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Developing an instrument to assess teachers' belief, confidence and motivation about digital game-based learning

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Abstract: The purpose of this study was to develop an instrument regarding teachers' belief, confidence and motivation of digital game-based learning pedagogies. A pool of 30 items was developed by revising items from Grove, Bourgonjon and Van Looy (2012)'s scale. A survey was used to examine and validate the instrument's structure and reliability. The participants include 134 in-service and pre-service teachers in Taiwan. An exploratory factor analysis with principal component method with varimax rotation was adopted to explore the factor structure of the instrument. Finally, a questionnaire was developed with a total of 13 items under three dimensions: confidence, belief and motivation. The internal reliabilities, alpha coefficients, were adequate for the overall scale (0.87) and for all the three subscales (0.83, 0.77 and 0.81, respectively). Applications of this instrument have been discussed at the end of this paper.

Keywords: Digital game-based learning, teacher education, confidence, motivation, belief

1. Introduction

Over the past few years, digital games have played an important role in education. Games not only bring entertainment to us, but also spark innovative thinking. Digital games offer teachers and students potentially power learning environments (Oblinger, 2004). Nowadays, digital game-based learning is widely used in education all over the world. There are several features about digital game-based learning: rules, goals, feedback, challenge and interaction, for instance (Prensky, 2001).

Because of these characteristics, digital games are used to try to raise students' motivation and promote students' performance. A study conducted by Papastergiou pointed out the gaming approach can enhance both students' knowledge of computer memory concepts and motivation. Educational computer games are used to improve learning environment, regardless of students' gender (Papastergiou, 2009). Besides, Divjak and Tomic´ (2011) revealed that adopting computer games can promote mathematics learning. To integrate computer games into learning may bring some good effects on learning, such as arising students' learning motivation and attitude; and further, it can make students have better learning outcomes than before.

From 2000 to 2010, there are more and more researches about digital game-based learning have been raised (Hwang & Wu, 2012). In recent years, the researches have indicated that digital game-based learning can bring others positive impacts for education. For instance, the experimental result showed that a game-based problem solving environment not only highly inspired users' concept learning, but greatly created entertainment (Cai, Bharathi, Klein, & Klein-Seetharaman, 2003).

As we can see, many studies have indicated that it is worthwhile adopting game-based learning to engage students. But in reality, there were not totally have positive responses. The prior research made a survey to survey 1048 in-service and 656 pre-service teachers about using video games in classroom. The result showed that there was less than half of the in-service teachers use gaming in their teaching (Ruggiero, 2013).

There are many innovative digital games, however, there are used in real classroom not very often. Hence, the purpose of this study is to develop a scale to assess teachers' belief, confidence and motivation about game-based learning pedagogies.

2. Method

2.1 The development of previous scales

A scale was developed by Frederik, Jeroen and Jan, to explore the teachers' adoption intention of digital games (Grove, Bourgonjon, and Van Looy, 2012). The scale focused on usefulness, ease of use and behavioral intention. The factors tended to investigate the technology acceptance of digital game-based learning.

Another scale is developed by Hsu, Su and Liang, they used a framework to measure the preschool teachers' Technological Pedagogical Content Knowledge-Games (TPACK-G) as well as their acceptance of digital game- based learning (Hsu, Su and Liang, 2012). The pervious scales all explore that teachers' can use digital games to represent the content or not.

2.2 The development of this scales

To develop this scale, a pool of 18 items was collected by mainly adapting items from developing by Frederik, Jeroen and Jan in 2012 and writing new items (Grove, Bourgonjon, and Van Looy, 2012). They proposed the following six following subscales for exploring teachers' adoption intention of digital games: usefulness, ease of use, experience, learning opportunities, curriculum relatedness, behavioral intention, including a total of 19 items. The rating range of the scale is from "strongly disagree" to "strongly agree" and is presented in a five-point Likert scale. The original reliability (Cronbach's alpha) coefficients are 0.86, 0.74, 0.89, 0.93, 0.69 and 0.92, respectively for usefulness, ease of use, experience, learning opportunities, curriculum relatedness, behavioral intention.

The items was developed in this study mainly basing upon these items, and this study change the term in the scale terms into "Confidence", "Belief", "Motivation". Besides, the author developed 8 additional items for the initial pool of items. The scale in this study hoped to develop a scale with low to high levels. As a result, the initial pool items in the scale included a total of 30 items. Each statement was measured on five-point Likert scale.

2.2.1 Participants

The participants in this study included 134 in-service and pre-service teachers in Taiwan. Among the participants, 71% are female, and 29% are male. Their age was from 21 to 51, and the mean age of all participants was 31.4 years (SD = 8.25).

3. Illustrations

3.1 Factor analysis

An exploratory factor analysis with principal component method with varimax rotation was adopted to explore the factor structure of the instrument. As seen in Table 1, the eigen values of the three factors were larger than one: 5.281, 1.735 and 1.146. Our three factors was retained in the final version of the scale, and they accounted for 62.8% of variance. Items were retained only when their loading was greater than 0.50 for the relevant factor and less than 0.50 for the non-relevant factor. The initial 30 items were reduced to 13 items. The internal reliability index, alpha coefficients, were adequate for the overall scale (0.87) and for the three subscales, 0.83, 0.77 and 0.81.

Table 1: Rotated factor loadings and Cronbach's alpha values for the three factors of the scale.

Item	Factor 1: Confidence	Factor 2: Belief	Factor 3: Motivation
Factor 1: Confidence α=0.83			
17	0.813		
23	0.741		
24	0.814		
27	0.742		
Factor 2: Belief α=0.77			
6		0.672	
19		0.609	
20		0.549	
26		0.766	
28		0.758	
Factor 3: Motivation α=0.81			
4			0.813
9			0.680
14			0.682
22			0.660
Eigen value	5.281	1.735	1.146
% of variance	40.62	13.35	8.82

3.2 Rerained items on the scale

The retained items and responding subscales was shown in Table2. A detailed description of the three subscales was presented below:

1. Confidence subscale: assessing teachers' experience and confidence of adopting digital games in teaching.
2. Belief subscale: measuring teachers' values and beliefs of digital game-based learning.
3. Motivation subscale: assessing teachers' potential and willingness to adopt digital game-based learning for teaching in the future.

Table 2: Retained items on the scale.

Item No.a	Subscale	Question
17	Confidence	It is difficult for me to integrate digital games into the instructions.[c]
23	Confidence	I have no idea how to integrate digital games into the curriculum.[c]
24	Confidence	I consider to use digital games in my courses.[c]
27	Confidence	I always feel upset when I use digital games in my classrooms.
6	Belief	Digital games offer opportunities to experiment with knowledge.[b]
19	Belief	Digital games increase my productivity in my job.[b]
20	Belief	Digital games offer opportunities to motivate students.[b]
26	Belief	Using digital games makes teaching easy.[b]
28	Belief	Digital games provide students opportunities to solve problems.
4	Motivation	It is easy for me to design a digital game- based curriculum.
9	Motivation	Digital games enhance my effectiveness in my job.[b]
14	Motivation	I'm planning to use digital games in my classrooms.
22	Motivation	When I prepare my teaching plans, I'll link the curriculum with digital games.

[a] The item number indicates the item order in the initial version of the scale (a total of 30 items).

[b] Not modified from Grove, Bourgonjon and Van Looy's (2012) scale.
[c] Scored in a reverse way.

3.3 Inter-correlation matrix of three factors

Table 3 further presented the inter-correlation matrix among three subscales. Because of the correlations reach significant level of 0.001, the three factors measure in a coherent way.

Table 3: Inter-correlation matrix matrix of three factors.

Three factors	Confidence	Belief	Motivation
Confidence	–		
Belief	0.390***		
Motivation	0.497***	0.599***	

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

4. Discussion

This study developed a scale regarding teachers' belief, confidence and motivation of digital game-based learning pedagogies. Over past few years, digital games have played an important role in education. There were some of scales have developed to assessing teacher' adoption intention and acceptance of digital games. Compare with these instruments in the following.

A previous framework was proposed by Frederik, Jeroen and Jan, to assess which factors influence the individual adoption intention of a teacher toward game-based learning (Grove et al., 2012). The instrument with the following six subscales: ease of use, usefulness, experience, behavioral intention and learning opportunities, constructing on the basis of previous research using the TAM (Bourgonjon et al., 2012). The study focued on measuring teacher' adoption intention toward adopt digital games.

CTPCK was developed Hsu, Su and Liang to examine the effects of the technology- and pedagogy-oriented course design on improving the in-service preschool teachers' Technological Pedagogical Content Knowledge- Games (TPACK-G). They assessed teachers' acceptance of digital game-based learning. Based on integrate ICT into classroom teaching and learning: which type of knowledge (e.g., TK, CK, or PK) should be instructed first during the course or not (Hsu et al., 2012).

This study was developed the scale about exploring the teachers' beliefs of teaching toward digital game-based learning. Because of beliefs might influenced teachers' teaching method. Hence, the study was developed the scale with the following three subscales: confidence, belief and motivation. Firstly, assess teachers' experience with design a digital game-based curriculum. Then, measuring whether they feel that adopting digital games into classrooms were usefulness or not. Finally, measuring teachers' confidence and they will adopt digital games in the future or not. Through this instrument to realize teachers' opinion toward integrate digital games in teaching.

Hope can use this instrument through from inside mental to outside behavior's way to realize teachers' opinion toward integrate digital games in teaching; and further, to improve and promote the implement of digital game-based learning.

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