Using technology to reach your learners: the theory behind the practice

Timothy C. Clapper, PhD
**Disclosures:** I am an Education and Simulation Consultant with TC Curriculum & Instructional Design, LLC, Healthcare Section Editor for Simulation and Gaming, and I teach graduate courses in Instructional Technology.
Objectives

Distinguish between using technology in a lesson and using technology to differentiate instruction.

Explain how research and learning theory guide practice and the effective use of technology in education.

Justify the use of technology for enriching and differentiating instruction for the learner.

Summarize the major learning theories and practices that support the use of technology in education.
Some present and emerging technologies that impact how we educate

Mobile learning and wearable technology
E-learning
Serious gaming and game-based learning
3D printing
Virtual labs
Cloud-based computing
Innovative apps

“Show me what you are thinking” – Tools for reflection and assessment
Future trends / emphasis in K-12 education?

Virtual or online learning. As noted by US Dept of Ed, “48 states and the District of Columbia currently support online learning opportunities that range from supplementing classroom instruction on an occasional basis to enrolling students in full-time programs.”

Full-time online schools. Fulltime online or virtual schools. Students receive all of their instruction and earn all of their credits through the online school. Students may go to a lab, but the instruction is monitored remotely by a certified, highly trained teacher.

Blended learning. Face-to-face and online learning opportunities. Recognizes student’s learning styles and allows them greater accessibility and accommodation to educational resources especially in remote areas.

Use digital resources well. Schools can use digital resources and technology to advance learning and incorporate reflection and feedback throughout the learning process.
Future trends / emphasis in higher education?

- Advance more innovation and creativity through problem-based learning – mirror the workplace
- Compile and share cloud-based resources to improve quality and accessibility
- Analyze learning-related data from number of logins to mastery of concepts
- Move to blended learning to increase accessibility
- Transition from traditional classroom settings to collaborative work spaces that promote active-learning activities

2015 New Media Consortium Horizon Report
What this can look like to the learner...

https://support.twitter.com/groups/54-mobile-apps/topics/222-ios/articles/20169499-getting-started-with-twitter-for-ipad#

http://www.loma.org/uploadedFiles/LOMAorg/LOMA_Root/HelpCenter/Reference/LoginWebEx.pdf

https://sites.google.com/site/eportfolioapps/online-tutorials/sites/sites-how-to
Online students perform better than those receiving face to face instruction.

Blended environments tended to do better. The media was not necessarily responsible for the positive outcomes, but instead, the additional time and instructional elements.

Guided facilitation and tools that prompted reflection led to better learning outcomes.

Self-explanation and application of the content in authentic ways, peer interaction, and student-centered or moderated instruction led to better outcomes.

The way the medium is used, including the user’s ability to manipulate and control it is more important than having access to it.

Zhang et al., 2006

US Dept of Education, 2010
Faculty training

Simulation, like many tools and strategies...

Not a separate learning modality, but one educational tool and strategy.

Significant growth in healthcare the past ten years. Many directors and educators thrust into positions without background experiences in instructional design. Some as early as one year out of residency.

Workshops help, but may be developed and taught by people with similar backgrounds or in the same situation.

(Clapper, 2014)

When do faculty receive instruction on techniques for applying learning theory to practice and making technology a tool for learning rather than just a “tool to use” or even a “tool of frustration?”

Think about the slide shown earlier and how overwhelming some learning environments can be for faculty in addition to the learners.
Faculty training

Faculty need to see a reason to change (Argyris and Schön, 1992).

Some barriers to using digital technology that should be addressed when considering faculty training:

- Teachers feel overwhelmed and pressed for time
- Blocked access to resources and sites
- Fear of failure (especially in front of peers and other professionals like themselves) (Hunt-Barron, 2015)
Theories and concepts supporting the correct use of technology in education

- Differentiated Instruction
- Situational interest
- Zone of Proximal Development
- Constructivism
- Cognitive load
- Situated cognition
- Theory of Margin
- Social cognitive theory
- Learning through the experience – Experiential learning
- Learning Styles - Dunn and Dunn
- Information processing theory
- Multiple Intelligences
- And many more
Technology
Frames of Reference and Piaget’s Schemata

**Frames of reference.** Most attributed to Kurt Lewin and other social psychologists.

**Schemata.** Most attributed to Jean Piaget.

Some similarities and differences, but the important takeaway:

People learn things a certain way and organize those thoughts and actions into mental models.

*It is how they learned it. It is what they know. It is real.*

Jeanne Ormrod’s marble building
Exercise 1

Not this kind
Constructivism

Maria Montessori, Jean Piaget, and John Dewey

• Constructivism as an educational philosophy becomes a basis for “Transformational learning” which you may read about in many adult learning journals.

• Piaget, (1962): Learner enters the environment with past experiences, schemata, or frames of reference that can be built upon or restructured if they have a reason to change them… (Importance of experience and reflection).

• Knowledge is constructed by the learner individually and with the assistance of others (Piaget, 1962; 2008; Vygotsky, 1978).

Learner experiences are very unique to each person. That is why they come into the learning situation with varied levels and context.

Not a turtle?! But you’re green, have four legs, and cute.

Assimilation – 😞 Disequilibrium – Accommodation 😊
Cooperative learning and the Zone of Proximal Development

David and Roger Johnson are perhaps best known for their research and practice with cooperative learning. *Not to be confused with group work* (Clapper, 2015a).

The *zone of proximal development (ZPD)* (Vygotsky, 1978): describes the difference between (a) what the learners can learn on their own and (b) what they can learn under the guidance of a facilitator or others in the learning environment.

Use intentional learning activities where learners can work together to move toward learning objectives (Barkley et al., 2005). Even working alone, learners can *use technology to organize or construct a product*. Learners can *use technology to share the product, which can assist others with moving through the ZPD*. 
Exercise 2

Not this kind
The Dunn and Dunn Model of Learning Styles

The Dunn and Dunn model (1978; 1992) identified three modality preferences that affect the way a person learns. Updated in 2009 according to international findings.

Dunn et al. (2009) found that most learners can possess up to six perceptual modalities including: a) auditory, b) visual/picture, c) visual/print, d) tactual, e) kinesthetic and/or f) verbal/kinesthetic (p. 136).

Use technologies that help them see it, hear it, and do it in many ways.
Learning styles in use

**auditory**
“What’s going with a shoulder dystocia and how does a clinician deal with it?”

**visual/picture**

**visual/print**

**tactual**

**kinesthetic**

clavicle?
Information Processing Theory

Compliments constructivism because the foundation is built upon the idea of self-regulation, relating new information with existing information, and processing information in the working memory.

Cognitive load. Demands on the working memory.

Use activities such as mind mapping, Thinking Map® and good instructional design principles to help the learner organize information and build connections.
Differentiated instruction does not fall neatly into one philosophy, ideology, or theory (Clapper, 2011). But can you see how they tie several together?

Facilitators can differentiate instruction by differentiating the content, the process, and the product (Tomlinson & McTighe, 2006).

**Differentiating the content** is important to address the various levels of learners in the classroom. How can you help them make multiple connections with the content?

**Differentiating the process** is important because the teacher selects learning activities that recognize the way the learner learns best. Think learning styles.

**Differentiating the product** is important because ongoing and varied forms of assessments (throughout the lesson) allow the learner to see those frames of reference and where the learner really is in their understanding.
Adult learners in your course rooms

Beyond Knowles: What those conducting simulation need to know about adult learning theory

Six characteristics of adult learners that course developers and facilitators should consider (Clapper (2010)):

1. Adult learners may have had bad learning experiences in the past.
2. Adult learners prefer learning that is active, and they want to be assisted with making meaning of the information.
3. Learning is an emotional event.
4. Adult learners prefer assessment and improvement to evaluation and failure.
5. Adult learners want to leave the lesson with a better understanding of the content.
6. Adult learners have many other priorities in their lives.
Evidence to support the correct use of technology in education

Comparison of Different Instructional Multimedia Designs for Improving Student Science-Process Skill Learning (Chien & Chang, 2012).

Randomized posttest comparison-group experimental design comparing the use of multimedia between animated and static visualizations to assist students in learning topographic measurements.

**Static Graphics (SG):** Static graphics were presented next to the corresponding texts.

**Simple Learner-Pacing Animation (SLPA):** Continuously dynamic illustrations with explanations. Includes learner-pacing function (pause, continue, and back buttons).

**Full Learner-Pacing Animation (FLPA):** Interactive dynamic illustrations with explanations. In addition, learners could pause or resume the animation. Further, the students could physically manipulate the graphic and control of the spatial relations such as the angles, heights, and distances, depicted in the animation.

*All participants were able to control the visuals, including the frame rate.*
Results

**Effort.** Mental effort ratings (student reported self-confidence or cognitive comfort levels) of FLPA group were, on average, lower than those of both SLPA and SG groups.

**Performance.** All students were required to measure a specific object with a real Abney Level using trigonometric leveling. Practical performances of FLPA group were, on average, higher than those of both SLPA and SG groups. Statistic significant level ($F(2, 24) = 6.931, p = .004, f = .76$, large effect size).

**Time.** FLPA group on average spent less time on learning in contrast to both SG and SLPA groups.
Evidence to support the correct use of technology in education

Lin and Griffith (2014) reviewed the studies published in academic journals for the impact of online technologies on computer-supported collaborative learning in second language and foreign language writing.

Findings from literature review: Online collaborative learning environments can enhance writing skills, critical thinking skills, and knowledge construction. In addition, they can increase participation, interaction, and reduce anxiety (think CoIT and ZPD).

Zhao and Chan (2014) examined a computer-supported knowledge-building environment of a tertiary education course.

Findings: Knowledge-building groups outperformed the comparison groups. Student engagement was a significant predictor of their academic literacy. Student groups engaging in more collective and meta-discourse assignments performed better on individual scores in academic literacy.
Evidence to support the correct use of technology in education

Emotional design in multimedia learning (Um, Plass, Haywood, & Homer, 2012).

Used color and shape effects in instructional design to induce positive emotions without changing the content of the materials

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<tr>
<th><strong>Emotions.</strong> The Positive Affect Scale (PAS) to ask respondents to indicate the degree to which they experience different feelings related to positive affect (interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, active), using a 5-point Likert-type scale ranging from 1 (<em>very slightly or not at all</em>) to 5 (<em>very much</em>; coefficient).</th>
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<td><strong>Prior knowledge.</strong> Assessed using a seven-item, self-report checklist. Learners indicated their level of knowledge of the topic of the learning material: immunization.</td>
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<td><strong>Transfer.</strong> The transfer test measured participants’ ability to apply the concepts learned to solve problems and consisted of four questions.</td>
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<td><strong>Learning outcomes.</strong> A comprehension test measured learners’ understanding of key concepts of the materials.</td>
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<td><strong>Effort / Cognitive load.</strong> To measure the <em>cognitive load</em> experienced by learners, participants completed a 9-point Likert-type Cognitive Load Subjective Experience Questionnaire targeting invested mental effort.</td>
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Results

Effort / Cognitive load. Positive emotions induced *during* the learning task reduced the perceived difficulty of the task.

Positive emotions induced *before* the learning increased the satisfaction toward the same learning material and experience.

Comprehension. Learners who studied the materials that were designed to induce positive emotions performed better.

Transfer. Positive emotions, externally or internally, increased participants’ performance on the transfer test.

**Remember:** Memory and emotions closely intertwined!

Positive emotions as retrieval cues.
Based on several experiments that test the way that learners process multimedia

Show connections: Students learn better when on-screen text and visual materials are physically integrated rather than separated.

Students receiving **instruction by narration and animations** outperform those who learn with concurrent on-screen text and animations (the researchers estimate that the learner may be missing part of the visual information while they are reading the text).

**Redundant verbal messages negatively affect learning when they are used in presentations of animations and explanations.**

Multimedia presentations should represent the verbal and non-verbal steps in synchrony.

Learners can hold images and verbal representations in working memory at the same time and can **build connections between them**.

Think animation with narration!

**Cognitive Theory of Multimedia Learning**

Moreno and Mayer (2000)
Applying theory to practice....some final thoughts on application

Use technology to enhance the quality of the learning experience and enrich the learning environment.

Research and teach best-practices so learners can have the best learning experiences and quality frames of reference.

When using simulation, make opportunities to teach before the scenario to ensure that everyone has the latest information and a shared mental model going into the scenario.

Select technologies that are easy for the learner to learn and use. Ask yourself, “will learning the technology be harder or take longer than learning the content itself?”

Naming one’s practice is an ongoing routine. Look to the past to help you design the future (Clapper, 2015b).
Contact: Timothy dot clapper at Gmail dot com

**How to cite this presentation:**

References


