

Session Number: TH101

Learning Styles:

What the Research Says and How to Apply it to Designing E-Learning

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Session Learning Objectives:

- Analyze learning situations and determine types of learner characteristics and/or learning styles to address in your instructional design.
- Develop e-learning instructional design strategies that match learner characteristics.
- Apply research-based principles when developing e-learning content for diverse groups of learners.

Overview

This session will enable you to fine-tune your thinking about “learning styles” by drawing upon what has been learned from over 30 years of research. The session will emphasize research-based principles to identify and address individual learner differences when designing e-learning.

Some Facts About Learning Styles

- The concept of “*cognitive* styles” originated in the 1930’s (Allport)
- Research on “learning style” emerged in the early 1960’s
- By 2006, over 650 books on learning styles have been published in the U.S. and Canada
- Over 4,500 articles have been written about learning styles in professional publications
- Over 26,000 web sites are available for measuring and addressing learning styles

Reputable Journals for Research on Learning Styles

The journals listed below are peer reviewed and good sources for information about research on learning styles, as well as additional topics related to e-learning.

- Journal of Educational Psychology
- Educational Technology Research & Development
- Computers in Human Behavior
- International Journal of Instructional Media
- British Journal of Educational Technology
- Educational and Psychological Measurement
- Educational Psychologist
- British Journal of Educational Psychology
- The American Journal of Distance Education
- Instructional Science

For additional journal listings you can search the ERIC database or use Google Scholar:

<http://www.eric.ed.gov/ERICWebPortal/Home.portal>

<http://scholar.google.com/>

Exercise: Your Current Learning Style Framework

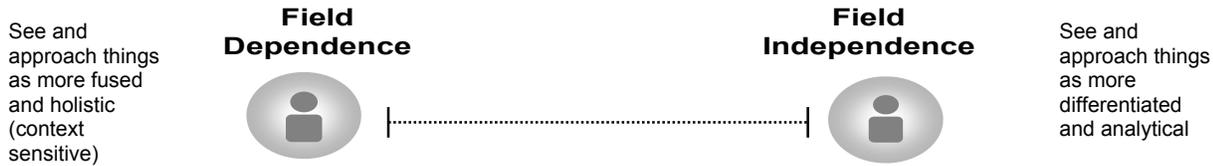
Think about how you currently incorporate learning styles into your e-learning instructional design. Take a few minutes and reflect on the following:

How do you ...

1. **Identify** individual differences in learners (innate characteristics, tools used to measure a learner’s “style” etc.)?
2. **Address** those individual differences in your instructional designs?
3. **Validate** your instructional design to ensure it made a difference at the individual and group level?

Example: Identifying a Learner “Style”

There are numerous tests psychologists use to identify innate differences in the way individuals process information when engaging in cognitive tasks such as problem solving, thinking, perceiving and remembering. One such test is called the Embedded Figures Test (EFT). It measures the degree to which a person is dependent on the structure of a surrounding visual field or external frame of reference for orientation. When used as a learning style measurement tool, individuals can be identified along a bipolar dimension of field dependence — field independence as illustrated below.



Example: Addressing a Learning “Style”

According to learning style theory, the following instructional design strategies have been recommended for Field Dependent (FD) and Field Independent (FI) learners (Jonassen and Grabowski):

FD learners need

- Orienting strategies with clear structure prior to learning
- Synergistic social learning environments
- Abundant guidance, cues feedback and clear instructions
- Lots of examples and emulation models

FI learners need

- Loosely structured pre-instruction
- Minimal guidance and direction while learning (learner control)
- Abundant content resources to sort through and self discover
- Independent learning opportunities

Validating Learning “Style”

If we want to adopt a more “evidence-based” approach to designing e-learning, the issue of validating learning styles becomes essential. For example, do we accept and implement the recommendations above for field dependent–independent learners because it seems reasonable and true? A question we need to ask ourselves with respect to applying learning style theory to any instructional design is:

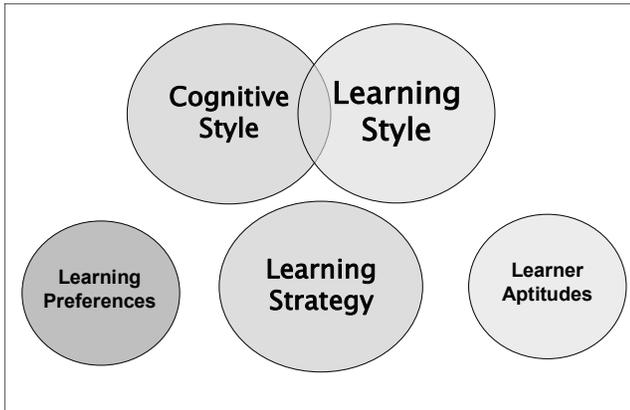
Does an instructional design strategy that addresses specific learner “styles” actually improve learning and performance in a significant way?

Learning styles research over the last 30 years has addressed the above question and provided answers to even more basic underlying questions:

- Just what are learning styles and how do they differ from related concepts such as learning strategies, preferences and aptitudes?
- How many learning styles are there?
- How does one identify and measure a learning style?
- How reliable and valid are the tools commonly used to measure learning styles?
- How exactly do learning styles match-up with specific instructional strategies?
- Is there clear evidence to validate learning styles and their application to instructional design?

Related, but Different Concepts

The terms below are often used differently by practitioners and educators.



The terms **learning style** and **cognitive style** are closely related and are often used interchangeably. Both operate without the individual's awareness and are assumed to be less amenable to change and conscious control.

Definitions

Cognitive Style: An innate habitual approach to processing information when engaging in cognitive tasks such as problem solving, thinking, perceiving and remembering. It has a high degree of stability and consistency. (Simon Cassidy)

Learning Style: An innate pattern of thinking, perceiving, problem solving, and remembering when approaching a learning task. It is fairly stable and consistent over time and across a wide variety of learning situations. Regarded as an application of cognitive style to learning situations.

Learning Strategy: A chosen plan of action in how to approach a given learning task. They are deployed depending on the nature of a task, prior experience with a learning situation and motivation. Individuals are usually conscious of strategies.

Learning Preferences: An expressed personal preference favoring one type of learning environment, method of teaching or instruction over another. May involve preference for group or independent study. (Simon Cassidy)

Learner Aptitudes: Special innate capacities that give rise to competencies in dealing with specific types of content in the world such as spatial patterns, musical sounds, interpersonal relations, body movements, etc.

Some Identified Learner "Styles"

Cognitive

Field dependent – Independent
 Convergent – Divergent
 Impulsivity – Reflexivity
 Holist – Serialist
 Verbalizer – Visualizer
 Assimilator – Explorer
 Adaptor – Innovator
 Leveler – Sharpener
 Reasoning – Intuitive
 Active – Contemplative
 Concrete – Abstract
 Sequential – Random

Learning

Concrete experience/reflective observation/
 abstract conceptualization/
 active experimentation
 Activist/theorist/pragmatist/reflector
 Meaning – Reproducing orientation/
 Achieving – Holistic orientation
 Intrinsic – Extrinsic orientation/
 Part – Holistic orientation
 Synthesis – Analysis/
 elaborative processing
 Initiator, Analyst
 Reasoner, Implementer

Other

Brain dominance (Right – Left)
 VARK (Visual, Auditory, Reading, Kinesthetic)
 Multiple Intelligences (aptitudes)
 Meyers-Briggs (personality)

Over 30 different learning "styles" have been identified by various researchers. Not all have been empirically validated. This is a list of some of the most common styles.

Identifying and Measuring Learning Styles

The table below lists some common tools used to measure learner “styles.”

Tool / Instrument	Style	Validity / Impact*
Cognitive Style Index (CSI)	Intuition - analysis	Undetermined
Gregoric Style Delineator (GSD)	Concrete – abstract / sequential - random	Questionable
Herrmanns Brain Dominance Instrument (HBDI)	Left – right brain (whole brain model)	Undetermined
Learning Styles Inventory (LSI)	Kolb’s experiential learning model	Questionable
Cognitive Style Analysis (CSA)	Holist – analytic Verbal - visual	Questionable
Inventory of Learning Styles (ILS)	Depth of processing meaning, production	Questionable
Meyers-Briggs Type Indicator (MBTI)	16 Personality types	Low

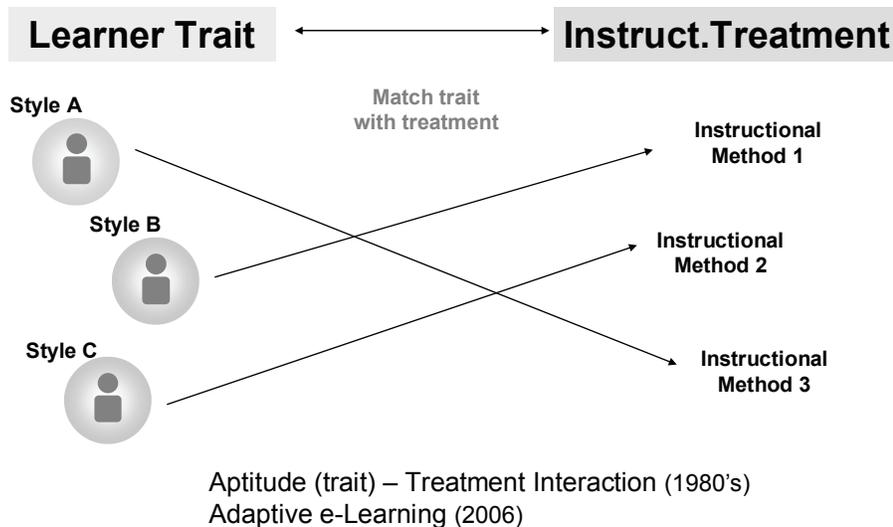
Most learning styles are identified through self-report questionnaires.

* The validity of each tool with respect to instructional impact is based on current psychometric research consensus.

Styles and Instructional Interactions

The learning style concept presupposes a causal relationship between a learner’s style, instructional design and learner performance. This is illustrated in the diagram below where a matching of style with instructional method is sought out and believed to be an underlying strategy for achieving learner success. In the research field, this has been referred to as Aptitude-Treatment Interaction where aptitude can represent a wide range of innate learner traits.

Matching trait (style) with treatment



“Adaptation is only useful if some learners (with a defined trait) do better with one method and other learners (with a complementary trait) do better with another method (aptitude-treatment interaction).” David Cook, MD; Academic Medicine, 2005.

Aptitude (trait) — Treatment Interaction Research Consensus

After more than 25 years of study and hundreds of controlled experiments, researchers have not been able to consistently replicate and validate an interaction between a learner’s style and specific instructional methods. This could be attributed to research flaws in measuring learning styles, but more likely, other variables within the learner and/or the instructional environment are difficult to control.

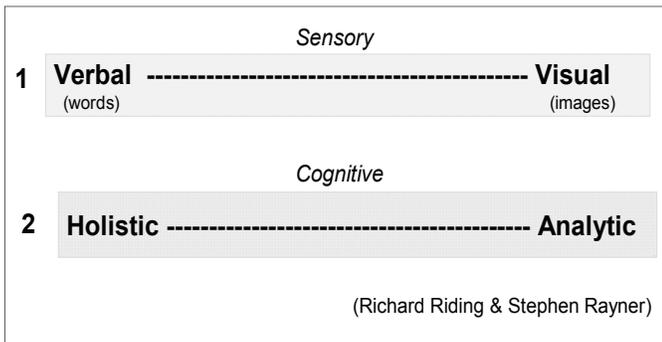
What does an instructional designer of e-learning do when the prevailing research consensus casts serious doubt on the validity of most learning style theories?

Strategy 1: Reinterpret and Consolidate

Many learning style researchers have recognized the practical difficulty of applying learning style constructs to instructional design, especially with 30 or more different learning style models. Some have proposed a more broad and simplified model by reducing the number of styles to a few categories (Riding, Cheema and Rayner). This appears to be a realistic option for implementing learning style theory in the day-to-day world of education and training.

Two Broad Learning Style Dimensions

The diagram below describes two major learning styles that many researchers and practitioners have emphasized since the late 1990’s.



Verbalizer – Visualizer

The degree to which individuals tend to represent information as words or images, as well as preferences for instructional modality. A prevailing belief is that people can be visual, auditory or kinesthetic learners, and possess a preferred sensory modality (PSM) which interacts with instructional methods.

Holist – Analytic

The manner in which individuals tend to process information either as a whole or broken down into separate parts. Other related learning styles include divergent and convergent thinkers, right and left brain orientations and intuitive and linear thinking styles.

Exercise: Validating the Verbal-Visual Learning Style



Superior at processing information that is spoken or heard (dialog & discussion)

Superior at processing information that is presented visually (diagrams, charts, maps)



Individuals will show superior learning and memory for material presented through their preferred sensory and representational modality.

How would you prove this?

Example Research Study of Verbal-Visual Learning Style

A recent study by Kratzig and Arbuthnott builds on other research that examines the relationship between a person's assessed learning style and actual performance with different instructional modalities. The table below outlines how their experiment was conducted.

University of Regina, Canada
G. Kratzig and K. Arbuthnott
Journal of Educational Psychology (2006)

What was done	How
Identified participant learning styles (visual, auditory and kinesthetic)	Self assessments and Learning styles inventory questionnaire (BLSI)
Measured memory and performance in visual, auditory and kinesthetic tasks	Used objective psychometric tests
Looked for correlations between LS inventory, self assessments and objective measures	Statistical analyses
Conducted a metacognitive analysis of participant approach to completing the learning style inventory	One-on-one interviews

Research Results on Verbal-Visual Learning Styles

Research Questions

- 1 Do learning style (LS) questionnaires correlate with visual, auditory and kinesthetic performance?
- 2 How accurate are individual beliefs about their own learning styles and performance?

Findings

- Assessment of LS based on sensory modality has no correlation with learning and memory retention.
- Many "kinesthetic" learners performed better with the visual treatment.
- Participants were very sure about their own LS type
- Participants completed inventories based on inconsistent and partial criteria.

The results of this study further confirm what other researchers have found regarding the validity of a sensory-based learning style.

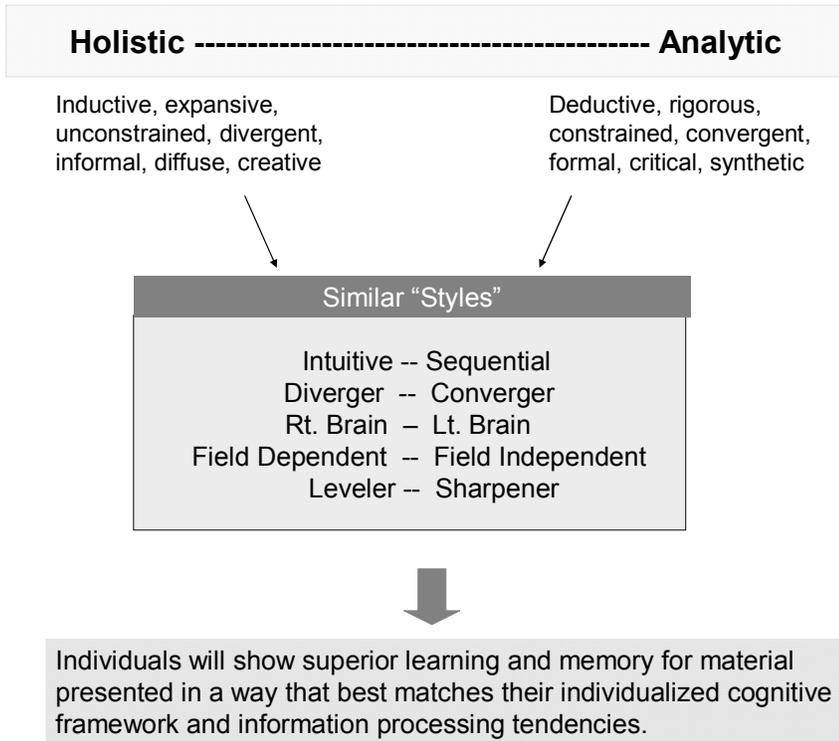
Research Consensus on the Verbal-Visual Learning Style

Summarized below are the conclusions reached by the majority of educational psychologists who have researched the verbalizer-visualizer learning style:

- Self-expressed "preferred" styles often don't match performance
- A preferred sensory modality (PSM) has little validity
- Learning from graphics correlates with spatial aptitude
- There are at least three distinct visual aptitudes (R. Clark)
- Most learners are likely multi-modal and multi-situational and adapt their strategies
- Applying the PSM assumption to instructional design can sometimes degrade learning (redundancy)

The Holistic — Analytic Learning Style

This learning style dimension refers to how an individual processes and works with incoming information in terms of unified wholes or a collection of parts (R. Riding and S. Rayner).



Holists require explicit structure and guidance, external motivation and social interaction.

Analytics are internally directed, generate their own structure and require less external motivation and support.

Research Summary on Validity of Holistic — Analytic Learning Style

- Manipulating content structure, sequencing and navigational elements can often improve learning for the respective "styles"
- Aggressively addressing one style can degrade learning for the other style
- Success in e-learning courses has a weak correlation with style

There is some evidence to support a trend indicating that analytics perform better in web-based learning environments that are less structured and promote in-depth content exploration prior to presenting overviews. Holists tend to do better in web-based learning environments that provide structure and a global perspective prior to deeper content exploration. They also tend to benefit more from social interactions. (David Cook, 2005)

Difficulty Applying Learning Styles to E-learning Instructional Design

Despite the weak empirical evidence to support learning style theory, it's worth remembering that:

Questioning the validity of learning styles is not a denial of individual learner differences.

Strategy 2: Focus on Other Learner Characteristics

From a research perspective, certain individual characteristics, other than learning styles, have been shown to be responsive to specific instructional treatments and are more valid predictors of learner success.

Exercise

In each of the e-learning scenarios below, identify the dominant learner characteristic that will significantly influence selecting best instructional strategy.

Design online training for sales reps for a new product line

A number of new sales staff have no prior experience or knowledge about the previous product line which is making it harder for them to understand the new product line.

Design webinars on how to conduct virtual meetings

Product training staff who prefer F2F meetings are resistant to learning how to use and implement new virtual meeting technology. An insider says: "we're no good at using this hi-tech stuff with people."

Design a new online training program for call center support staff

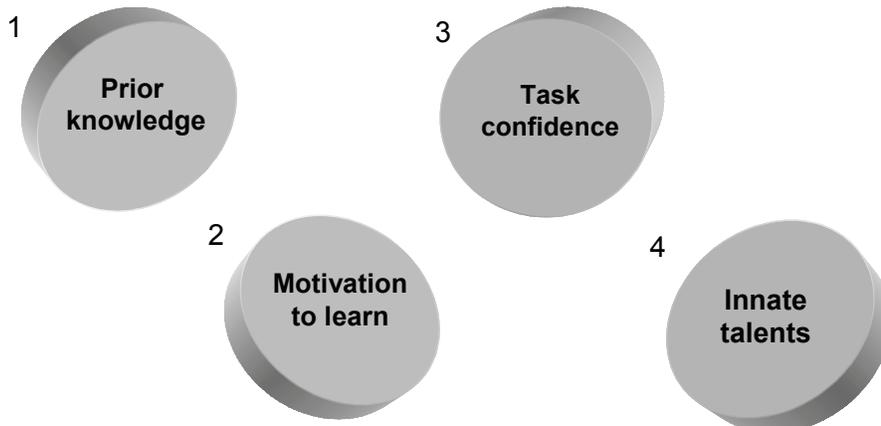
Over 60% of call center staff fail to complete an existing CBT tutorial. They say it is boring and requires too much effort to apply the material to the "real" world.

Design training for clerical staff on using a database system

About 25% of new clerical staff are error prone and slow at retrieving info from the company's customer database. They say the interface is visually too complex. The majority of other clerical staff do not have this problem.

Additional Learner Characteristics (empirically validated)

At first glance, the learner characteristics below may not be as appealing as global learner traits such as "styles." However, research in learning psychology is unequivocal about the significant impact that most of these have on learner success in specific learning situations.



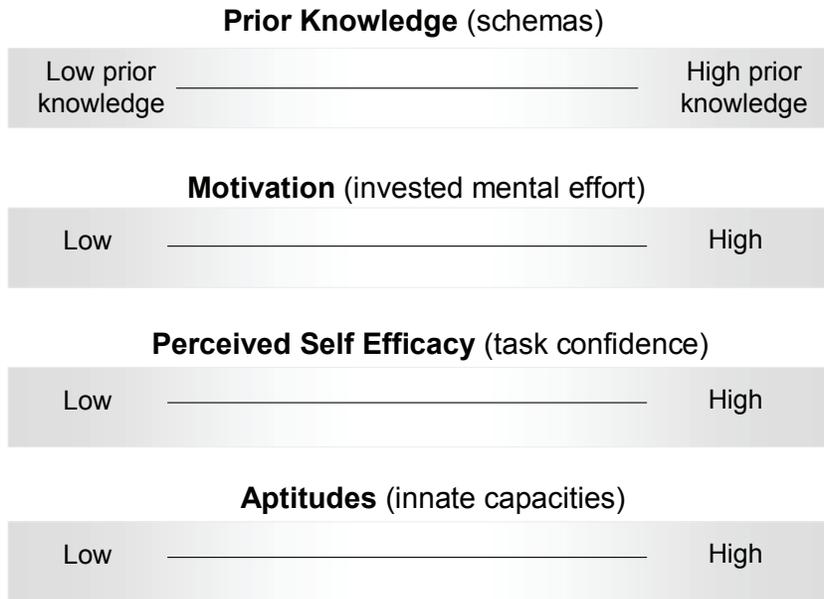
Research terms:

1. Schemas
2. Amount of invested mental effort
3. Perceived self-efficacy
4. Aptitudes

Bipolarized Learner Characteristics

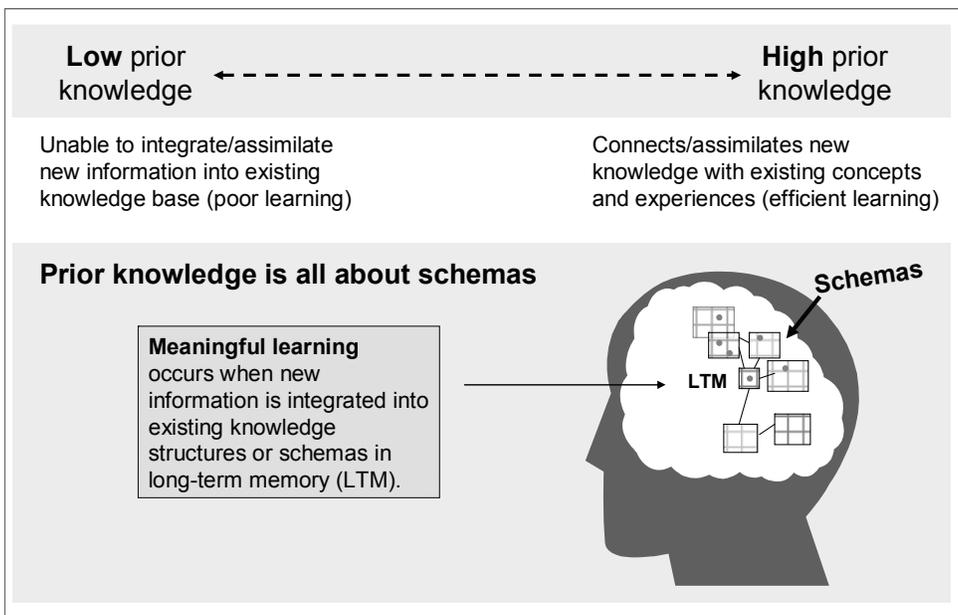
Similar to learning “styles,” these four learner characteristics can be represented on a bipolar scale as illustrated below. Where individuals or groups of learners fall on each scale can often be determined by asking a few simple questions that relate the content or performance to be learned with each of the learner characteristics (see page 12).

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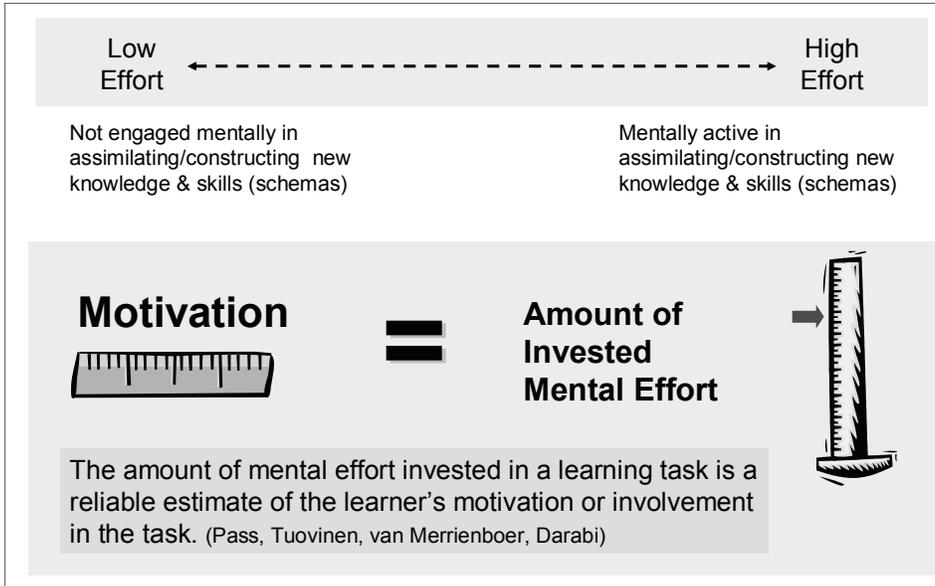
With perhaps the exception of aptitudes, it is important to recognize that these dimensions are **not** to be viewed as global innate traits that influence learning across all situations. Instead, a learner can be high or low on the same scale depending on the instructional context, content and learning goals.

Learner Prior Knowledge (schemas)



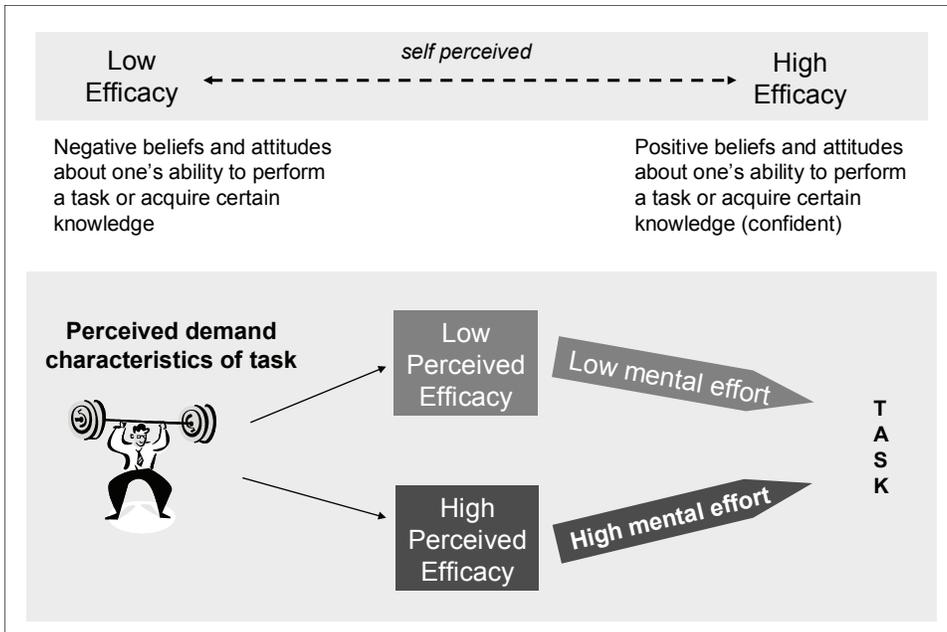
Prior knowledge and experience along with associated schemas are indisputably the biggest factors in predicting a learner’s initial success in almost every learning situation.

Learner Motivation (Amount of Invested Mental Effort)



A highly motivated learner will learn just about anything despite inadequacies in instructional design. Highly motivated learners will often excel in settings where instructional resources are readily accessible.

Learner Confidence About Task (Perceived Self-Efficacy)

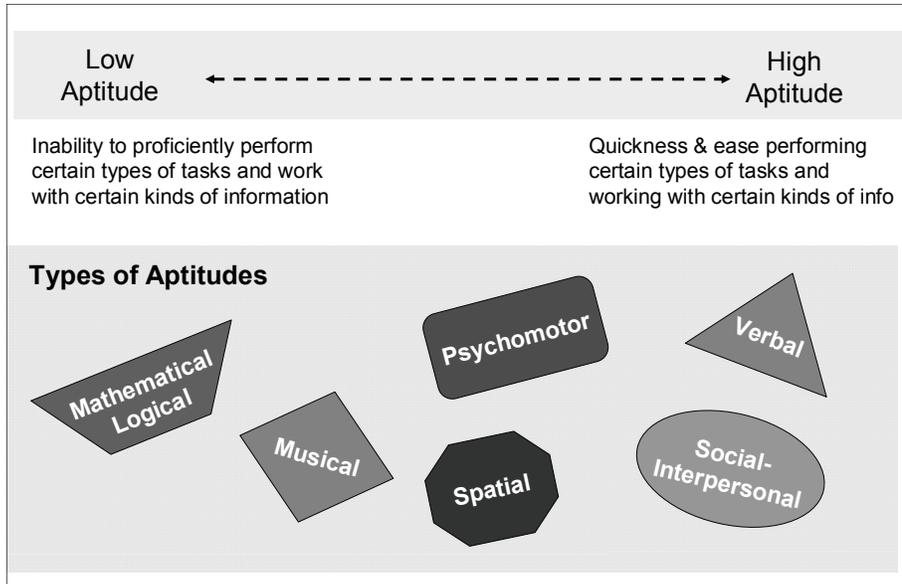


In any given learning situation a number of internal and external factors can influence a learner's perceived self-efficacy. Some of these include:

- Anxiety and fear of failure
- Prior experiences with the task or content to be learned
- The perceived difficulty of a task
- Other psychological factors within the individual

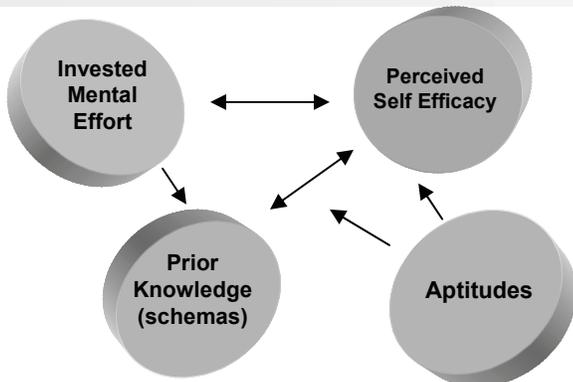
Low perceived self-efficacy can function as a potential internal distraction. If cognitive resources are consumed with managing negative states associated with an instructional task, learning will be negatively impacted.

Innate Capacities (Aptitudes)



In Howard Gardner's book, Frames of Mind: the Theory of Multiple Intelligences, he identifies seven aptitude-like traits which he refers to as "intelligences." Although these aptitudes are mainly biologically and environmentally determined, their interaction with instructional methods and content is largely situational.

Interaction of all 4 Learner Characteristics



In any learning situation, these learner characteristics operate at various levels and interact with each other as well as with instructional methods.

Identifying Learner Characteristics

Listed below are some sample questions you can ask to help identify these learner characteristics.

Answer on a scale of 1 – 10

- How much knowledge do you currently possess about x?
- How excited are you to learn about x? How important is x to doing your current job?
- How confident do you feel about your ability to learn x?
- How good are you at tasks that involve using or doing y? (y is a high level aptitude domain of which x is a subset)

Select all that apply

- How would you like to approach learning x?
- a) Get big picture overviews before learning details.
 - b) Jump right into it and sort things out as I go along.
 - c) Get lots of examples as I learn about x.
 - d) Interact with other learners and share experiences.

Exercise

Match the learner characteristic with a recommended instructional strategy.

Learner says

- 1 It's all very new to me.
- 2 This stuff is boring and not very important to me.
- 3 There's no way I could ever learn to do that well.
- 4 This is very complicated
- 5 This kind of stuff is fun and comes easy to me.
- 6 I'm a visual learner and need more examples that I can see.

Instructional strategies

- a) Simulation or game
- b) Advanced organizers
- c) Keller's ARCS model
- d) Demos of successful performances
- e) Lots of concrete examples
- f) Content organized in small chunks
- g) Enable full learner control
- h) Explicit sequencing
- i) Worked-out examples

Others strategies?

Additional Learner Characteristics

Not covered in this session are a variety of other learner characteristics that should be considered in the design of e-learning materials. A few of these are listed below:

- Age (NetGen and seniors)
- Gender
- Personality types
- Disabilities
- Culture
- Others?

Summary and Advice for E-learning Designers

Here is a summary of what the research says about learning styles and what you can do to incorporate this knowledge into your e-learning designs and improve your overall approach to addressing individual differences in learners.

- Start reading peer reviewed journal articles that deal with a range of instructional design issues including learner characteristics, multimedia learning and e-learning. If these materials are difficult for you to access read the journal article abstracts by accessing Google Scholar or the ERIC online database.
- Recognize the complexity involved in identifying a particular learner “style,” especially when most of the existing instruments to measure “styles” have not been carefully and objectively validated by the research community.
- Don’t feel forced to completely abandon learning styles. The concept of learning style is not necessarily wrong; rather, it appears to be based on an incomplete paradigm. You may need to tune your existing mental model (schemas) to incorporate the research-based evidence presented in this session.
- Apply the holist—analytic learning style model judiciously. Keep in mind that over-designing for one particular “style” may degrade learning for others.
- In your instructional designs, focus on developing learner schemas, rather than just conveying content. Good instructional message design is often the key to simultaneously addressing a variety of individual learner differences.
- Select instructional methods and media that match the nature of the content to be taught (i.e., use graphics for content material that is predominately visual in nature, and verbal/textual media for content that is more abstract and declarative in nature).
- Recognize that most learners are adaptable and cognitively flexible, especially if motivated. You don’t need to overcompensate for a hypothesized innate trait that—in many instances—may not be valid.
- Supplement your learning “styles” paradigm with other learner attributes that have been tried, tested, and proven true (prior knowledge, motivation, aptitudes, and learner confidence related to the content or task to be learned).
- Recognize that the concept of learning styles is very appealing and has somehow become an integral part of our education and training folklore. How strongly one feels about a particular belief is no justification for ignoring the hard scientific evidence.

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