The Impact of Student Expectations and Tutor Acceptance on Computer-Based Learning Environment Acceptance and Future Usage Intentions

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International Defense and Homeland Security Simulation Workshop 2011
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Topics for Discussion

• Research Motivation/Background

• Methodology

• Preliminary Results

• Conclusions

• Questions
• Users’ acceptances of a technology is critical to its success.

• What factors contribute to technology acceptance that can be measured?
  – Users’ Attitudes, Perceptions, Usability, Expectations, individual differences, etc...

• Intelligent Tutoring Systems (ITSs) and other computer-based learning environments approach to promoting technology acceptance is to embed agents into the learning environment.
  – Facilitates the learning process
  – Establishes a learner-agent relationship
  – Impacts learner outcomes

Technology Acceptance Model (TAM) (Davis, 1989)

Can you save the situation?
Select the best option

We have this great van with a state of the art entertainment center to keep your kids happy on those long weekend trips! You can test drive it tomorrow!

Well - You were looking at our new van. Why don’t you tell me a little more about what you need.
Research Problem

Prior to System Interaction:
Learner Individual Characteristics
Learner Expectations

- System Acceptance Evaluations—since late 80s/early 90s; PA Acceptance Evaluations —since 1999+
- No or Limited Empirical Investigation of:
  - The relationship between these two types of interactions
  - Learner’s expectations prior to system interaction of the agent and learning environment
  - How both interactions impact learner outcomes

After System Interaction:
Learner Outcomes
Learner Acceptance

Emotional Support ?
Competency ?

LEARNER Interactions LEARNING ENVIRONMENT
Pedagogical Agent (PA)

Interface

Prior to System Interaction:
Learner Individual Characteristics
Learner Expectations
Research Questions

- What are student’s expectations of a PA and a computer-based LE?

- What is the relationship between learners’ acceptance of a PA and their acceptance of a computer-based LE the PA is embedded within?

- How does a PA’s characteristics of emotional support and competency impact learners’ mood and knowledge acquisition?
Methodology

• A learning environment was developed to teach learners the rules and strategies of Sudoku.

• 4 versions of PA:
  – Emotionally Supportive & Competent (ESC) (N=9)
  – Competent Only (CO) (N=8)
  – Emotionally Supportive Only (ESO) (N=9)
  – Neither Emotionally Supportive or Competent (NESC) (N=8)

• Pre-, Mid-, and Post-experiment surveys

• Sample Population:
  – 35 volunteers (22 males and 14 females)
    • Sudoku Experience: 31% - None; 31% - Basic; 37% - Advanced
    • 81% advanced computer users.
    • 91% believe that computer can help learn difficult concepts.
    • 65% were interested in increasing their Sudoku Knowledge.
    • 86% were motivated to participate in the study.
1. Student’s acceptance of a PA’s qualities will have a strong, positive relationship to their acceptance of the learning environment.

2. The PA condition experienced by the learner will have a direct effect on their self-reported mood dimensions (Pleasure, Arousal, and Dominance).
Learning Environment

What Can I Help You With?

- Lone Rangers Hint
  *Intermediate Technique - Limit 2/game

- Twins Hint
  *Advanced Technique - Limit 2/game

- Triplets Hint
  *Advanced Technique - Limit 2/game

Display Possible Values of Empty Cells
  **Golden Ticket - Limit 4/game

Need a refresher on CRME, Lone Rangers, Twins, or Triplets?

Let me show you how these concepts work!

CLICK HERE

Sudoku Tutorial

Take your time to understand this tutorial...no need to rush. I talk fast, but I will always wait for you.) Oh, and don’t forget to scroll down as needed!

Sudoku is an easy to learn logic-based number placement puzzle with 3 simple rules.

Sudoku originated in Switzerland in the 18th Century, but became popular worldwide in 1986 when it was publicized in Japan.

The goal is to use the given numbers to complete the puzzle by placing the numbers 1 through 9 without repeating a number in any row, column or 3x3 minigrid.

The blue Sudoku puzzle to the right lays out the three Sudoku Rules, which are:
Hi Friend, Welcome to the Learning Environment! Here, we will be playing our 2 Sudoku games.

**SUDOKU!!**

Select number 1 2 3 4 5 6 7 8 9 Erase

---

**TIME: 00:34**

SCORE: 90

Select number 1 2 3 4 5 6 7 8 9 Erase

- Row 1: 6 7 2 3 1
- Row 2: 8
- Row 3: 7 2 5 8 9
- Row 4: 4 7 3 6 8 2
- Row 5: 2 6 1 9 3
- Row 6: 9 7 1
- Row 7: 8 9 1 4 3 5
- Row 8: 3 1 6 2 7 9

---

Audie’s Suggestions Box
Score: 90

- Since there is a 9 in Column 8 and Column 9, which column should you place a 9 to satisfy the Column Rule?
- Yes, you are correct. There cannot be another 9 in either Column 8 or 9. Great Job.
- Now we know the 9 should go in Column 2, but what row should it go in?
- Sorry, you are incorrect. Column 7. 9 has to go in Row 5, because the 3rd missing already has a 9, and Row 6 already has a 9. Fixing in there, you will get it.
- Now you know that cell (2.5) = 9. Place it in the appropriate cell now, then click on ME again.

---

Audie’s Suggestions Box
Score: 90

- Number 2 placed at (2.3)
- Invalid move of 9 at (9.5)
- Invalid move of 9 at (8.6)
- Number 9 placed at (7.5)
### Initial Expectations Results

#### Statement: A tutor that...

<table>
<thead>
<tr>
<th>Statement: A tutor that...</th>
<th>Min., Max.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Ranked (Most Imp., Least Imp.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>...you would use again</td>
<td>4,9</td>
<td>7.91</td>
<td>1.463</td>
<td>40% 40%</td>
</tr>
<tr>
<td>...you would strongly recommend to others</td>
<td>4,9</td>
<td>7.71</td>
<td>1.447</td>
<td>29% 54%</td>
</tr>
<tr>
<td>...you would enjoy working with</td>
<td>6,9</td>
<td>8.31</td>
<td>0.963</td>
<td>34% 34%</td>
</tr>
<tr>
<td>...you feel motivated to work with</td>
<td>5,9</td>
<td>8.14</td>
<td>1.264</td>
<td>14% 51%</td>
</tr>
<tr>
<td>...helps you better understand the learning content</td>
<td>7,9</td>
<td>8.60</td>
<td>0.604</td>
<td>49% 26%</td>
</tr>
<tr>
<td>...lets you know how well you are doing</td>
<td>2,9</td>
<td>8.06</td>
<td>1.434</td>
<td>37% 20%</td>
</tr>
<tr>
<td>...keeps you updated on your progress</td>
<td>5,9</td>
<td>8.11</td>
<td>1.022</td>
<td>31% 23%</td>
</tr>
<tr>
<td>...understood how much you knew</td>
<td>6,9</td>
<td>8.43</td>
<td>0.815</td>
<td>31% 31%</td>
</tr>
<tr>
<td>...provided you helpful feedback</td>
<td>5,9</td>
<td>8.51</td>
<td>0.853</td>
<td>49% 17%</td>
</tr>
<tr>
<td>...increases your interest in the learning content</td>
<td>5,9</td>
<td>7.91</td>
<td>1.380</td>
<td>31% 34%</td>
</tr>
<tr>
<td>...holds your interest</td>
<td>5,9</td>
<td>8.14</td>
<td>1.264</td>
<td>14% 34%</td>
</tr>
<tr>
<td>...you’re satisfied with its performance</td>
<td>5,9</td>
<td>8.09</td>
<td>1.147</td>
<td>40% 34%</td>
</tr>
</tbody>
</table>

#### Statement: A learning environment that...

<table>
<thead>
<tr>
<th>Statement: A learning environment that...</th>
<th>Min., Max.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Ranked (Most Imp., Least Imp.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>...is easy to use. (PEU)</td>
<td>5,9</td>
<td>8.14</td>
<td>1.115</td>
<td>57% 26%</td>
</tr>
<tr>
<td>...is controllable. (PEU)</td>
<td>2,9</td>
<td>7.43</td>
<td>1.668</td>
<td>17% 34%</td>
</tr>
<tr>
<td>...is enjoyable. (PEU)</td>
<td>4,9</td>
<td>7.54</td>
<td>1.482</td>
<td>17% 51%</td>
</tr>
<tr>
<td>...does not require a lot of mental effort. (PEU)</td>
<td>2,9</td>
<td>6.74</td>
<td>2.049</td>
<td>26% 51%</td>
</tr>
<tr>
<td>...is easy to learn how to use. (PEU)</td>
<td>6,9</td>
<td>8.14</td>
<td>1.089</td>
<td>40% 31%</td>
</tr>
<tr>
<td>...is easy to intuitively navigate through. (PEU)</td>
<td>4,9</td>
<td>8.17</td>
<td>1.224</td>
<td>26% 17%</td>
</tr>
<tr>
<td>...has good functionality (features). (PEU)</td>
<td>5,9</td>
<td>8.06</td>
<td>1.211</td>
<td>37% 20%</td>
</tr>
<tr>
<td>...is useful for learning content. (PU)</td>
<td>5,9</td>
<td>8.40</td>
<td>1.006</td>
<td>51% 17%</td>
</tr>
<tr>
<td>...is reusable for learning other content in the future. (UI)</td>
<td>4,9</td>
<td>7.43</td>
<td>1.720</td>
<td>29% 51%</td>
</tr>
</tbody>
</table>

**Note:** Perceived Ease of Use (PEU), Perceived Usefulness (PU), and Future Usage Intentions (UI)
Acceptance of PA & LE Post-Interaction

Tutor Perceptions

- I would use Audie as my tutor again
- Audie helped me better understand Sudoku
- Audie provided helpful feedback
- My experience with Audie was better than I expected

Acceptance of Learning Environment

- Perceived Ease of Use
- Perceived Usefulness
- Future Usage Intentions

Agent Condition

- ESC
- ESO
- CO
- NESC
Mood Assessment

Mood Assessment Results: Pleasure

Mood Assessment Results: Arousal

Mood Assessment Results: Dominance

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Conclusions

• A few limitations:
  – Small Sample Size
  – Learner’s Expectations of the PA and LE were not met.
  – LE is more suitable for novice than advanced Sudoku players.

• Learners’ initial expectations of a PA and LE may provide better insight to their attitudes/perceptions toward and interactions with the system.
  – Different levels of initial competency is an influential factor.

• There is a significant positive connection between the learners’ perceptions of a PA and the LE it’s embedded within; thus, increasing the learners’ trust/acceptance in the PA will increase their trust/acceptance of the LE.

• More investigation is needed to:
  – Explore the relationship between expectations and acceptance.
  – Understand how a PA’s characteristics (i.e., emotional support and competency) influence learners’ moods and other outcomes.