Commercial Card Games Improve Middle School Students’ Executive Functioning

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Introduction

Improving your score at a card game to defeat your friends requires practice. You not only practice the game’s strategies, but also improve the mental processes needed for gameplay. Games and executive functioning can both be practiced and improved upon; perhaps simultaneously.

Background

Executive Functioning (EF) refers to the cognitive abilities that allow people to adapt in order to meet their goals. EF encompasses the following skills (Miyake et al., 2000):
- shifting: switching between mental processes
- updating: monitoring and updating information in working memory
- inhibition: suppressing typical responses

EF is a significant predictor for Middle School academic achievement (Samuels et al., 2016). Shifting ability has been shown to be related to science achievement and to science learning in middle and high school students (K. Varma, Van Boekel, & S. Varma, 2018). A student who struggles with EF skills does not need to do so for their entire life. EF can be improved through intervention and training (Diamond & Lee, 2011).

Research Questions

1. Do students show increased performance on measures of executive function after playing games?
2. Is there a relationship between students’ performance on specific scientific practices targeted in the games and measures of EF?

Measures

Executive Functioning assessments were paper-delivered.

Methods

Participants: This study took place in a large, urban middle school located in the Upper Midwest. The seventh graders who participated were relatively high-achieving students.

Single Group Pre-Post-Test Research Design. Students were given Executive Functioning pre-tests.

Students were randomly divided into groups of 4 to play each of the games below with each other for 3 class periods. They were given a delayed post-test two weeks later.

Results

Time (in seconds)

<table>
<thead>
<tr>
<th>Flanker Antisaccade</th>
<th>n=47</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>m ± SD</td>
<td>m ± SD</td>
<td>m ± SD</td>
<td>m ± SD</td>
</tr>
<tr>
<td>20.3 ± 9</td>
<td>95.91 ± 102</td>
<td>94.02 ± 918</td>
<td></td>
</tr>
</tbody>
</table>

Inhibition: On the Flanker and antisaccade tasks, students reported significantly faster completion times on the posttests. However, they did not improve in the number of items they answered correctly.

Shifting: Students performed significantly better on the local-global task after the gameplay experiences. They answered significantly more items correctly. They also made fewer errors, however, that difference is only marginal.

Conclusion + Discussion

Students improved their executive functioning after playing games with their classmates for several days. Their desire to win the game naturally resulted in EF training without the need for heavy-handed intervention.

Thus, EF improvement is not exclusive to researcher-designed training. The commercial games the students played are marketed as entertainment games and produced en masse. This can make EF training more accessible to families and schools.

Future studies of EF should assess the potential effect of games students are already playing in their free time.

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References


