Student diversity of learning preferences: Implications for instructional design in digital age

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Question 1:
Which of the following provides a closer description of your learning preference?

A: I see teachers as sources of structure. I look for clear guidelines from teachers on what is required and how I shall do it. I note almost everything the teacher says in class. I will do and only do what is exactly required. I like the class sessions that are highly organized.

B: I feel that my ideas about the content are often good and am confident about my ability to learn. I like to think for myself what are important, develop my own ideas about the course content, and work by myself on assignment. I like the class sessions where I can work at my own pace.

C: It is important for me to perform better than other students. To do well, I think it is necessary to compete with other students for teacher's attention, to answer questions before anyone else can, to do better assignment than others and to get good grades. I enjoy teacher's recognition for the good work I do.

D: I like to work with other people when I learn, sharing ideas, collaborating with each other, and helping each other out for better understanding of things. I like the class sessions that have small group discussions and prefer group work rather than individual projects.

E: I have little interest in attending classes and participating in the classroom activities. In class, I socialize with other people and would prefer that teachers ignore me. I study just hard enough to get by.

F: I generally enjoy going to class and take responsibility for getting the most out of a course. I often sit toward the front of the classroom and participate actively in activities. I do all assignments including the optional ones before the deadlines.

Riechmann, S. W., & Grasha, A. F. (1974). A rational approach to developing and assessing the construct validity of a student learning style scales instrument. The Journal of Psychology, 87, 213-223.

Dependent	Have little curiosity for new learning and learn only what they are told to. Consider teacher and classmates as resources for support and help. Depend on authorities to determine the area of activities.
Independent	Like to think by themselves. Feel sure about their ability to learn. Prefer to learn the content which they think is important.
Competitive	Aim at having better performance than the other students in the classroom. Believe that they have to compete with other students to get reward.
? Collaborative	Feel that learning is possible through sharing the ideas and opinions with stronger students. Like to work with others and also prefer to discuss in small groups in the classroom.
Avoidant	Don't ike to be present in the classroom and don't participate in the activities other students and the teacher do in the classroom. In general, don't enjoy the classroom climate and whatever is happening in the classroom.
Participant	Follow the class and enjoy going to and participating in the class. Being eager to volunteer for activities and prefer to have discussion and lecture in the classroom.

Riechmann, S. W., & Grasha, A. F. (1974). A rational approach to developing and assessing the construct validity of a **student learning style scales** instrument. The Journal of Psychology, 87, 213-223.

Question 2:

In your opinion, which of the following learning approaches is more likely related to higher academic achievement?

A. The intention of this learning approach is to obtain a paper qualification from a university and avoid failure. The learning strategies involve doing as little as possible, studying only what one has to, and focusing on fairly accurate reproduction of learning materials or specific facts rather than the transformation and internationalization of the materials.

B. This learning approach is related to the personal interest in the subject matter of study and the intention to self-actualisation. The learning strategies involve reading widely for better understanding, sometimes beyond what is assigned by the teacher, attempting to look for correlations between materials, and constructing an overall conceptual framework that is meaningful to oneself.

Biggs, J. (1979). Individual Differences in Study Processes and the Quality of Learning Outcomes. *Higher Education, 8*(4), 381-394.

Student approaches to learning

S Approach

Intention to reproduce

- Rote memorization of information needed for assessment
- Sticking closely to the course requirements and doing the minimum for assessment
- Failure to distinguish principles from examples
- Treat tasks as external impositions
- Focusing on discrete elements without integration

D Approach

Intention to understand

- Meaningfully memorising information for later use
- Relating new ideas to previous knowledge
- Relating concepts to everyday experiences
- Relating evidence to conclusions

Biggs, J. (1979). Individual Differences in Study Processes and the Quality of Learning Outcomes. *Higher Education, 8*(4), 381-394.

Question 3:

Which of the following provides a closer description of you?

- A: I get my energy for learning from active involvement in activities with other people. I often understand new information better when I can talk about it with others and hear what others say about it. I am normally seen as an "outgoing" person. I sometimes jump too quickly into an activities and don't give myself enough time to think before acting.
- B: I get my energy for learning from dealing with the ideas and images in my mind, namely, my inner world. I often learn better through quiet and private reflection. I prefer doing things myself or with only a few people I know well. I am normally seen as reflective. I sometimes spend too much time thinking and am slow in taking actions.
- C: I prefer to bring life under control as much as possible and feel more comfortable when things are settled and organized. I like to make plan for my work to avoid hassles before a deadline. I sometimes focus too much on plans and may miss some new information.
- D: I am open to new experiences and information. I prefer to understand and adapt to the world rather than to organize it. I can make plans and be decisive but prefer a flexible and spontaneous way of life. I sometimes stay too open to new information and am not able to make decisions timely.

Myers-Briggs Type Indicator (MBTI) personality inventory

Extraversion	• Enjoy action-oriented activities and group interactions
Introversion	• Enjoy reflection and individual efforts
Judging	• Prefer more structured learning environments
Perceiving	• Prefer learning situations that are more free, open, and flexible
Sensing	• Rely primarily on concrete information provided by the five senses
Intuition	• Like to find general patterns and new ways of doing things
Thinking	• Rely primarily on impersonal and analytic reasoning in making decisions
Feeling	• Rely primarily on personal and social values in making decisions

Myers-Briggs Type Indicator (MBTI) ***personality inventory***

Cassidy, S. (2004). Learning Styles: An overview of theories, models, and meas. *Educational Psychology*, *24*(4), 419-444.

Table I. Individual Styles in Nine Style Models

Style construct	Individual style	Key characteristics
Learning approach	Surface	Reproduce what is taught to meet the minimum requirement
	Deep	Gain a real understanding of what is learned
	Achieving	Maximize one's academic grades
Career personality type	Realistic	Work with things
	Investigative	Engage in scientific kinds of work
	Artistic	Deal with tasks that provide opportunities to use imagination
	Social	Work in situations that provide opportunities to interact with others
	Enterprising	Work in environments in which leadership opportunities are available
	Conventional	Work with data under well-structured situations
Mode of thinking	Holistic	Process information in an intuitive, Gestalt-type, and synthesized manner
	Analytic	Process information in a piecemeal, analytical, and sequential manner
	Integrative	Process information in an interactive and dynamic way
Personality type	Extroversion	Enjoy action-oriented activities and group interactions
	Introversion	Enjoy reflection and individual efforts
	Sensing	Rely primarily on concrete information provided by the five senses
	Intuitive	Like to find general patterns and new ways of doing things
	Thinking	Rely primarily on impersonal and analytic reasoning in making decisions
	Feeling	Rely primarily on personal and social values in making decisions
	Judging	Prefer more structured learning environments
	Perceiving	Prefer learning situations that are more free, open, and flexible
Mind style	Abstract random	Approach learning holistically and prefer to learn in an unstructured way
	Concrete-sequential	Extract information through hands-on experiences and prefer well-structured work environments
	Abstract-sequential	Adopt a logical approach to learning and strong in decoding written, verbal, and image symbols
	Concrete random	Take trial-and-error, intuitive, and independent approaches to learning
Decision-making style	Innovative	Work in non-traditional ways and not concerned with the social consequences of producing less acceptable solutions
	Adaptive	Work within existing frameworks and minimize risks and conflicts
Conceptual tempo	Reflective	Tend to consider and reflect on alternative solution possibilities
	Impulsive	Tend to respond impulsively without sufficient forethought
Structure of intellect	Divergent	Deal with problems in a flexible way and tend to generate multiple solutions to a single problem
	Convergent	Deal with problems in a mechanical way and tend to see a problem and a solution as having a one-to-one relationship
Perceptual style	Field independent	Tend to see objects or details as discrete from their backgrounds
	Field dependent	Tend to be affected by the prevailing field or context

(P.6-7)

Zhang, L-F., & Sternberg, R. J. (2005). A threefold model of intellectual styles. *Educational Psychology Review, 17*(1), 1-53. doi:10.1007/s10648-005-1635-4

$$B\text{ehaviour} = f(P\text{erson}, E\text{nvironment})$$

Behavior is a function of the interaction between the person and environment.

Lewin, K. (1936). *Principles of topological psychology*. New York: McGraw-Hill Book Company.

Image from https://www.niehs.nih.gov/health/assets/images/hands_holding_two_puzzle_pieces.jpg.

Question 4:

In your opinion, which of the following teaching approaches is positively related with student deep approach to learning?

- This is an approach that intends to **transmit to the students information** about the discipline. In teaching, the **focus is on facts and skills** instead of the relationships between them. The prior knowledge of students is considered unimportant. Teacher aim at helping students to **pass the formal assessment**. It is assumed that students **do not need to be active** in the teaching-learning process.

- This is an approach that intends to help students **change their conceptions** of phenomena they are studying. In teaching, **the focus is on what the students are doing** instead of what a teacher is doing. Teachers who use this approach believe students should be given **the responsibility to re-construct their knowledge and produce new conceptions**. Therefore, teachers' role is **help** students to achieve this and this can't be achieved by transmitting information.

Approach	Intention	Strategy
Information Transmission/Teacher-Focused approach	Transmitting information to the students	- Focusing on detailed information instead of the relationships - Helping students pass the formal assessment
Teacher-focused strategy with the intention that students acquire the concepts of the discipline		
Teacher/student interaction strategy with the intention that students acquire the concepts of the discipline		
Student-focused strategy aimed at students developing their conception		
Conceptual Change /Student-Focused approach	Helping students change their conceptual understanding of the subject	- Focusing on helping students to construct their own knowledge - Giving students responsibility to construct their knowledge and produce new conceptions - Emphasizing what the students are doing

Trigwell, K., & Prosser, M. (2004). Development and Use of the Approaches to Teaching Inventory. *Educational Psychology Review, 16*(4), 409-424. doi:10.1007/s10648-004-0007-9.

Information Transmission/Teacher-Focused approach

More surface approach to learning

Teacher-focused strategy with the intention that students acquire the concepts of the discipline

Teacher/student interaction strategy with the intention that students acquire the concepts of the discipline

Student-focused strategy aimed at students developing their conception

Conceptual Change /Student-Focused approach

Deeper approach to learning

Discussions on learning styles

- Better or worse? Or simply diversities?
- Traits or relatively labile states?
- Entirely different constructs or similar constructs with different style labels?

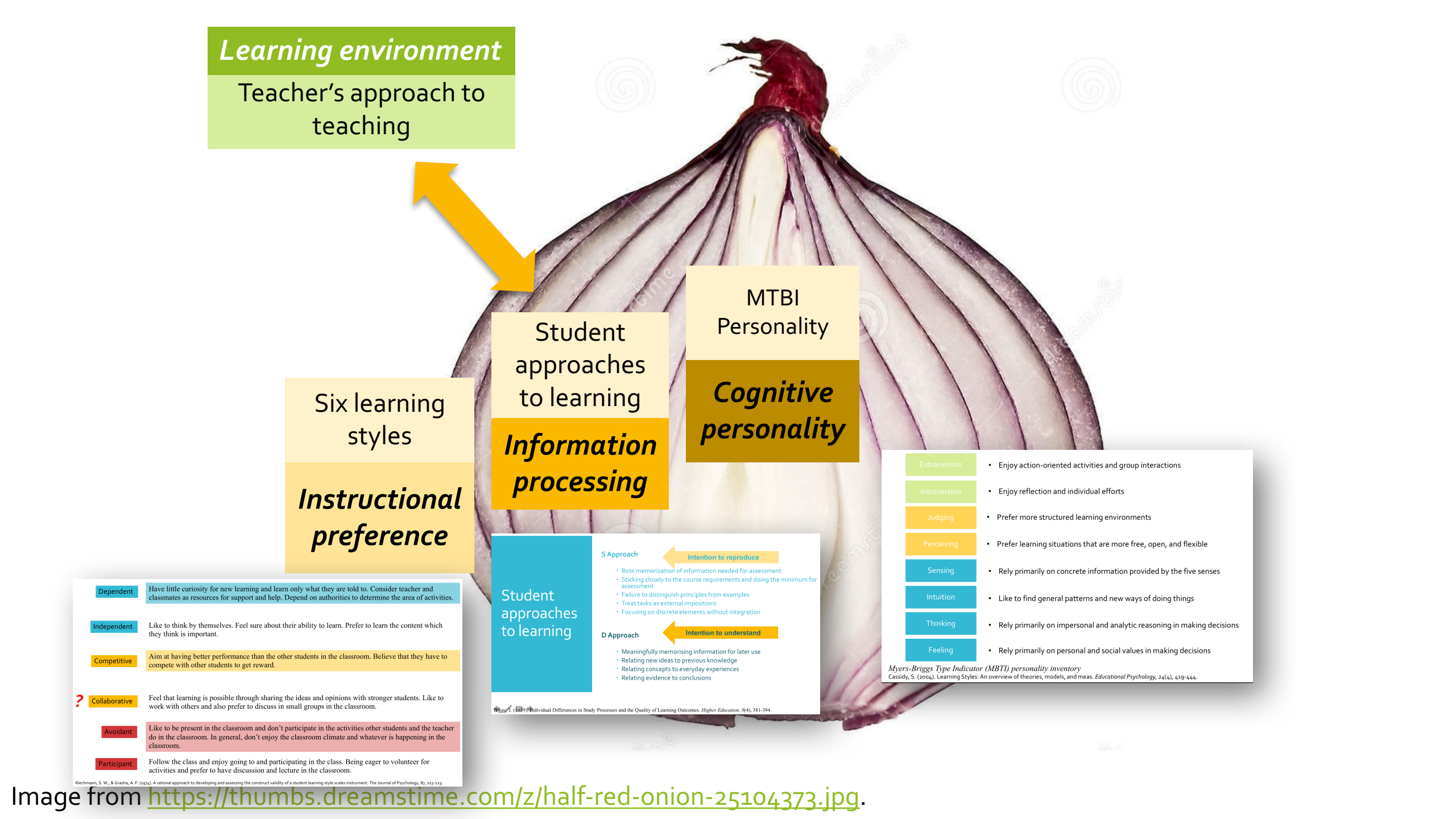

Image from https://thumbs.dreamstime.com/z/half-red-onion-25104373.jpg.

Characteristics of digital native learners

Characteristic	Potential benefits	Potential risks
Craving for speed and inability to tolerate slow-paced environment (Prensky, 2001b, p. 442; Tapscott, 2009)	Ability to scan text and process information quickly (Prensky, 2001c)	Interferes with deep reading and reflection (Carr, 2010, p. 276) and the development of abstract thinking (Small & Vorgan, 2008)
Desire or perceived need to multitask (Prensky, 2001b, p. 442; Rosen, 2010; Tapscott, 2009)	Prevents boredom (Prensky, 2001b, p. 442, 2001c, 2008); digital natives can regulate multitasking when needed (Rosen, 2010)	Interferes with memory (Hembrooke & Gay, 2003); causes inefficient study time (Bowman, Levine, Waite, & Gendron, 2010); is associated with lower grades (Fried, 2008); causes mental exhaustion (Small & Vorgan, 2008)
Preference for pictures rather than text (Prensky, 2001b, 442; Tapscott, 2009)	May develop visual-spatial skills (Prensky, 2001b, p. 442; Tapscott, 2009)	Visual skills may be gained at the expense of deep, reflective reading ability (Carr, 2010, p. 276)
Tendency to process information in nonlinear ways (Prensky, 2001b, p. 442; Tapscott, 2009)	Simultaneous multiple perspectives increase potential for greater understanding of inherent complexity in ill-structured domains (Spiro & Jehng, 1990)	Loss of ability to read in linear manner even when linear reading is the most productive strategy (Carr, 2010, p. 276)
Preference for collaboration and constant connectivity (Prensky, 2001b, p. 442; Rosen, 2010; Tapscott, 2009)	Use of personal online networks to enhance learning (Prensky, 2001b, p. 442); contribution to authentic projects such as Wikipedia can make learning relevant (Tapscott, 2009)	Excessive focus on socializing at the expense of learning (Bauerlein, 2008)
Preference for learning through activity rather than reading or listening (Prensky, 2001b, p. 442)	Ability to figure things out rather than wait for instruction (Prensky, 2001b, p. 442)	Impatience with guided instruction may impair learning of essential content (see Mayer, 2004)
Mixing of work and play (Prensky, 2001b, p. 442; Tapscott, 2009); use of leisure time for effortful pursuits (Ito et al., 2010)	Cognitive playfulness – a tendency toward imaginative hypothesis testing – can enhance learning (Mortocchio & Webster, 1992)	Expectation that the teacher entertain them would impair self-regulated learning (see Credé & Kuncel, 2008)
Expectation for immediate feedback and "payoff" for their efforts as found in games (Prensky, 2001b, p. 442; Rosen, 2010)	Could increase motivation in learning environments where immediate feedback is present	Inability to persevere in the face of short term boredom would impair learning (see Credé & Kuncel, 2008)
Preference for fantasy contexts as found in games and realistic TV and movies (Prensky, 2001b, p. 442)	Potential for increased motivation and contextualization of learning (Cordova & Lepper, 1996) in learning environment where fantasy context is present	Dependence on fantasy or narrative would be unproductive since it is not practical for all learning to be designed this way
Expectation that technology is part of the landscape; difficulty with environments that lack technology (Prensky, 2001b, p. 442; Tapscott, 2009)	Pedagogically sound use of technology can enhance conceptual understanding (Mishra & Koehler, 2006, 2009)	Novelty of technology may be distracting; students with less technology competence may experience extraneous cognitive load (see examples in Atack, 2003; Niederhauser, Reynolds, Salmen, & Skolmoski, 2000)

Thompson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education*, *65*, 12-33. (p.14)

Thompson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education*, *65*, 12-33.

- Year: before 2013
- Sample: 388 freshmen
- Country: USA
- Method: Survey
- Context: When students are learning topics in which they have personal interest

Question 7:
Which of the following do university freshmen do most frequently? (Choose the top three)

A. **Web resource use**: Use the web to explore a topic in depth; look up a fact; watch a video online; listen to music online

B. **Rapid communication technology use**: Send text/voice message or chat on electric devices; check, update, or comment on social network media; use several technologies at one time

C. **Book reading**: Read books for enjoyment or for learning (old/traditional approach)

D. **Productivity tool use**: Use word processors, spreadsheets, databases, and presentation tools

E. **Gaming**: Play games alone or with others

F. **Active web reading and writing**: Read, write, or comment on blog entries; create or maintain a website; read long detailed web pages; read entertainment web pages

G. **Microblogging**: Update or read a microblogging site (e.g. Twitter)

H. **Multimedia creation**: Create a digital image or audio file; create or edit a video; upload a digital image or a video to a file-sharing site

I. **Collaborative web tool use**: Annotate a web page; use a social bookmarking site; use a shared document on the web (e.g., Google docs), and contributing to a wiki

Question 8:

In your opinion, which ones of these may have significantly negative correlation with Productive Learning Habits (e.g. focused attention, deep processing vs shallow processing, seeking multiple perspectives more than trusting a single source) ?

A. **Web resource use**: Use the web to explore a topic in depth; look up a fact; watch a video online; listen to music online

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The correlations between technology use & Productive Learning Habits scale

Two with the largest effect sizes

Rapid Communication Technology

Frequent vs infrequent

- More likely to
  - perform fast and expedient (rather than iterative) web searches
  - seek answers to questions as they arise (rather than following up later)
  - maintain constant contact with friends while studying, and multitask while learning
- Less likely to
  - being able to control their multitasking while studying
  - read in a reflective way rather than merely gathering information
- Greater propensity to multitask and less ability to control their multitasking behavior.

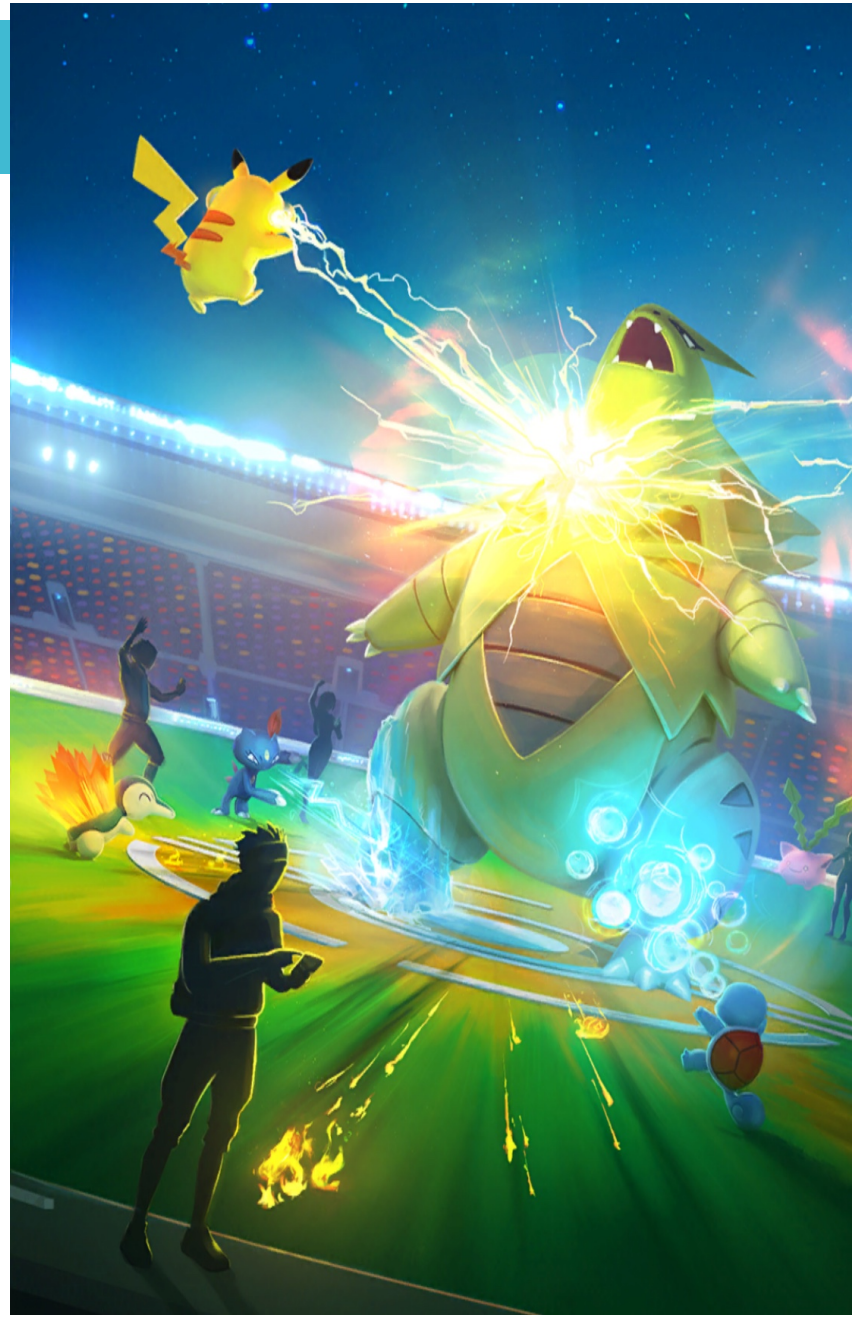
Book Reading

Frequent vs infrequent

- More likely to
  - persist in the face of short-term boredom
  - control their multitasking
  - listen attentively to a lecture
  - find learning enjoyable
  - stay on task (as opposed to socializing) when studying with friends
  - recognize their own responsibility (as opposed to teacher responsibility) for finding enjoyment in the learning process.
- less likely to
  - Think technology is necessary for learning
  - focus on graphics before text
  - report a preference for quick rather than long-term rewards for their efforts.

If students grow up with technology, does technology use shape their learning behaviours?

- **Method:** Quantitative & longitudinal study & experimental
- **Sample:**
  - Control Group (CG): n = 103
  - Experimental Group (EG): n = 87 (Played Pokémon GO for 8 weeks)
- **Location:** Spain
- **Age:** 12–15 years
- **Play time:** 39.22 ± 28.60 min/day on average
- **Walking distance:** 54.33 ± 32.44 km on average



Ruiz-Ariza, A., Casuso, R. A., Suarez-Manzano, S., & Martínez-López, E. J. (2017). Effect of augmented reality game Pokémon GO on cognitive performance and emotional intelligence in adolescent young. *Computers & Education*.

If students grow up with technology, does technology use shape their learning behaviours?

- Significantly increase in EG
  - Selective attention
  - Concentration
  - Sociability levels

Ruiz-Ariza, A., Casuso, R. A., Suarez-Manzano, S., & Martínez-López, E. J. (2017). Effect of augmented reality game Pokémon GO on cognitive performance and emotional intelligence in adolescent young. *Computers & Education*.

Correlations between learning approach and learning outcomes in digital learning environment

487 undergraduate students from seven universities in South Korea

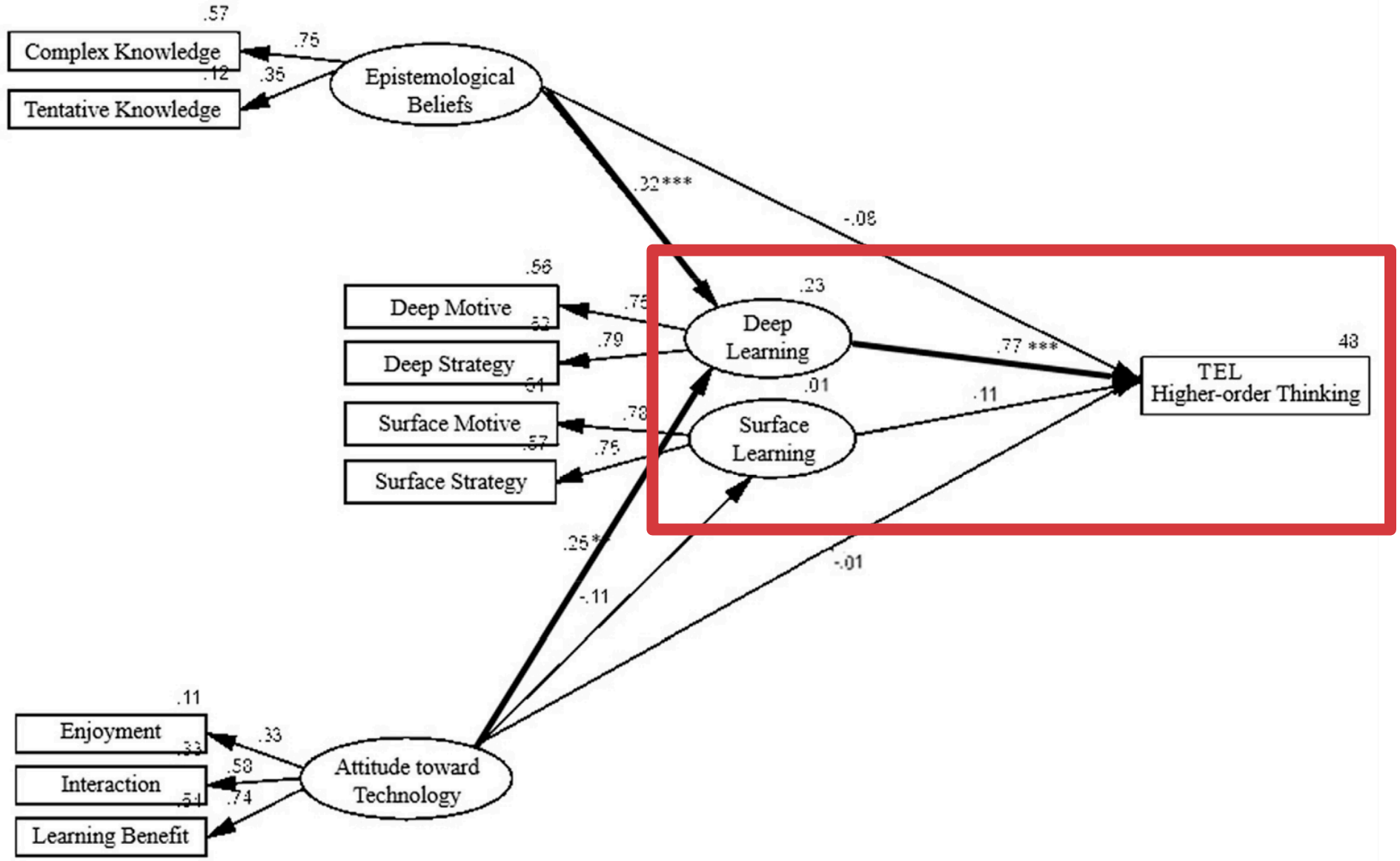


Fig. 2. Standardized path coefficients of the final model ($^{**}p < 0.01$, $^{***}p < 0.001$).

Lee, J., & Choi, H. (2017). What affects learner's higher-order thinking in technology-enhanced learning environments? The effects of learner factors. *Computers & Education*, *115*, 143-152.

Thank you! Questions?

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