Motor Skill Learning for Effective Coaching & Performance

Chapter 2

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*.

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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

+ Phases of Motor Skill Learning

- Cognitive Phase

  - Athlete

  - Coach

Phases of Motor Skill Learning

- Associative Phase

  - Athlete

  - Coach

+ Phases of Motor Skill Learning

- Autonomous Phase

  - Athlete

  - Coach

+ Practice Organization

- Practice Variability

- Contextual Interference

- Practice Specificity

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
  - Dynamic pattern theory stresses the learner's needs to explore and discover which increases there potential to perform.

Practice variability hypothesis

- Learning is the greatest when one performs the skill in a variety of ways and/or contexts rather than one way and/or one context.

BENEFITS OF PRACTICE VARIABILITY

- Increases the capacity to perform the skill in a future test situation (e.g., game or contest)

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 and others results involving retention and transfer tests confirmed the variability hypothesis.
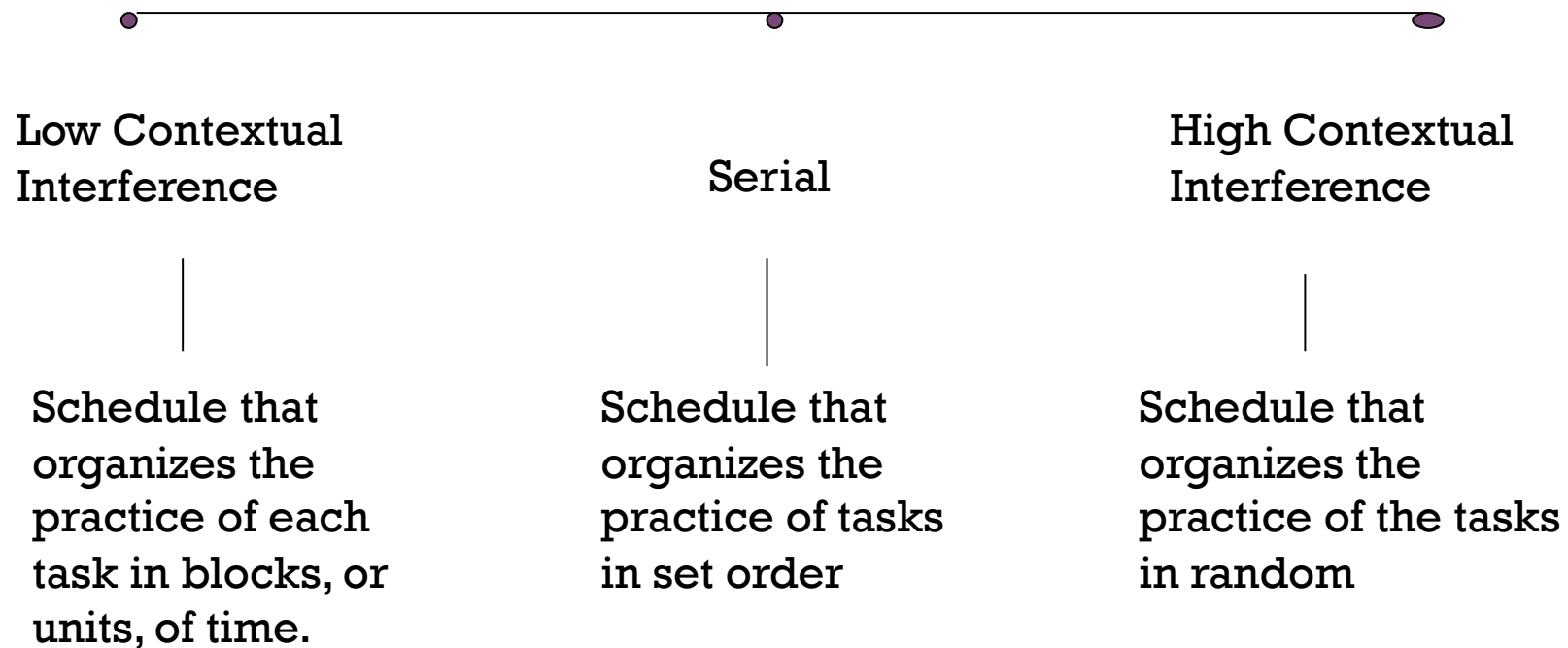
+ IRONY OF PRACTICE VARIABILITY

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

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

ORGANIZING VARIABLE PRACTICE

- Variable practice can involve more than one skill in a practice

- 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

Serial

High Contextual Interference

Schedule that organizes the practice of each task in blocks, or units, of time.

Schedule that organizes the practice of tasks in set order

Schedule that organizes the practice of the tasks in random

Contextual Inteference Practices

		Class day					
		1	2	3	4	5	6
Blocked practice	30 min	All overhand	All overhand	All underhand	All underhand	All sidearm	All sidearm
Random practice	5 min	Underhand	Overhand	Sidearm	Overhand	Underhand	Sidearm
	5 min	Overhand	Sidearm	Overhand	Sidearm	Overhand	Overhand
	5 min	Underhand	Sidearm	Sidearm	Sidearm	Underhand	Sidearm
	5 min	Sidearm	Underhand	Underhand	Underhand	Sidearm	Underhand
	5 min	Underhand	Overhand	Underhand	Overhand	Underhand	Underhand
	5 min	Overhand	Overhand	Sidearm	Overhand	Overhand	Sidearm
Serial practice	5 min	Overhand	Overhand	Overhand	Overhand	Overhand	Overhand
	5 min	Underhand	Underhand	Underhand	Underhand	Underhand	Underhand
	5 min	Sidearm	Sidearm	Sidearm	Sidearm	Sidearm	Sidearm
	5 min	Overhand	Overhand	Overhand	Overhand	Overhand	Overhand
	5 min	Underhand	Underhand	Underhand	Underhand	Underhand	Underhand
	5 min	Sidearm	Sidearm	Sidearm	Sidearm	Sidearm	Sidearm

CONTEXTUAL INTERFERENCE EFFECT

- High contextual interference results in better learning of the task

- Low contextual interference inhibits performance in novel performance contexts (e.g., game or contests)

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.

+ Practice Specificity

- Oldest principle of human learning

- Most practitioners are faced with a common dilemma…..design a practice that best prepares the learner or client to perform in a future "test" or "criterion condition."

Practice specificity

- Franklin Henry 1960's basic assumption is that every skill requires special underlying abilities that is required to perform successfully.

- If the practicing of a task under one set of conditions and then performing it as a criterion task under different conditions (e.g., game or contest) would require a shift in the underlying abilities, *therefore the conditions in practice and "test" should be similar .*

Different types of specificity

- Sensory and motor specificity

- Context specificity

- Cognitive Processing specificity

+ Sensory & Motor Specificity

- Learning a motor skill is specific to the sources of sensory/perceptual information available during practice.

    - Let's say early in practice the performer used visual information primarily to learn a skill…..What would happen to one's performance on a retention or transfer test that required him or her to performing the skill without visual information?

    - It's not surprising that the performer did worse since vision is our dominate source but when the performer becomes solely depended on one sensory source to perform the task then it become a problem.

+ Context Specificity

- During practice we encode information about the skill(s) to perform.

- In a "test" situation we attempt to retrieve the information encoded so we can perform the skill.

- More similar the practice context is to the text context the greater the retention.

- This association between encoding context and retrieval context has become to be know as the encoding specificity principle

- Practical example:
  - Home field advantage. Playing on one's home field or arena has many encoding & retrieval contexts that are similar between practice and the "game," But as many when one playing a does not at home. This may be the reason why playing a home results in more wins.

Cognitive Processing Specificity

- Assumption is that each skill requires their own unique cognitive processes that relate to performing that skill.

- The best practice is when the athlete is learning a skill in practice that requires the same cognitive processing that will be required in "test" situation (e.g., game or contest).

Cognitive Processing Example

- The game of soccer requires fast decision making by the players.
  - The coach designs a "mini type game" situations that requires the player to make the same quick decisions when to pass or kick they would make in the game.
  - Another coach design drills in passing and kicking that are repetitive and sequential but does not require the decision time as compared to how passing and kicking is executed in the game.
  - Which practice is better?

Practice variability vs. Practice specificity

- These two concepts seemly conflict with each other but:
  - Practice variability relates to movement characteristics of the sport skill performed in practice (e.g., we need to have practice of the skill in as many ways as possible).

  - Practice specificity relates to practice characteristics, that is practice is similar to the game or contest).

- Bottomline. If we apply practice specificity principles to learning a sport skill, the typical result(s) is/are the skill (s) improve in practice but *poor adaptability results if it does not include practice variability*.

+ Whole versus Part Practice

- Task Complexity

- Part Methods

  - Progressive Part

  - Pure Part

Whole Versus Part Learning

- Which is better, practice the skill in parts or in it's entirety?

- Practical application in coaching.
  - Should one teach and practice the tennis serve in parts? Or in entirety?
  - Should the gymnastic routine be practiced in parts? Or in it's entirety?

+ Answer depends

- How complex the skill is?

- How organized the skill is?

SKILL COMPLEXITY AND ORGANIZATION

- The organization and complexity characteristics of skill provides the basis of using whole or part practice (Naylor & Briggs)
  - Skill Complexity is how many part or components are in the task
    - Level of complexity relates to level of processing demands on the human performer
  - Skill Organization refers to how spatially and temporally the components are interrelated
    - High organization = high inter-dependency
    - Low organization = low inter-dependency

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+ DECISION TO USE WHOLE OR PART PRACTICE

- *Skills low in complexity and high in organization*
  - *One should practice the skill as a whole*

- *Skill s high in complexity and low in organization*
  - *One should practice the skill using some type of practice part strategy*

Steps to determine if one uses whole or part method?

1. Analysis of skill
   - How many part are their?
   - Are these part dependent upon each other or independent?

2. Evaluate the skill on a continuum of skill complexity from high to low and organization from high to low
   - Most motor skills and sport skills are closer to complex
   - Group parts into natural part to evaluate organization.

+ VARIOUS PART TASK TRAINING APPROACHES

- Fractionalization

- Segmentation

- Simplification

+ FRACTIONALIZATION APPROACH

- Related to bimanual skills where one practices each arm separately before performing with the arms together (asymmetric)
  - Most skills require simultaneously move their arms and legs to achieve a goal.
  - Our limbs like to work together (heavily linked)
  - When ever you have a skill where the each arm (leg) does something different from the other arm (leg) one needs to consider fractionalization part approach.
  - For skills where one hand has a more difficult movement pattern over the other practice should begin with the limb that has the more difficult task

+ SEGMENTATION APPROACH

- Involves separating the skill into parts and then practicing one part.
  - Problem is putting the practice parts back together to perform the skill

- Progressive Part is strategy used to prevent this problem
  - Practice part A then AB then ABC then entire skill

SIMPLIFICATION APPROACH

- Involves reducing difficulty of the whole skill or specific parts of a skill
  - Reduce the difficulty of the objects manipulated
  - Reduce the attention demands of the skill without changing the action goal
  - Provide auditory accompaniment for skills having a rhythmical pattern
  - Reducing speed at which a athlete first practices the skills.
  - Sequencing of task progression (easy to difficult).
  - Simulators and virtual reality environments
  - Do not use miming as a simplification method

+ PROFESSIONAL IMPLICATION

- Determine if the performer should practice the skill as a whole or in parts

  - Whole practice for skills low in complexity and high in organization

  - Part practice for skill high in complexity and low in organization

- Use the various part training approaches in the practice of the skill

- Then have the athlete perform the whole skill but direct the athlete's attention to one aspect or part of the skill that they are having difficulty with.
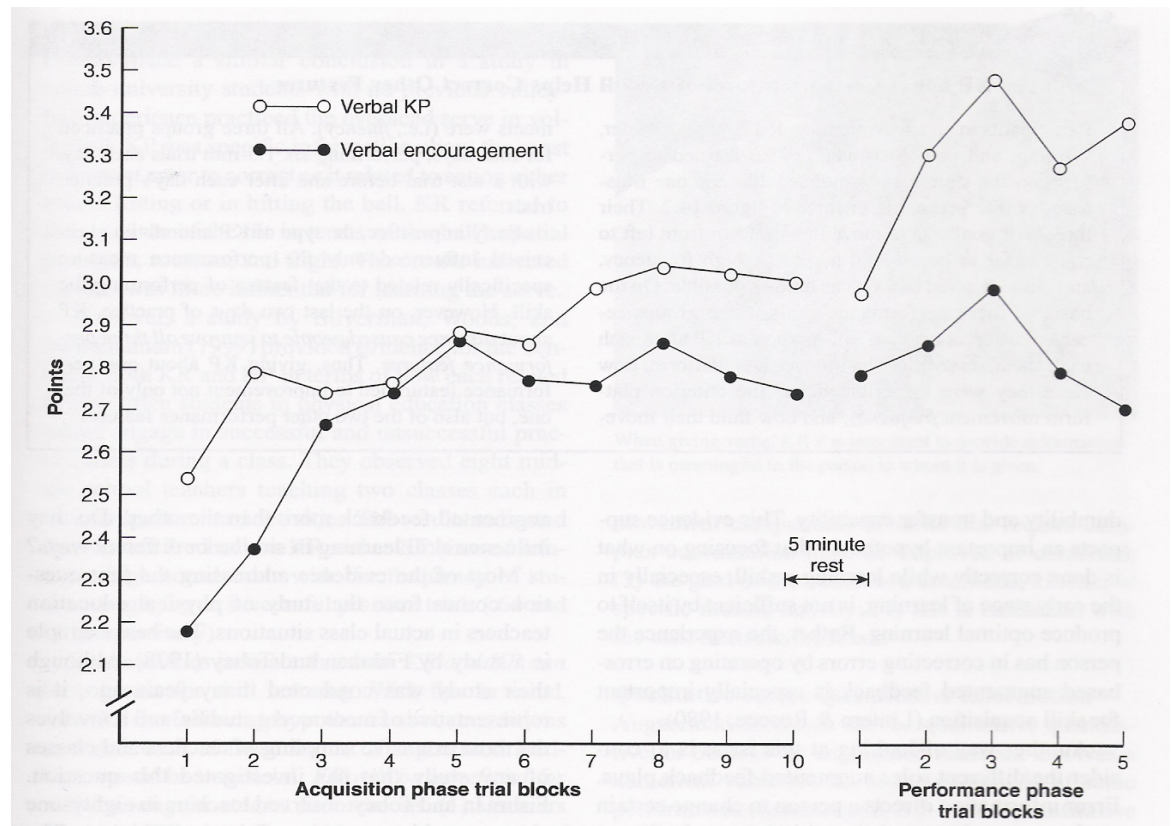
Reinforcement or Feedback

- Reinforcement is usually verbal and is direct to the learner to motivate or maintain persistency in learning a task.

- Feedback can come in many form but directly relates to the performance to the intend outcome and primary guides the athlete to the intended outcome.

Wallace & Hagler's Basketball Study

1. KP group exceeded verbal encouragement initially and later in practice.

2. Verbal encouragement group showed no further improvement.

FEEDBACK

- Two types of performance information

  - Task-intrinsic feedback
    - Sensory-perceptual information that is a natural part of performing the skill
  - Augmented feedback
    - Add-on to task intrinsic feedback
      - Adds to information detected
      - Adds to information one cannot detect

Types of Augmented Feedback

- Knowledge of Results-
  - Externally presented information about the outcome of performing a skill or achieving the goal
  - KR does not describe the outcome, only tells the performer if they achieved the goal

- Knowledge of performance-
  - Information about movement characteristics that led to the performance outcome

Roles of Augmented Feedback

- *Helps the learner achieve the goal more quickly (guidance)*

- Influences the person's perception of his/her own ability in a skill (motivation)

- Improves the chance that the performer will repeat the performance (reinforcement)

How essential is augmented feedback depends on:

- Depends on the skill being learned.

- Depends on the stage of learning

AUGMENTED FEEDBACK IS NOT NEEDED WHEN.

- Skill that inherently provides high amount of task-intrinsic feedback

- Skill that has a detectable external reference in the environment that the learner can use to determine the appropriateness of the action (i.e. targets, basket, goal)

- In observational learning situations
  - Observational learning situations seems to precludes the need for augmentation.

AUGMENTED FEEDBACK HINDERS SKILL LEARNING

When the athlete becomes dependent on augmented feedback which causes he/she not to perform in a test situations.

(Classic example is when the athlete performs well in practice but in a contest or game there performance is worst than practice performance)

When the learner is given erroneous feedback

When the learner is given concurrent feedback but!!!

+ AUGMENTED FEEDBACK IS NEEDED:

- Some situations where sensory information is not available (e.g., athlete cannot see the target or external reference)

- Situations where the athlete is not capable of detecting intrinsic feedback because they lack experience (e.g., early stages of learning or inexperienced athlete).

- In about any complex, multi limb skill where a person is required to attain a certain degree of success simply by making repeated attempts to achieve a performance goals.

+ In Summary

- Deliberate Practice is associated with being an expert sport performer

- Different phases of learning require different interventions by the coach.

- Practice organizations principles affect practice effectiveness.

- Performance feedback has different role.

- Task intrinsic feedback is more important than augmented feedback.

- Augmented feedback when given may help or hinder performance.