ACADEMY OF NEUROLOGIC PHYSICAL THERAPY

ACADEMY OF NEUROLOGIC PHYSICAL THERAPY SYNAPSE ONLINE EDUCATION CENTER

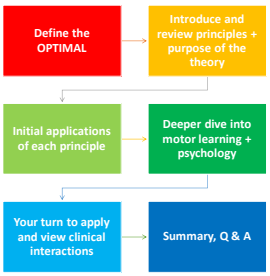
An ANPT Practice Committee "Hot Topics" Webinar

Applying the OPTIMAL: "We believe you can do this!"

Mike Studer, PT, sDPT, MHS, NCS, CEEAA, CWT, CSST, FAPTA

1

Applying the OPTIMAL: Timeline



2

The OPTIMAL Theory of Motor Learning

Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning

Wulf & Lewthwaite, 2016

- Engaged patients learn better
- Autonomy and reward ↑ engagement (success)
- Learning ↑ through external focus (far transfer)
- Engaged, attentive, expect success = ↑ motivation and intensity

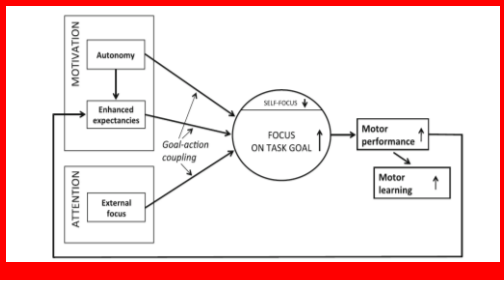
3

The OPTIMAL theory of motor learning

- Optimizing
- Performance
- Through
- Intrinsic
- Motivation (and)
- Attention (for)
- Learning

4

OPTIMAL – A visual depiction



6

What is different when we practice OPTIMAL(ly)?s

- **Autonomy**
- **Enhanced expectancies**
- **External focus**

8

What is different when we practice OPTIMAL(ly)?s

Autonomy
Empowerment
Engagement
Shared decision-making
Team-oriented
Personalized
Self-directed/guided
Agency
Collaborative goal setting
Autodidacticism

9

What is different when we practice OPTIMAL(ly)?s

Enhanced expectancies
Priming
Repetitions
Success
Reward
Self-efficacy
Locus of control

10

What is different when we practice OPTIMAL(ly)?s

External focus
Accomplish the task
Movement specifics emerge from the task, moreso than the feedback
Affordances
Whole vs. part
Results vs. performance?
Summary feedback?
Allows for compensations?

11

Autonomy = What are the options?

- Time of day
- Order of activities
- Ranges, weights, heights, speed, duration
- Music
- Timing for help (assistance, advice)
- Device – what type, when to use, not (FWW, AFO, etc)
- Task difficulty
- Choosing a time out

12

The Value of Autonomy

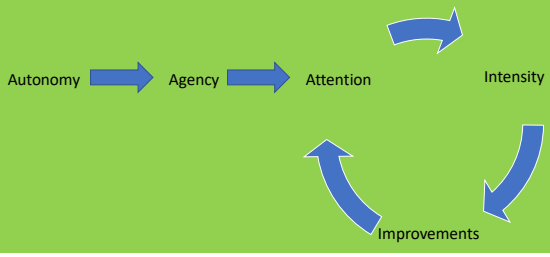
14

Authority: Initial applications

- **Session content/order**, "I have a great plan for you today, but I would like your help in choosing which of these activities we do...."
- **Max capacity**, "Do you feel that you could try this at 2.0mph today?"
- **Permission for authority**, "Would you like for me to help you? (can be cog. or phys. assist)
- **Asking for patient input**, prior to offering your own. "Tell me how that went....Now, how would you like to do it differently next time?"

15

Autonomy is a catalyst for patient engagement



16

Contrary Points: Autonomy

- What if my patient chooses “the wrong thing”?
- What if my patient does not want to choose?
- What if my patient complains that I am not doing my job by having her choose?

17

Enhanced Expectancies - What are the options?

- Compares to self in this health condition (gamification)
- Compares to self in prior life trials, challenges (self efficacy)
- Vicarious experiences, being compared to someone
- Watches others in a group

18

Enhanced Expectancies – examples

Initial exam to progress exam, "My first 2MWT was 168'…and today was 225'? Wow…by next month I will…"

Practice effect in a set, "I balanced for 5 seconds on my L LE that time…that was my best so far. Maybe I can make 10 seconds next visit."

Or…"Okay…that was 11 steps in a row, walking with my cane held off of the floor…I wonder how many I can do?"

19

The power of recent success = Enhanced Expectancies

- You just took 8 steps in a row with your eyes closed at 2mph….that is 4 more than last time. How many do you think that you will get next time?
- This CB has never intercepted a pass from you. You have thrown 4 TDs on him
- Each visit, I have gained in knee ROM…
- Last session, you got up from a 27" high surface without using your hands...
- The last time I had BPPV, Marlene repositioned it in one session
- Last year, I got a raise because I had a perfect 5.0 star rating from my patients
- I should be able to keep my balance, I did this in therapy many times…

20

Use EE to *reverse* the power of negative thoughts…

- …you are running as hard as you can and are in the bottom 10%"
- Seeing other runners pass you or pull away
- Getting a bad grade on your last pop quiz
- Falling forward with injury the last time you ____ (got up from this chair, went down these stairs)
- Got into an accident when you drove on an icy street
- Dropped a perfectly thrown pass
- Forgot where you parked your car twice in 1 week
- Criticized at school or work for a project that you were responsible for

21

Enhanced Expectancies: Early Experiences



22

Neurophysiologic benefits: enhanced expectancies

"Forcing novices to succeed"

…when they **expect** to succeed, they:

1) Try harder and pay more/full attention
2) Try to beat their own expectations
3) Try to exceed ***your*** expectations
4) Receive dopamine, reinforcing learning
5) Can tolerate losses/failed attempts later in learning, better

23

The power of self efficacy…related to EE

I have been through challenging times and overcome in the past

I see other people like me, improving. I can too.

People have challenges in life. I am the kind of person that can handle this.

24

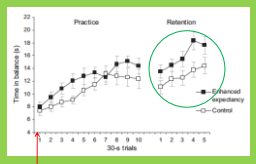
Contrary Points: Enhanced Expectancies

- Should our patients have a false sense of success?
- What happens when they expect success and do not achieve it?
- Can one become addicted to success and crash when not experienced?
- Are EEs merely a placebo effect?
- Does our feedback after a task, "good, yes, well done, nice", promote EEs?

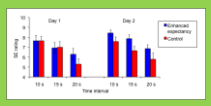
25

Enhancing expectancies through vicarious experience …

Participants
Women, 60-74 years



- Enhanced expectancy
  'Active people, with your experience, usually do well on this task"



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27

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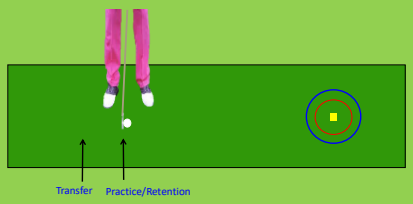


Groups

- **Large circle**: Balls ending up in the BLUE circle are considered "good" trials
- **Small circle**: Balls ending up in the RED circle are considered "good" trials

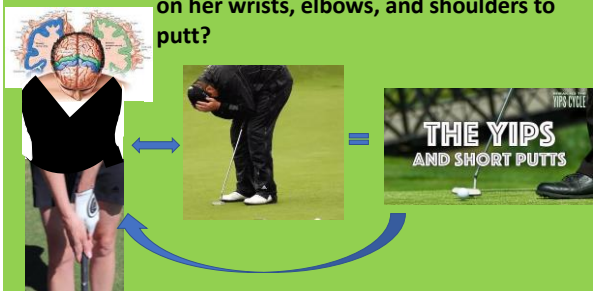
28

External Focus – Task oriented motor control

- Should we focus on the movement(s)…or the goal?
- Is there a time when each is superior over the other, in learning?
- Are there dangers in pursuing either at the full exclusion of the other?
- What are the neural correlates to internal vs. external focus?
- What remains/persists after a lesion (stroke, other) in the motor cortex?
- Can we use goal-directed movements (procedural memories) to ***re-learn***?

30

What happens when our golfer focuses on her wrists, elbows, and shoulders to putt?



31

External Focus: Applications

- Driving/visibility
- Sport/goal (FT or penalty)
- Instrument (string)
- Assembly line
- Fine motor/craft
- Function
- **External focus on posture after stroke**
- **Gait training goes external!**

34

Contrary Points: External Focus

- Does focusing on a goal exclude movement quality?
- Are people across the learning continuum ready for EF full time?
- Can patients give their own movement-based feedback?
- Are we and how do we *never* cue about movement?
- How do novice learners acquire technique?

35

The OPTIMAL – restated and summarized

Optimizing
Performance
→ Early success primes learners expectations

Through
Intrinsic
Motivation (and)
→ Expectations + autonomy permit greater intensity in practice, remove mental (motor control) barriers

Attention (for)
Learning
→ Permanent changes (learning) require motor schemas built on repetitions with success and goal-directed focus

36

Autonomous Support (AS)
Enhanced Expectancies (EE)
External Focus (EF)
The Deep Dive

- Advanced concepts
- Neurophysiology
- Applications

37

Perceived exertion drives dosage: "Autonomy + Borg = Prescription"

History of Borg scale: "*Give me your rating*"

Novel/OPTIMAL application: "***Let's use your rating to create your dosage***"

- Cardiovascular workload (duration, % max, mode)
- Strength workload
- Balance (Espy, et al): Rate of Perceived Stability
- Future applications:
  - Gait speed
  - Percentage error

38

Autonomous Support: Applications

Patient chooses:

- Constraint (speed, weight, no device, no hands, eyes closed, with head motion, cushion, etc)
- Order of practice
- When to get feedback
- Level of difficulty or accuracy expected

Patient is MORE LIKELY to experience, when they set the parameters for the task:

- **Operating at a higher level of difficulty* or intensity**
- **A new PR in objective measures**
- **Enduring longer than expected**
- **Willingness to struggle longer (AND persevering), knowing that they can choose**

*Perceived exertion becomes a measure for dosage

39

Benefits of autonomous support

Psychologic

Reduced:

- **Fear**
- **Confusion**

Increased:

- **Self efficacy**
- **Awareness**
- **Safety/control**

Physiologic

Reduced:

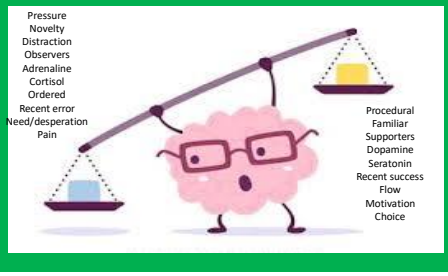
- **Cortisol** (Montoya et al., 2014)

Producing or allowing increased:

- **Serotonin**
- **Endorphins**
- **Neurotransmitter**
- **BDNF**

40

Intensity AND autonomy matter – cortisol influences each



41

Perceived exertion drives dosage: "Autonomy meets the Borg scale"

- History of Borg scale
- Applications cardiovascular workload
- Strength workload
- Cognitive challenge (ADL, speech, IADL)
- Balance (Espy, et al)
- Future applications:
  Gait speed, sit to stand height
  Difficulty of reading, naming or swallowing (texture)
  ADLs in complexity, time, memory, or surface

42

Espy, D. (2014)
Used with personal permission

43

Applying Autonomy (AS)

- Patient involvement without patronizing
- Teamwork does NOT mean loss of agency
- Offer choice considering reality and personality
- Patient feedback order consideration
- The fine balance of "value, choice and copay"

44

Enhanced Expectancies (EE)

- Reinforcing vicarious experiences: PT + patient
- Recalling recent gains prior to the next trial
- Affirming language **(~~I want, you should, must~~)**
- Dyad training
- Videotape support
- Personalizing the dosage: frequency of success
- Priming for the next repetition

45

How does one regain their independence?

- **Autonomy** – "I want to walk without help"
- **External Focus** – "I need to make it to my mailbox"
- **Enhanced Expectancies** – "I am walking farther each day"

46

Enhanced Expectancies = MORE than "placebo"

49

Priming = Placebo = EE?

THE ART OF PREVIEWING A STIMULUS OR MOVEMENT, IN AN EFFORT TO MORE COMPLETELY SOLIDIFY THE UPCOMING SENSORY OR MOTOR EXPERIENCE

YOUR PAST EXPERIENCES PRIME YOU…

"I HAVE BEEN SUCCESSFUL AND EXPECT TO BE SUCCESSFUL"

50

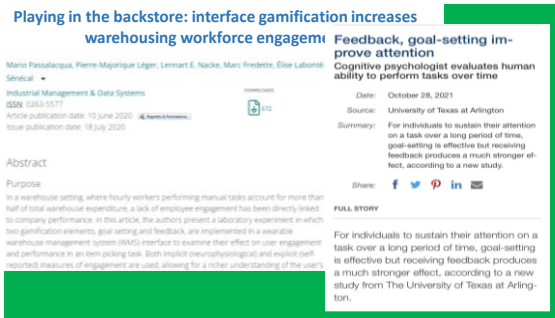
EE and a "surprising" success…

"Although rewards have objective, physical, and chemical properties, their value is defined by the needs of the individual decision maker and thus intrinsically subjective.…The data suggest that both **subjective perception** and **physical presence of a stimulus** are necessary to evoke dopamine responses, whereas physical presence alone is insufficient." (Schultz, 2013, pp. 231-232)

Schultz, W. (2013). Updating dopamine reward signals. Current Opinion in Neurobiology, 23, 229–238.

51

Playing in the backstore: interface gamification increases warehousing workforce engagem



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Abstract

Purpose

In a warehouse setting, where hourly workers performing manual tasks account for more than half of total warehouse expenditure, a lack of employee engagement has been directly linked to company performance. In this article, the authors present a laboratory experiment in which two gamification elements, goal setting and feedback, are implemented in a wearable warehouse management system (WMS) interface to examine their effect on user engagement and performance in an item picking task. Both implicit (neurophysiological) and explicit (self-reported) measures of engagement are used, allowing for a richer understanding of the user's

Feedback, goal-setting improve attention

Cognitive psychologist evaluates human ability to perform tasks over time

Date: October 28, 2021

Source: University of Texas at Arlington

Summary: For individuals to sustain their attention on a task over a long period of time, goal-setting is effective but receiving feedback produces a much stronger effect, according to a new study.

Share:

FULL STORY

For individuals to sustain their attention on a task over a long period of time, goal-setting is effective but receiving feedback produces a much stronger effect, according to a new study from The University of Texas at Arlington.

52

Using the Reward Pathway

- Consider the timing of a challenge or test
- Fatigue, priming, motor performance
- Observers, threat, pressure
- Consider using #placebocity to your advantage
- Volume of celebrating, frequency/habituation

53

Enhanced expectancies "EE" …

- **Prime recent successful attempts** (program selection)
- **Real-time temporal pairing trigger dopaminergic response. (makes practice more important, "saved episodic memory"**
- **Success with challenge**

  Risks (i.e., challenge)amplify the impact of success + strengthen learning (Schultz, 2010, 2013).

  Synaptogenic effect: learning increases the survival of newly generated neurons in the hippocampus to the extent that the learning experience is new, effortful, and importantly *successful* (Shors, 2014).

54

External Focus: The Deep Dive

- Advanced concepts
- Neurophysiology
- Applications

55

Focusing Externally (EF)

- Principles of motor learning apply (KR/KP)
- Consider the stage of learning for each person
- Focusing on: external
  environmental
  movement effects

56

The lure of the finish line is more powerful…

The amount that one is willing to endure *may be* increased if there has been a reward for the same in the past:

Endurance event (hike, run, etc.)
Childbearing
Running for political office
Recovery from cancer
Moving primary residence
Creating a lecture

…if you have been there before

57

Holding your breath…

Low consequences
Easily gamified (self, others)
Far transfer
Early success, builds

58

Successive Approximations (early, fading success)

- A series of opportunities to gain/establish:

- Confidence
- Substrate motor skills
- Parameters of autonomy/risk
- "Near-successes"
- Infrequent success

60

Learning vs. Performance (EF)

1. An external focus of attention directs us to the task goal, enhancing goal-action coupling
2. An internal focus of attention impedes performance by directing attention to the self
3. Movement success resulting from an external focus enhances expectancies for future success
4. Internal focus is subject to distraction, pressure
5. Storing parts of a motor task vs. a strategy

61

Neurophysiologic benefits of EF/contrasting IF

Functionality/specificity:
Goalpost vs foot
Rim vs fingertips
Hole vs wrist
Walk vs foot

Effects of re-programming automaticity* (M1)

Far transfer, practice-life

Adaptability!

63

External Focus: Applications

- Therapist cues to goal and inanimate > body
- Educating patients for self application
- Analogies of sport
- Seeing success through visualization of goal completion
- Creating opportunities in the clinic
- Compensatory applications with EF

64

Goal-action coupling

Autonomy support (AS), enhanced expectancies (EE), external focus (EF)
- direct performers with relative clarity toward their task goal
- suppress self-focused attention

Practice under optimal motivational and attentional focus conditions (AS, EE, EF) directly or indirectly triggers a dopamine response – facilitating the development of more effective neural connections, and enhancing performance and learning.

65

Neural efficiency : Goal-action "coupling"

- Structural brain changes are the result of formation of new connections by dendritic spine growth (synaptogenesis) and other neuroplastic processes.
- Functional connectivity – temporally coherent activity over large and distinct regions of the brain – changes with practice: More distinct functional connections are associated with higher skill.

What is the result of neural efficiency? More brain activity, or less?

66

Examples in Gait training

Pre-OPTIMAL	OPTIMAL-enhanced
"Spend less time on your R"	"Can you get there in fewer steps?" (EF)
"Take steps more frequently"	"Do you believe you can make it in 17 strides? "(EF/AS)
"Try to make sure that your L foot goes past your R"	"That's impressive! When we started, this took 22 steps. What is a reasonable goal for you now?" (EE/EF/AS)
"Take bigger steps and don't lean over so much…"	

67

Examples in sit to stand

Pre-OPTIMAL	OPTIMAL-enhanced
"Lean forward more"	"Imagine there is a band holding you back into the chair" (EF)
"Put equal weight on both legs"	"Are you able to sit down like you are trying to be very quiet?" (EF)
"Don't lean back as you stand up"	"Wow! Great job! Do you want to try to get up from a lower surface now?" (AS/EE/EF)
"Push from your hips first"	
"Don't straighten your knees first"	

68

Area of focus: Curb ascent

Pre-OPTIMAL	OPTIMAL-enhanced
"You have to go up with your L leg first"	"Which leg do you feel can best lift your body up there today?" (AS)
"Put the cane up on the step with you, before you push up"	"The last time we tried this…you did very well…Can you recall what worked for you?" (AS/EE/EF)
"You need to really lean on the L and lift the R foot up high"	

69

Autonomy impacts learning…

Novice drivers, recovering patients, players, students the opportunity to rate and or prescribe their preferred level of difficulty and what do you get…?
The difference in autonomy and not?

Awareness
Cortisol reduced (finite limits) | Attentional resources | Improved motor learning
Intensity

70

Enhanced expectancies impact learning…

Novice drivers, recovering patients, players, students taste some success and see themselves as having potential and self-efficacy

Attentive
Dopamine loaded, primed for success | Intense | Improved motor learning
Goal directed
Storing (learning) rules

71

External focus impacts learning…

Musicians, patients, players, students see the goal and organize movement around success, exploring repetition commonalities

Attentive

Intense

Rule-forming

Tolerating inefficiencies

Procedural memory centers inform about past success

Creating procedural memories (reduced cognitive reliance)

72

What does the OPTIMAL theory ADD?

- Motivation (social-cognitive-affective) attributes of various practice conditions
- Attentional focus from the learner or guided by others/environment
- Psychological interplay of performance and history

74

Applying the OPTIMAL: Summary

- Define the OPTIMAL and principles
- Introduce and review principles + purpose of the theory
- Early success reviewing initial applications
- Enhanced expectancies and a deeper dive
- Your turn to apply..”or not, you decide”
- An external focus on the concepts: video applications

84

What is different when we practice OPTIMAL(ly)?s

Autonomy
- Empowerment
- Engagement
- Autodidacticism
- Team-oriented
- Personalized
- Self-directed/guided
- Agency
- Shared decision-making
- Collaborative goal setting

Enhanced expectancies
- Priming
- Repetitions
- Success
- Reward
- Self-efficacy
- Locus of control

External focus
- Accomplish the task
- Movement specifics emerge from the task
- Affordances
- Whole vs. part
- Results vs. performance?
- Summary feedback?
- Allows for compensations?

85

Questions, comments and contacts…

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86

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88

Patient engagement

How do we get "there"? How does the OPTIMAL help?

98

How is your *CURRENT* engagement approach working?

99

How is your *CURRENT* engagement approach working?

100

How is your *CURRENT* engagement approach working?

A few good men photo

101

How is your *CURRENT* engagement approach working?

- Yelling
- Cheerleading
- Debating/cross examining = forceful logic
- "Tough love"

All transient and dependent on therapist presence

102

PSYCHOLOGICAL

Above **ALL**…what ***NOT*** to do:

- Cheerleading
- Using high intensity and high expectations
- Mismatch of challenge to patient personality
- Error rate exceeding patient tolerance
- Lecturing

103

103

Motivation is crucial in maximizing treatment outcomes

Depression and Mood

Self-efficacy

Optimism

Pessimism

Apathy

105

Internal Focus: The Dangers

- The "yips"
- Applications in sport (goalpost vs foot; rim vs fingertips; hole vs wrist)
- Drivers focus on body, make MANY small changes and over corrections
- Exhausting experiences on the road
- Internal focus is fatiguing and cortisol-provoking

107

"Your" turn/ Our turn: Applying to rehabilitation

Let's REALLY talk about:

- Early success
- External vs internal focus
- Amount/frequency of success/role of error
- The role of stress, distractions, pressure

109

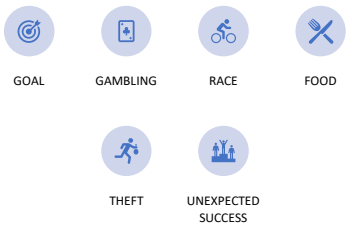
Enhanced Expectancies: Applications

- Brief periods with higher demands*
- Exceeding self predictions
- Exceeding therapist-stated expectations
- Holding task performance in constraint**
- Setting new PR in objective measures
- Enduring longer than expected
- Struggling AND persevering

* Consider nearly any task made harder: speed, reaction time, balance requirements, forces, complexity of environment
**To be discussed, error-inductions, task demands

111

Dopamine!



112

Predictions (EE/AS)

1. When temporally associated with skill practice, conditions that enhance expectancies for positive outcomes trigger dopaminergic responses and thereby benefit motor performance
2. Enhanced expectancies and autonomy support contribute to efficient goal-action coupling by readying the motor system for task execution
3. Autonomy support facilitates performance by enhancing expectancies

113

Predictions and Attention: "Triple Play"





114

Predictions (EE/AS/EF)

1. Autonomous choice to state a prediction
2. Enhanced expectancies that you will be correct
3. External focus on an outcome, score, other

Discussion: Examples in rehabilitation…

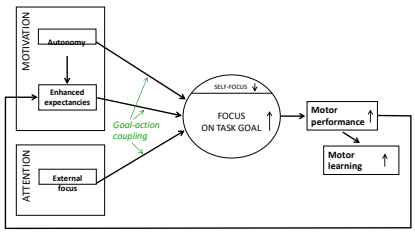
115

The benefits of individualizing care

- Know THIS person
- International Classification of Function (ICF)
- Reach out and touch…somebody's brain
- Consider frequency of ***success*** rate in practice

117

OPTIMAL theory of motor learning



121

The Oregon Driver's Education Project….

- Watch for rehabilitation analogies
- There will be a test **(A DRIVER'S TEST!!!!)**
- I believe that you can succeed in this test
- People like you have succeeded already
- We know you and what level you are at now
- We can hold one another accountable
- We will measure you again later

122

Novice Drivers MUST feel successful

123

Enhanced Expectancies: Applications

- Exceeding self predictions
- Exceeding instructor (or parent) - stated expectations
- Holding performance steady under pressure
  - Speed
  - Accuracy (narrow road)
  - Higher winds
  - Rain

124

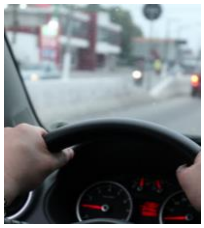
Supporting Autonomy (AS)

- Student choice without burden: route, time, etc.
- Self feedback comes first "what will I do different"
- Teamwork, not hierarchy "*we* passed this test"
- Facilitating choice within reality and personality

"Choice Burden (paradox of choice) vs. Autonomy"

125

Internal vs. External?
GOAL: Driving between the lines



- Should we direct focus on the body…
- …or an inanimate goal?

126

Internal vs. External Focus: Driving

127

External Focus: Applications

- Instructor cues to goal and inanimate > body
- Educating drivers for self application
- Seeing success through visualization of goal completion
- Creating opportunities on the road
- Sport analogies: Free throw, putt, batting, serve

128

Internal Focus: The Dangers


129

Internal Focus: The Dangers


130

The pathway to a successful outcome…

A healthy balance of success and errors
PLUS
An accurate understanding of cause(s)
PLUS
Enough attention to capture the moment
PLUS
Enough memory to apply the learning

132