.
At the Latter Stage of Practice

If it involves a closed Skill – movement become fixated (e.g. draw in archery), that is, he/she refines the movement so the goal:
- is consistently achieved (e.g. changes the stance in archer so he/she can shoot to different target sizes)
- performed with little, conscious effort and minimum energy.

If it involves a open skill – movement requires diversification, that is, performer can:
- systematically modify the movement pattern according to the environmental demands (e.g. shooting a jump shot from different distance and locations on the court.)
PROFESSIONAL IMPLICATION OF GENTILE’S

- Goal of practice in stage one
  - Develop the basic movement pattern regardless if it is a open or closed skill

- Goal of practice in second stage
  - Closed skills require a structure similar to actual performance
  - Open skills require one to vary the conditions based real life environmental setting.
PERFORMER AND PERFORMANCE CHANGES ACROSS THE STAGES OF LEARNING

- Rate of improvement
- Changes in coordination
- Altering an old or preferred coordination pattern
- Muscles used
- Energy cost

- Achievement of kinematic goals
- Visual attention
- Conscious attention
- Error detection
- Changes in brain activity
Rate of Improvement

- Negatively accelerated pattern is more typical of motor skill learning than other patterns.
  - Early in practice we experience a lot of success but later in practice amount of improvement rate decreases. (Snoddy’s Power law of practice)
  - The rate in improvement is task specific
Change in movement coordination

- We need to free the degrees of freedom so movement can be fluid.
- At the beginning, our limb-segmentation (joints and muscles) are frozen (move as one unit)
- Later in learning, our limb-segmentation becomes functional or unfrozen (move in a cooperative way)
- E.g. soccer kick & stroke patients sitting to standing and then to sitting involving hip and knee joints
Altering an old or preferred coordination pattern

- We possess a preferred way to perform many motor skills.
- When acquiring a new coordinated pattern to a already learned skill there is transition period.
  - We will resist for period of practice (continue to perform in the preferred way - biases)
  - There will be period of instability in limb movement.
  - Eventually we will adopt the new preferred pattern
- We need to provide extra…extra motivational reinforcement and feedback during this transition period.
Muscles Used

In early practice, muscle activation or involvement is incorrect with increases the number of muscles used to produced a given movement.

In later practice, muscle activation becomes appropriate which reflects a reorganization of the motor control system.

- The muscles are activated accordingly to a specific sequence.
Energy Cost

- Once the muscles are activated accordingly to a specific sequence, the performer is more economical in their use of energy.
- Economy of movement refers to minimizing the energy cost of performing a skill.
  - Physiological energy (oxygen uptake)
  - Mechanical energy (calories cost)
- Across practicing a complex skill, decrease in energy cost and rate of perceived exertion where as mechanical efficiency increases.
Kinematic goal changes

■ Displacement, velocity, and acceleration defines the spatial and temporal features of the performance

◆ Spatial features (displacement) of the skill is achieved first then temporal features (velocity and acceleration).

★ Implications are to focus on spatial features in the beginning and temporal features later.
Visual Selective Attention

In review,

- Beginners look at too many things whereas high skill performers direct their attention to appropriate environment cues.
- Experienced Soccer goalkeepers' eye fixations were less but were longer in duration, located the ball faster, better in predicting ball direction, etc... then inexperienced soccer goal keepers.
Conscious Attention

- Early in learning, learner consciously thinks about every part of the skill

- Late in practice, learner amount of conscious attention diminishes to a point where they perform the skill automatically.
Error Detection*

- Ability to detect and correct one’s error major characteristic of highly skilled performers.
- Major determining factor in the learner between early and latter stages of practice
Changes in brain function

- Brains area of activity changes during early stages of learning to that of later stages of learning.
  - Brain network is principally involved in stimulus identification and controlling movement during the early stages of learning (cortico-cerbellum-thalamic loop).
  - Brain network is principally involved in planning during later stages of learning (cortico-basal ganglia-thalamic loop).
EXPERTS

- One becomes experts from practice
  - How much practice is need?
- Experts knowledge is more conceptual than novice
  - Expert solve problems and make decisions faster.
- Experts know how to perform in a specific situations
- Experts “see more” and anticipate the actions of others by experience not visual acuity.
- Experts can correct their own errors.
How much does it take?

“In well-established domains of expertise, even the most talented cannot reach an international level in less than approximately a decade of experience and intense preparation.” (Ericsson & Lehnmann, 1996)

The only way to achieve an expert level is through *deliberate practice*. 
Deliberate Practice  (Starkes & Ericsson, 2004)

Continued to search to find a better methods to perform the skill(s)
Access to sound training resources
Control over aspects of practice
Viewed practice as playful experience
Have well-defined goals.
Provided feedback about their goals
Ample amount of repetition
Involved in problem solving

*Extensive quality and amount of solitary practice*
Can we predict one potential from initial practice?

Three approaches to answer this question:

- Examine the relationship between initial practice to later performance.
- Examine the relationship of every trial from the beginning to later performance.
- Examine the relationship of performance across practice to changes in underlying motor abilities changes across practice.
Results using these approaches

- First approached indicated that relationship between initial to late practice was about the same as flipping a coin and calling heads or tails.
- Second approach looking at each trial across practice indicated that early practice is a poor predictor of performance later in practice.
- Third ability – performance approach indicated prediction was impossible from early to later practice.
What’s the point?

Don’t be fooled or discouraged by initial performance practice results.

We should be aware of coordination pattern changes in performance to give us cues on the rate of learning.

We should rely on task analysis (Gentile’s model) in providing developmentally appropriate activities during early and late practice.

Screening tests to assess potential performance success needs to be task specific not general and conducted by skillful performers or professionals who know.
The End