Comparing E-learning Tool Success: The Case of Instructor-Student Interactive vs. Self-paced Tools

by

Dr. JJ Hsieh & Dr. Vincent Cho

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Time: 3:30 pm - 4:30 pm
Venue: M802

Abstract:

The wide acceptance and application of e-learning tools have profoundly transformed modern pedagogical approaches. Vendors are providing different types of systems, such as self-paced (SP) and instructor-student interactive (ISI) e-learning tools. The global market of e-learning tools was expected to reach US$ 23.7 billion by 2006. Given such a large investment and the associated impact it must have had on students’ learning outcomes, it is critical to evaluate the effectiveness of these e-learning tools.

In this paper, we first develop a model to evaluate e-learning tools’ success by extending and contextualizing Seddon’s IS success model for the e-learning environment. Furthermore, drawing on communication and education theories, we deduce four hypotheses to predict the differences in the key success factors between SP and ISI e-learning tools. The model and hypotheses are tested using survey data from 783 students of seven higher education institutes in Hong Kong. The results support the extended Seddon’s model and the four hypotheses. Specifically, ISI e-learning tools outperform SP tools in terms of system quality, information quality, perceived usefulness, satisfaction, and learning outcomes. The students also have higher intention to use ISI than SP tools in the future. Discussions on the theoretical insights and practical implications are further elaborated.

All interested are welcome.
Comparing E-learning Tool Success: Instructor-Student Interactive (ISI) vs. Self-paced (SP) Tools

JJ Hsieh and Vincent Cho
Motivation

- E-learning is a promising trend in the future
  - E-learning market: US$6.6 billion in 2002
  - Grow at 140% annually (IDC 2005)
  - Instructor – Student Interactive VS. Self-Paced Tools

- Affect student learning experiences

- Implementation of e-learning tools requires substantial resources.

- How do we evaluate the success of e-learning tools?

- Which tool is more successful?
Research Questions

- **RQ1**: What is the model for E-Learning tool success?

- **RQ2**: Between self-paced and instructor-student interactive e-learning tools, which is more effective for students’ learning?
E-learning Tools

- Instructor-Student Interactive (ISI)
  - digital technologies that facilitate distribution and exchange of information between instructors and students, in addition to their classroom interaction

- Self-paced (SP)
  - computer or online learning programs that include informational resources of a course topic and assessment mechanisms for self-evaluation
Seddon’s IS Success Model

Measure of Information & System Quality

- System Quality
- Information Quality

Perceptual Measures of Net Benefit

- Individual Impact
- Org’ Impact
- Societal Impact

Perceived Usefulness

Satisfaction

Usage Intention
Proposed E-Learning Tool Success Model

- Measure of Information & System Quality
- System Quality
- Information Quality
- Perceived Usefulness
- Performance Outcome
- Perception Measures of Net Benefit
- Satisfaction
- Future Use Intentions
- Added Path
Theories

- **Learning:**
  - Feedback
  - Individualization

- **Communication:**
  - Medium Richness Theory
  - Social Presence Theory
Feedback

- Continuous loop
  - Experiencing
  - Acting
  - Reflecting
  - Evaluating
- Evaluation of the outcomes of these actions
- Continuous process of goal-directed action
- Both SP and ISI e-learning tools can help students to obtain feedback
Individualization

- Individual learners differ in their
  - Backgrounds
  - Learning styles
  - Pace of learning
  - Traits
  - Needs

- Learning activities such as experiencing and reflecting → individualized phenomenon

- Enhance learning efficiency & effectiveness
Medium Richness Theory (MRT)

- The ability of the media to “overcome different frames of reference or clarify ambiguous issues to change understanding in a timely manner”

- The richer a media, the more it has
  - immediate feedback
  - the number of cues involved
  - message personalization
  - natural languages

- Reduce Equivocality
Social Presence Theory (SPT)

- The degree to which a medium permits users to experience others as being psychologically present.

- Transfer information that is beyond pure text-based messages:
  - Facial expression
  - Direction of looking
  - Posture
  - Dress
  - Nonverbal cues

- High socially-present: video or voice conferencing

- Low socially-present: interaction with software packages
Hypothesis 1: Info Quality

- ISI and SP tools
  - ISI higher media richness (i.e., natural language)
  - ISI higher social-presence (i.e., more human cue)
  - ISI higher individualization (i.e., more personalized message)

- **H1:**
  Information Quality of the instructor-student interactive e-learning tools will be higher than information quality of the self-paced e-learning tools
Hypothesis 2: Perceived Usefulness

- SP Tools: computer-generated feedback (more mechanical & generic)

- ISI tools:
  - Supplement traditional classroom learning → more flexible interaction between instructor and student
  - More specific and individualized feedback

- H2: Perceived Usefulness of the instructor-student interactive e-learning tools will be higher than perceived usefulness of the self-paced e-learning tools.
Hypothesis 3: Learning Outcomes

ISI tools:
- better understanding about individual students’ need
- continuously refined feedback based on individual needs
- more elaborated discussions
- more in-depth understanding of subjects

- better adjustment and regulation towards learning objectives
- Higher motivation towards learning

H3: Learning Outcomes of the instructor-student interactive e-learning tools will be higher than learning outcomes of the self-paced e-learning tools.
Hypothesis 4: Satisfaction

- **Satisfaction:**
  - Reflects individuals’ overall feeling after interacting with the technology
  - Captures such perceptions as Information Quality, Perceived Usefulness, and Performance Outcomes

- **ISI tools:**
  - Social presence of instructor → represents authority of the course knowledge → more reliable and trust-worthy learning means

- **H4:** Satisfaction with instructor-student interactive e-learning tools will be higher than satisfaction with self-paced e-learning tools.
Method: Survey

- Convenient random sampling

- Students of seven higher education institutions in HK

- 738 effective respondents (445 on SP tools and 293 on ISI tools)

- 70% response rate
Profile of Survey Respondents

<table>
<thead>
<tr>
<th>Types Demographics</th>
<th>Tool</th>
<th>Self-Paced Mode</th>
<th>Instructor-Student Interactive Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under-graduate</td>
<td>151</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>294</td>
<td>191</td>
<td></td>
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<tr>
<td>Age</td>
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<td></td>
<td></td>
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<tr>
<td>18-25</td>
<td>291</td>
<td>183</td>
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<td>26-30</td>
<td>61</td>
<td>50</td>
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<td>31-36</td>
<td>44</td>
<td>37</td>
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<tr>
<td>37-40</td>
<td>18</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>&gt;41</td>
<td>31</td>
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<tr>
<td>Gender</td>
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<td>Male</td>
<td>232</td>
<td>178</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>213</td>
<td>113</td>
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</table>
## Measurement Model Fit

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Self-Paced Mode</th>
<th>Instructor-Student Interactive Mode</th>
<th>Desired Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$/df</td>
<td>1.891</td>
<td>1.675</td>
<td>$&lt; 3.0$</td>
</tr>
<tr>
<td>CFI</td>
<td>0.967</td>
<td>0.965</td>
<td>$&gt; 0.95$</td>
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<tr>
<td>TLI</td>
<td>0.960</td>
<td>0.958</td>
<td>$&gt; 0.90$</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.045</td>
<td>0.048</td>
<td>$&lt; 0.06$</td>
</tr>
<tr>
<td>Standardized RMR</td>
<td>0.0305</td>
<td>0.0432</td>
<td>$&lt; 0.08$</td>
</tr>
<tr>
<td>GFI</td>
<td>0.932</td>
<td>0.912</td>
<td>$&gt; 0.90$</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.912</td>
<td>0.885</td>
<td>$&gt; 0.80$</td>
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<tr>
<td>Number of Latent Variables</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Total Number of Items</td>
<td>22</td>
<td>22</td>
<td></td>
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</tbody>
</table>
## Descriptive Statistics and Reliability of Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Self-Paced E-Learning Mode</th>
<th>Instructor-student Interactive Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
</tr>
<tr>
<td>Information Quality (5)</td>
<td>3.46(0.56)</td>
<td>3.55(0.59)</td>
</tr>
<tr>
<td>PEOU (3)</td>
<td>3.46(0.63)</td>
<td>3.61(0.62)</td>
</tr>
<tr>
<td>Perceived Usefulness (4)</td>
<td>3.39(0.65)</td>
<td>3.53(0.66)</td>
</tr>
<tr>
<td>Satisfaction (3)</td>
<td>3.23(0.66)</td>
<td>3.48(0.76)</td>
</tr>
<tr>
<td>Learning Performance (3)</td>
<td>3.28(0.67)</td>
<td>3.50(0.71)</td>
</tr>
<tr>
<td>Behavioral Intention (4)</td>
<td>3.40(0.68)</td>
<td>3.53(0.69)</td>
</tr>
</tbody>
</table>

a. The number in parentheses indicates the resulting number of items in the scale.
b. Average Extracted Variance
<table>
<thead>
<tr>
<th></th>
<th>Self-Paced E-Learning Mode</th>
<th>Instructor-Student Interactive Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IQ  SQ  PU  SAT  LO  BI</td>
<td>IQ  SQ  PU  SAT  LO  BI</td>
</tr>
<tr>
<td>IQ</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>SQ (PEOU)</td>
<td>0.36</td>
<td><strong>0.60</strong></td>
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<tr>
<td>PU</td>
<td>0.22</td>
<td>0.21</td>
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<tr>
<td>SAT</td>
<td>0.19</td>
<td>0.16</td>
</tr>
<tr>
<td>LO</td>
<td>0.26</td>
<td>0.21</td>
</tr>
<tr>
<td>BI</td>
<td>0.26</td>
<td>0.23</td>
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<tr>
<td>Reliability</td>
<td>0.82</td>
<td>0.82</td>
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<tr>
<td>C.R.</td>
<td>0.82</td>
<td>0.82</td>
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</tbody>
</table>

- Diagonal Elements: AVE of each construct
### Structural Model Fit

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Self-Paced Mode</th>
<th>Instructor-Student Interactive Mode</th>
<th>Desired Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$/df</td>
<td>1.971</td>
<td>1.737</td>
<td>&lt; 3.0</td>
</tr>
<tr>
<td>CFI</td>
<td>0.963</td>
<td>0.961</td>
<td>&gt; 0.95</td>
</tr>
<tr>
<td>TLI</td>
<td>0.957</td>
<td>0.955</td>
<td>&gt; 0.90</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.047</td>
<td>0.050</td>
<td>&lt; 0.06</td>
</tr>
<tr>
<td>Standardized RMR</td>
<td>0.0379</td>
<td>0.0484</td>
<td>&lt; 0.08</td>
</tr>
<tr>
<td>GFI</td>
<td>0.929</td>
<td>0.909</td>
<td>&gt; 0.90</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.909</td>
<td>0.883</td>
<td>&gt; 0.80</td>
</tr>
</tbody>
</table>
Analyses for RQ1

RQ1: What is the model for E-Learning tool success?

Evaluate the structural model of ISI and SP success.
Structural Model of Self-Paced Tools

Measure of Information & System Quality

Ease of Use

Information Quality

Perceived Usefulness (0.51)

0.16 (*)

Satisfaction (0.68)

0.14 (+)

Learning Outcomes

Perceptual Measures of Net Benefit

Future Use Intention (0.61)

0.42 (**)

0.50 (**)

0.66 (**)

0.46 (**)

+ P < 0.1
* P < 0.05
** P < 0.01

Significant Path

Insignificant Path
Analyses for RQ2

RQ2: Between self-paced and instructor-student interactive e-learning tools, which is more effective for students’ learning?

→ Compare latent construct means between groups.
Measurement Invariance

- **Configural Invariance**
  - Congeneric Item loading patterns across Groups

- **Metric Invariance**
  - Equal Item Loading Scales across Groups

- **Scalar Invariance**
  - Equal Measurement Intercepts across Groups

- Hierarchical order: configural → metric → scalar

- Change in CFI between two nested models is smaller than 0.01, then more complex invariance is supported (Cheng and Rensvold 2002)
### Goodness of Fit Indices

<table>
<thead>
<tr>
<th>Goodness of Fit Indices</th>
<th>Configural Invariance</th>
<th>Metric Invariance</th>
<th>Scalar Invariance</th>
<th>Desired Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2 / \text{D.F.}$</td>
<td>1.783</td>
<td>1.756</td>
<td>1.773</td>
<td>&lt; 5</td>
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<tr>
<td>TLI</td>
<td>0.945</td>
<td>0.944</td>
<td>0.941</td>
<td>&gt; 0.90</td>
</tr>
<tr>
<td>CFI</td>
<td>0.966</td>
<td><strong>0.965</strong></td>
<td><strong>0.963</strong></td>
<td>&gt; 0.95</td>
</tr>
<tr>
<td>SRMR</td>
<td>0.0305</td>
<td>0.0339</td>
<td>0.0355</td>
<td>&lt; 0.06</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.033</td>
<td>0.032</td>
<td>0.032</td>
<td>&lt; 0.08</td>
</tr>
</tbody>
</table>
Mean Comparison of Latent Constructs across Groups

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Self-Paced E-Learning Mode</th>
<th>Instructor-student Interactive Mode</th>
<th>Support Hypothesis?</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Quality</td>
<td>- 0.266 **</td>
<td>&lt; 0</td>
<td>No hypothesis</td>
</tr>
<tr>
<td>Information Quality</td>
<td>- 0.175 **</td>
<td>&lt; 0</td>
<td>H1 (√)</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>- 0.244 **</td>
<td>&lt; 0</td>
<td>H2 (√)</td>
</tr>
<tr>
<td>Learning Outcomes</td>
<td>- 0.342 **</td>
<td>&lt; 0</td>
<td>H3 (√)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>- 0.385 **</td>
<td>&lt; 0</td>
<td>H4 (√)</td>
</tr>
<tr>
<td>Behavioral Intention</td>
<td>- 0.190 **</td>
<td>&lt; 0</td>
<td>No hypothesis</td>
</tr>
</tbody>
</table>

significant at (**: p <0.01,  *: p<0.05)
Limitations

- Cross-sectional study

- Additional factors not modeled:
  - Individual learning styles
  - Nature of studied subjects
  - Instructors’ teaching philosophy
Contributions and Implications: Theory

- Identified the Success Model for E-learning Tools.
- Theoretical deduced and empirically validated relative effectiveness of different types of e-learning tools
- The role of feedback in e-learning contexts
  - Format, Timing
- Technology advance → replace human beings?
Contributions and Implications: Practice

- Cost & limitations of e-learning tools
- When to use ISI or SP tools?
- Access to e-learning tools