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Probing in-service Teachers' Perceptions on TPACK-G and Acceptance of GBL

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Abstract: This study was to investigate how junior and senior teachers' perceptions of the Technological Pedagogical Content Knowledge—Games (TPACK-G) differ and how their TPACK-G perceptions predict their acceptance of game-based learning. 376 in-service elementary school teachers in Taiwan were invited to answer the TPACK-G and acceptance of game-based learning questionnaires. The results show that junior elementary school teachers tended to have higher GK, GCK and GPCK than the senior. Junior elementary school teachers' GPCK directly predicted their Attitude and Actual teaching usage, though none of the predictions were significant for the senior. Finally, the senior elementary school teachers' GK had negative relation to their Actual teaching usage.

Keywords: TPACK, game-based learning, teacher education, games

1. Introduction

Using digital games (hereafter named games) to support teaching and learning has been receiving growing attention. Games can positively affect students' learning motivation and outcomes, and also improve students' critical thinking skill and problem solving ability through appropriate pedagogical design (Akcaoglu, 2014). However, most games studies investigated the impacts of games on students' knowledge acquisition and motivation, and very few have examined technological pedagogical content knowledge toward games (TPACK-G) and acceptance of game-based learning (GBL) of teachers, the key agent in class. Furthermore, teachers' teaching and gaming experience plays a crucial role in influencing their TPACK-G perceptions and acceptance of GBL. Prior research has identified that junior teachers tended to perceive higher self-efficacy in their TPACK-G perceptions than the senior (Hsu, Tsai, Chang & Liang, 2017). Senior teachers were less likely to adopt games in class (Li & Huang, 2016). Thus, this study paid attention to teachers' teaching experience, and was to probe how junior and senior teachers' perceptions of TPACK-G differ and how their TPACK-G perceptions predict their acceptance of game-based learning. Two research questions are:

1. What were junior and senior elementary school teachers' TPACK-G perceptions?
2. How did junior and senior teachers' TPACK-G perceptions predict their acceptance of game-based learning?

2. Methodology

2.1 Participants

The participants of this study were 376 in-service elementary school teachers (120 males and 256 females) from different geographical regions in Taiwan. The average age was 38.94 (S.D. = 6.88). Their average year of teaching experiences was 13.32 (S.D. = 7.40).

2.2 Instruments

The TPACK-G questionnaire was used in this study to probe the elementary school teachers' confidence in TPACK-G. This instrument, 22 items in total, was developed by Hsu, Liang, Chai and Tsai (2013) according to the work of Koh, Chai and Tsai (2013) as well as Lee and Tsai (2010). The factors were game knowledge ("I can learn digital games easily"), game pedagogical knowledge ("I know how to integrate digital games into teaching"), game content knowledge ("I can tell whether the digital games represent the targeted subject matter knowledge"), and game pedagogical content knowledge ("I can select digital games to use in my classroom that enhance what I teach, how I teach and what students learn"). The reliability are .95, .96, .96, .97, .97, respectively for GK, GCK, GPK, GPCK, and overall reliability. The second questionnaire was to probe teachers' acceptance of game-based learning. The factors were, teachers' attitudes toward game-based learning ("I constantly play digital games") and actual teaching usage of games ("I am using digital games in class"). Each factor had five items. The reliability is .95 for Attitude and .93 for Actual teaching usage. All items presented with a 7-point Likert scale from 1 "strongly disagree" to 7 "strongly agree".

2.3 Data analysis

This study used confirmatory factor analysis (CFA) to examine the construct validity of the questionnaires. The *t*-test was applied to compare differences in junior and senior elementary school teachers' TPACK-G perceptions and acceptance of GBL. Then, the structural relationships among the latent variables of the questionnaires were evaluated via SEM analysis for both group teachers, respectively.

3. Results

The CFA results show that a total of twenty items were retained and grouped into six factors in the model. Three to four items were remained for each factor. All measured item factor loadings are significant ($p < 0.001$) and higher than 0.7 that specify the relations of the questionnaire items to their posited underlying factors in one model. The reliability coefficients for these six factors ranged from 0.89 to 0.96, the average variance extracted (AVE) ranged from 0.67 to 0.87, and the composite reliability (CR) coefficients ranged from 0.89 to 0.96. The RMSEA is 0.064 and 0.052, respectively for the junior and senior elementary school teachers, suggesting a good model fit. Table 1 shows the *t*-test results of comparing junior and senior elementary school teachers' TPACK-G, attitudes, and actual teaching usage. As shown, junior elementary school teachers had significantly higher "GK," ($t = 3.16$, $p < 0.01$) "GCK" ($t = 2.47$, $p < 0.05$) and "GPCK" scores ($t = 2.00$, $p < 0.05$) than senior elementary school teachers in TPACK-G, but not in Attitude and Actual teaching usage. Given that there are significant differences between these two groups, this study further employed SEM analysis to examine the group differences in the structural models of the factors.

Table 1: comparison of junior and senior elementary school teachers' TPACK-G, attitudes, and actual teaching usage.

	GK	GCK	GPK	GPCK	Attitude	Actual usage
Junior (n=193)	4.60 (1.41)	4.82 (1.09)	4.81 (1.11)	4.76 (1.20)	3.13 (1.60)	4.03 (1.23)
Senior (n=183)	4.14 (1.44)	4.52 (1.26)	4.59 (1.28)	4.49 (1.34)	2.87 (1.55)	3.80 (1.37)
t-test	3.16**	2.47*	1.73	2.00*	1.59	1.66
Cohen's *d*	0.32	0.25	0.18	0.21	0.17	0.18

The goodness-of-fit (GOF) indices showed that the junior elementary school teachers' model well explained the data. Among the fit indices, the values of Chi-square = 332.11, degree of freedom = 162, the ratio of Chi-square to degrees of freedom = 2.50, RMSEA = 0.074, GFI = 0.86, NFI = 0.93, IFI = 0.96, TLI = 0.95 and CFI = 0.96, indicated a good model fit for this model and suggested that this model was suitable for interpreting the structural relationships among the factors of TPACK-G and Acceptance of GBL in junior elementary school teachers. According to Figure 1, junior elementary school teachers' GK was the significantly positive factor for explaining the variation in their GCK, GPK and Attitude, whereas both of junior elementary school teachers' GCK and GPK were the

significantly positive factor for explaining the variation in their GCK. In addition, junior elementary school teachers' GPCK was the significantly positive factor predicting both of their Attitude and Actual teaching usage. Attitude also positively related to Actual teaching usage. In addition, the fit indices, including the values of Chi-square = 275.36, degree of freedom = 162, the ratio of Chi-square to degrees of freedom = 1.70, RMSEA = 0.062, GFI = 0.87, NFI = 0.94, IFI = 0.98, TLI = 0.97 and CFI = 0.97, indicated a good model fit for this model and suggested that the structural relationships among the factors of two questionnaires in senior elementary school teachers was interpreted properly in this model. According to Figure 2, senior elementary school teachers' GK was not only the significantly positive factor for explaining the variation in their GCK, GPK, and Attitude, but also the significantly negative factor for explaining the variation in their Actual teaching usage. Furthermore, senior elementary school teachers' GPK was the significantly positive factor predicting both of their GPCK and Actual teaching usage.

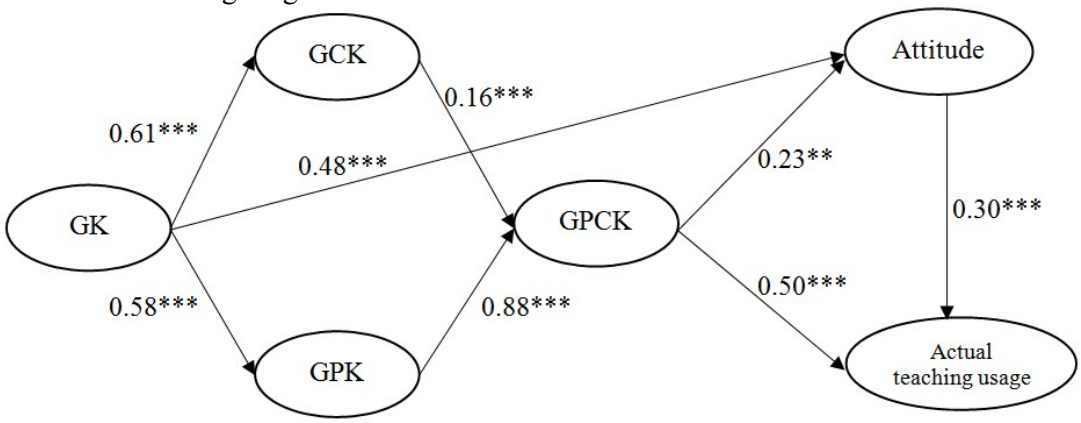

Figure 1. The junior teachers' structural model of their TPACK-G and acceptance of GBL.

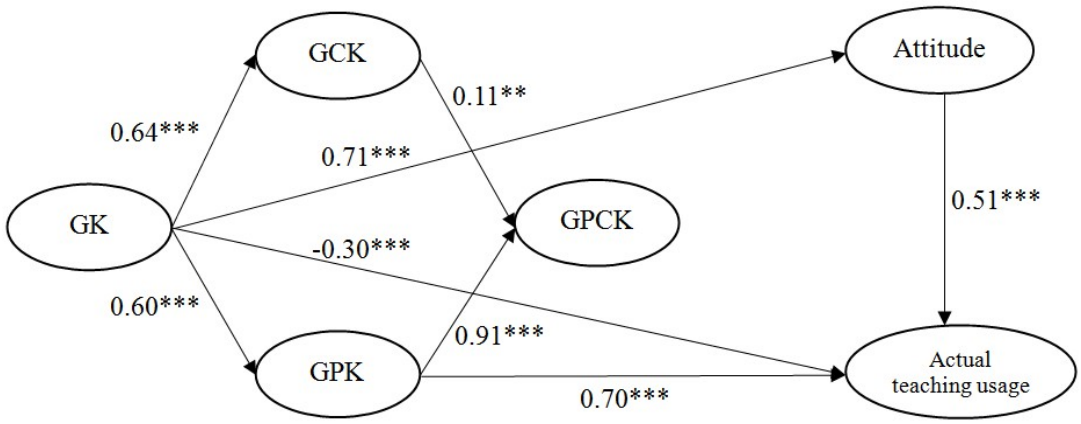

Figure 2. The senior teachers' structural model of their TPACK-G and acceptance of GBL.

4. Discussion

Findings of this study include, first of all, the insignificant difference between the junior's and senior's GPK might imply that the elementary schoolteachers hardly identify the difference between GPK and GPCK. Second, the junior teachers' GK, GCK and GPCK outperformed the seniors, which is resonant to the prior research (Hsu et al., 2017). Third, GPK is the most predictive factor to their GPCK. Finally, the senior teachers' GPCK is unable to predict their attitude and actual teaching usage, and their GK is negatively related to their Actual teaching usage. It was possible that the senior teachers' GPCK is not developed; thus, they were less likely to know how games can be utilized to enhance the quality and effectiveness of their teaching practice.

References

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