Does time fly when having fun? A study assessing the relationship between estimated time on task and enjoyment of infectious disease serious games

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BACKGROUND
Mastering the fundamentals of infectious diseases (ID) requires students to memorize large volumes of material about pathogens, antibiotics, patients, and the interactions between the three.

Microbiology and ID courses often depend on PowerPoint slide lectures as their primary teaching tools. This strategy encourages short-term memory and does not foster application of knowledge, understanding, or long-term retention. This method relies heavily on students to memorize vast amounts of content and has been shown to negatively influence career interest in ID.

It is hypothesized that there is a positive relationship between time on task and engagement. Attentional demands shorten estimates of time and highly enjoyable activities can monopolize attention.

Transitioning the hours students spend memorizing lists and flashcards to a gaming environment may increase material retention, decrease study fatigue, and increase engagement. However, it is unknown if the immersive effect of gamification can increase student enjoyment of a serious game and the estimated time spent playing.

OBJECTIVE
To explore the relationship between enjoyment of a serious game and the estimated time spent playing.

GAME DESCRIPTION
Fightin’ Figures – calculations card game similar to “War”
• Content: Sterile and non sterile compounding, PK/PD
• Description: Sets of two players compete against each other. Each player flips over a card and solves the calculation problem. If both players answer the problem correctly, the highest number wins. If only one player answers correctly, the opponent earns a point. If neither answers correctly, both cards are discarded. Players rotate each round.
• Time allotted: 20 minutes (UW), 10 minutes (CU)

Rapid Rounds – quiz game
• Content: antimicrobials, antihypertensive medications, DM
• Description: Group game of 2-4. A player is asked a multiple-choice question, if correct, they roll the dice and move game piece forward. If incorrect, they lose a turn. The first player to 40 wins. Time allotted: 25 minutes (UW), 40 minutes (CU)

Pills & Placebos – board game
• Content: ID, antipsychotics/antidepressants, toxicology
• Description: Group game of 2-4. A player draws a card and describes the subject. After teammates guess the answer an opposing team player describes a card subject. The goal is to not be describing the subject. When time runs out, neither answers correctly, both cards are discarded. Players rotate each round.
• Time allotted: 20 minutes (UW), 10 minutes (CU)

Fightin’ Figures
• Description: Group game of 2-4. A player is asked a multiple-choice question, if correct, they roll the dice and move game piece forward. If incorrect, they lose a turn. The first player to 40 wins. Time allotted: 25 minutes (UW), 40 minutes (CU)

Pills & Placebos
• Description: Group game of 2-4. A player draws a card and describes the subject. After teammates guess the answer an opposing team player describes a card subject. The goal is to not be describing the subject. When time runs out, neither answers correctly, both cards are discarded. Players rotate each round.
• Time allotted: 20 minutes (UW), 10 minutes (CU)

STUDY DESIGN
Design and sample: Voluntary cross-sectional study of third and fourth year pharmacy students at the University of Wyoming and the University of Colorado

Participants: Winners for each game won prizes (estimate cost of $5), food and beverages were provided

Schedule:
• 5 minutes: game concept, directions, rules, and modeling of game play
• 15-40 minutes: game play
• 5 minutes: completion of 5 question survey

RESULTS
STUDENT DEMOGRAPHICS

<table>
<thead>
<tr>
<th>Age, years (range)</th>
<th>27 (24-30)</th>
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<tbody>
<tr>
<td>Female, n (%)</td>
<td>45 (53.6)</td>
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<tr>
<td>Reported GPA, points (range)</td>
<td>3.6 (3.3-3.9)</td>
</tr>
<tr>
<td>Prefer to study alone, n (%)</td>
<td>73 (86.9)</td>
</tr>
<tr>
<td>Game is more efficient than individual NAPLEX review, n (%)</td>
<td>24 (28.6)</td>
</tr>
<tr>
<td>NAPLEX review, n (%)</td>
<td>32 (38.1)</td>
</tr>
<tr>
<td>Pills &amp; Placebos, n (%)</td>
<td>48 (57.1)</td>
</tr>
</tbody>
</table>

SUMMATIVE EVALUATION OF GAMES

<table>
<thead>
<tr>
<th>Game</th>
<th>Correct Estimation</th>
<th>Underestimation</th>
<th>Overestimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fightin’ Figures</td>
<td>10 (10.0)</td>
<td>6 (6.0)</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Rapid Rounds</td>
<td>10 (10.0)</td>
<td>8 (8.0)</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>Pills &amp; Placebos</td>
<td>10 (10.0)</td>
<td>8 (8.0)</td>
<td>2 (2.0)</td>
</tr>
</tbody>
</table>

*Time Estimate Ratio Legend: Psychological studies have shown that duration estimates are influenced by engagement, arousal, and motivation. This results in a discordance between subjective duration and objective duration. When time passes quickly, it feels like time flew by (+1) or when time passes slowly, it feels like time dragged on (+2).

DISCUSSION
Although a small study, there was no trend toward association of time underestimation and enjoyment of these teaching methods. Students enjoyed the board game Pills & Placebos most yet the time estimation ratio was 1.0, indicating estimated and actual time on task were the same. Students enjoyed Fightin’ Figures the least, but this was the only game they underestimated time spent on task. More research should be performed investigating if and how different learning strategies affect student time progression and content immersion.