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The Impact of Time Constraints on Flow Experience in an Educational Game

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Abstract

Flow is a promising approach to enhance learning performance and promote deep learning. This study involved 90 students in China as they played a puzzle game called 2048 with four different levels of time constraint. Data was collected and analyzed using a mixed-methodology approach. An overall negative linear relation between time constraint and flow experience was found. Flow experience declined as the constraint level went higher. However, some positive effects of time constraint on flow experience as well as deep learning could be evidenced by some qualitative data. Implications on flow theory and optimal learning performance were discussed.

Background

- Flow is firstly described by Csikszentmihalyi (1975, 2000) as an optimal psychological state in which a person is fully immersed in what he or she is doing for the sake of the activity itself.
- There is evidence suggesting that time constraints may influence individual's affective state, cognition and behavior (e.g., Qin, 2015). There are three main models of the impact of time stress: negative linear model (i.e., time stress is detrimental), positive linear model (i.e., time stress represents a motivation), and inverted-U model (i.e., moderate time stress is necessary).
- Previous studies have reported the positive influence of flow experience on learning performance in various kinds of learning contexts (e.g., Wang & Hsu, 2014), but few studies focused on the impact of time constraints on flow (Yildirim, 2015).

Hypothesis

There is an inverted-U relation between time constraints and flow experience. Time constraints have bidirectional impacts on flow. Moderate time constraints evoke the best flow experience.

Method

- This study set four levels of time constraints for experienced and inexperienced participants separately following an experience-based method.

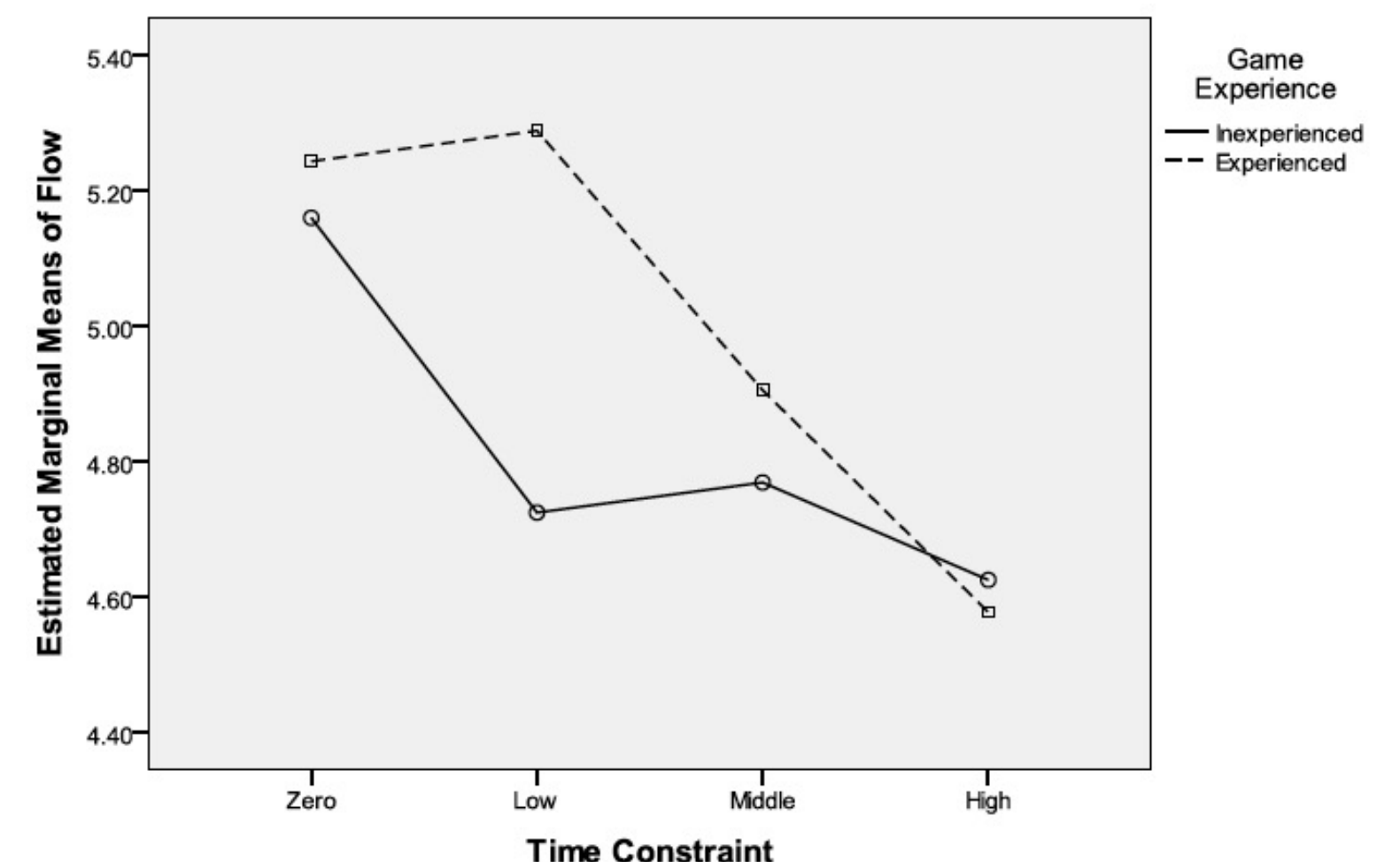
Constraint level		Zero	Low	Middle	High
Calculation formula		/	$M \pm SD$	M	$M \pm SD$
Inexperienced	Time duration	/	6min 18s	4min 24s	2min 26s
	% completed	100%	96%	61%	17%
Experienced	Time duration	/	3min 27s	2min 15s	1min 2s
	% completed	100%	85%	59%	13%

- Participants were randomly assigned to four groups based on a Latin Square design.

Sequence	Treatment 1	Treatment 2	Treatment 3	Treatment 4
A	z	l	m	h
B	l	h	z	m
C	m	z	h	l
D	h	m	l	z

Results

- There was an overall negative correlation between time constraint and flow experience. Time constraint showed significant main effects on flow experience.
- For the experienced participants, flow with low time constraint was highest. For the inexperienced, flow experience without time constraints was best.



- An overall negative correlation between time constraint and performance was also revealed. Experienced participants' score declined as time constraint increased while the inexperienced got the best score at low constraint in failed tasks.
- In tight time constraint conditions, most participants had strong time consciousness, low concentration, and experienced negative affects. Participants felt very relaxed in tasks without time constraint and could concentrate on the game without the time bothering. However, some participants said that they had optimal experience with mild time constraints.

Discussion and Conclusion

Though the hypothesis was rejected, an inverted-U relationship was still expected with an assumption that the present study merely found the negative half of the inverted-U model. There are three main implications of the present study.

- First, field experiment but not laboratory experiment was suggested for the future research using common learning tasks but not educational games. This could avoid already existing high flow experience in unconstrained conditions and lower experimental effect.
- Second, time transformation is suggested as the by-product of concentration and positive affects but not a necessary component of flow. Thus the componential approach to measure flow may need to be revised further.
- Third, an ideal learning state where learners have a harmonious balance of intrinsic and extrinsic motivation is put forward. When flow is induced at the zone of proximal development of learners, they will have the most enjoyable and productive learning experience.