Practice Variability & Practice Specificity

Variability in practice conditions is important for learning motor skills.
PRACTICE VARIABILITY

- Refers to the variety of movement and context characteristics the learner experiences while practicing a skill.
  - Key predictor according to motor program theory (Schmidt) of successful future performance depends on the amount of variability the learner experiences during practice.
  - Dynamic pattern theory stress the learner’s need to explore and discover …..
BENEFITS OF PRACTICE VARIABILITY

- Increases the capacity to perform the skill in a future test situation
  - Compare effects on retention or transfer tests of constant practice to those of variable practice.
  - Performers who experience more variability learn more (Schema Theory hypothesis by Schmidt)
Variability Hypothesis Support

- Shea & Kohl studies compared constant to variable practice conditions in producing force.
- Shoenfeld et al basketball freethrow study comparing constant to variable practice conditions.
- These studies results involving retention and transfer tests confirmed the variability hypothesis.
IRONY OF PRACTICE VARIABILITY

- Practice variability will produce more performance errors during practice and learning.

- But research shows that the learner is more accurate when performing a future novel transfer task (Edwards & Lee, 1985).
IMPLEMENTING PRACTICE VARIABILITY

- First step is to assess the skill in degree of being closed or open.
- Second step is determining the physical context and skill characteristics of the future situation (e.g. game, contest) in which the learner will perform the skill(s) so the teacher, physical therapist, or exercise leader can determine what type of practice is needed.
Implementing Practice Variability

Second step is based on one’s assessment of the features of the performance context:

- Regulatory conditions (directly influence the movement characteristics)
- Nonregulatory conditions (indirectly influence the movement characteristics)
HOW SHOULD ONE PRACTICE A CLOSED SKILL?

- Depends on degree of intertrial variability of physical context and skill
  - Closed skills that do not involve intertrial variability of regulatory conditions, regulatory conditions should remain constant, but nonregulatory conditions should vary.
  - Closed skills that do involve intertrial variability, both regulatory and nonregulatory conditions should be varied in practice.
HOW SHOULD ONE PRACTICE A OPEN SKILL?

- The performer must perform variations of the skill never made before within changing context when performing.
- Practice needs to include experiences with regulatory characteristics that change from one attempt to another.
ORGANIZING VARIABLE PRACTICE

- Variable practice can involve more than one skill in a practice session.
- One way to solve this practice schedule problem is to understand the concept of *contextual interference*.
- *Contextual interference* is the interference that results from practicing various skills within the same context of practice.
Continuum of Contextual Interference Effect

Low Contextual Interference
- Schedule that organizes the practice of each task in blocks, or units, of time.

Serial
- Schedule that organizes the practice of tasks in set order

High Contextual Interference
- Schedule that organizes the practice of the tasks in random order
# Contextual Interference Practices

## Table of Practice Types

<table>
<thead>
<tr>
<th>Practice Type</th>
<th>Time</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
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</thead>
<tbody>
<tr>
<td><strong>Blocked practice</strong></td>
<td>30 min</td>
<td>All overhand</td>
<td>All overhand</td>
<td>All underhand</td>
<td>All underhand</td>
<td>All sidearm</td>
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<tr>
<td><strong>Random practice</strong></td>
<td>5 min</td>
<td>Underhand</td>
<td>Overhand</td>
<td>Sidearm</td>
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<td>Sidearm</td>
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<td>Underhand</td>
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<tr>
<td><strong>Serial practice</strong></td>
<td>5 min</td>
<td>Overhand</td>
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CONTEXTUAL INTERFERENCE EFFECT

- High contextual interference results in better learning of the task variation than a low amount
- Low contextual interference inhibits performance in novel performance contexts
CONTEXTUAL INTERFERENCE EFFECTS OUTSIDE THE LAB

- College women in random practice of three badminton skills outperformed the blocked practice group (Goode & Magill)
- Baseball hitters in random practice of three types of pitches outperformed the blocked practice schedule (Hall & Others)
- Other studies in basketball, tennis, volleyball and rifle shooting found similar findings.
Physical Therapy Example

- Hanlon (1996) rehab study with hemiparetic arm patients comparing random to block practice schedule.
  - Retention tests shows that random groups performed a 5-step sequence better than blocked practice group.
WHY DOES THE CONTEXTUAL INTERFERENCE EFFECT OCCUR?

- Elaboration hypothesis (Morgan, 1979)
  - Random practice engages one in more strategies
  - Performer retains in working memory all the skill variations
  - Performer develops a memory representation of the skill

- Action plan reconstruction hypothesis
  - Random practice requires performers to reconstruct an action plan for each practice trial
  - Performer engages in more problem solving
Practice Specificity

- Oldest principle of human learning
- When more of the elements of two skills or situation have in common, the greater the amount of transfer (Identical elements theory).
- Three characteristics of Practice specificity that applies to motor skills:
  - Sensory/perceptual similarity
  - Intentional & incidental remembering
  - Similarity of cognitive processing
Sensory/Perceptual Information

- Learning a motor skill is specific to the sources of sensory/perceptual information available during practice:
  - Visual sensory feedback is important in the early stages but diminishes in importance with more practice and is replaced by proprioceptive feedback.
  - If one has vision early in practice, vision remains an essential source of sensory information throughout the stages of learning.
  - Observing a skill performer influences one performance.
Intentional & incidental remembering

*Intentional remembering* is where I refer you to exact information about the performance or situation I want you to remember.

*Incidental remembering* refers to information that you remembered that was nonessential parts of the performance or situation.

*e.g. I ask you to estimate the speed of your serve in tennis.* One can also report the speed (intentional) but also the where the ball landed in the serve (incidental).
Incidental Remembered Information

- Research consistently shows that characteristics of a practice environmental context that are not part of the skill to be learned becomes part of what gets learned (Wright & Shea, 1991, 1994).
  - The point is people learn more about the context than they are explicitly instructed to learn.
  - When these incidental parts occur during a test, they become cues, or aids, to help retrieve of information related to performance.
  - Practice should included as many features of the test environment as possible in practice.
Similarity of Cognitive Processes

- Transfer appropriate processing concept

- When a person is learning a skill in practice that requires the same type of cognitive processing activities that will be required in a testing situation.
Practice variability vs. Practice specificity

- These two concepts seemly conflict with each other but:
  - Practice variability relates to movement characteristics of the skill performed in practice.
  - Practice specificity relates to practice characteristics such as
    - Sensory-perceptual information
    - Environmental context
    - Cognitive processes
- If we apply practice specificity principles to learning a motor skill, the typical result is the skill improves in practice but poor adaptability results occur.
Summary & Application

- Performing the skill to be learned in a variety of ways maximizes performing it in future test situation or real life situations.
- Assess how the skill is performed in real life situations and determine the type of practice based on whether the skill is an open or closed.
- Early in learning or relearning a skill start with blocked practice then once they attain a degree of success move them to serial and/or random practice.
Summary & Application

- Practice specificity improves the skill but does not assure one that the performer will be able to perform the skill in a real life or game situation.
- Best practices or learning occurs when one applies practice variability, contextual interference, and practice specificity.