幼児の協同的問題解決能力を育む「遊び込み」ー量的データと保育実践研究データの統合による考察ー
Developing Toddlers' Cooperative Problem-Solving Abilities Through "Totally-Absorbed Play": Integrating Quantitative Data and Educational Practices

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preschool, totally absorbed play, cooperative problem-solving, mixed methods

ABSTRACT

本研究では，幼児の自己調整力，見通しをもつ力，好奇心探究心を，協同的問題解決に必要な力と位置づけ，「遊び込む」ことで，これらの力が高まるのかを検討した。また，上越教育大学附属幼稚園における一連の実践研究の分析結果との統合を試みた。そして，質的データと小規模サンプルの量的データとを用いた混合法の意義を論じた。2014年~2016年，毎年1月に，保育者が個々の幼児について質問紙に回答した。対象幼児は，各年，59，57，47名だった。縦断的パス解析の結果，「遊び込む」ことで，協同的問題解決に必要な力が高まる可能性が示唆された。これらの要因は，上越教育大学附属幼稚園（2016）で見出された力と重なることも考察された。本研究から以下の3点が論じられた。（1）量的データからの知見が実践知とマッチすると，数量データと実践知双方の価値を高める。（2）教育研究における混合法は，ある教育介入とその結果との間の複雑な関係を取り扱うことが出来る。（3）個別の学校の小規模データも，個に応じた実践のための貴重な情報となる。

The purpose of this article was twofold: 1) to integrate a small-sample quantitative study and field studies as part of the larger ongoing research project at the Kindergarten attached to Joetsu University of Education (K-JUE), and 2) to consider the feasibility or viability of using a mixed method in a single school setting in Japan. This study examined whether toddlers' cooperative problem-solving abilities are fostered by "totally absorbed play" (*Asobi-komu*) (K-JUE, 2014, 2015, 2016). Self-regulation, foresight, and curiosity are all viewed as fundamental abilities for cooperative problem-solving. Six kindergarten teachers at K-JUE responded to a questionnaire about eight abilities of the children in their classrooms and the children's "degree of being absorbed in play" in January 2014, 2015, and 2016 (N = 59, 57, 47, respectively). The results of longitudinal path analyses showed that the "totally absorbed play" enhanced children's fundamental abilities in cooperative problem-solving. These findings were consistent with those found in case studies. Finally, the significance of this mixed-method study using mixed methods include the following: a) This study confirms that fitting quantitative data with teachers' practical knowledge enriches the practical and contextual value of the quantitative data. Teachers' awareness of the consistency between their practical knowledge and quantitative data (although derived from a small sample) gave them confidence in their practices. b) Mixed methods were able to accommodate the complex relations between some educational interventions, children's psychological states, and performances. c) Even with a small sample, using quantitative data on a single school can be of great practical value in promoting children's development over the span of several years.

1. Introduction

This study examines whether toddlers' "totally absorbed play" would increase cooperative problem-solving abilities, such as self-regulation, foresight, and curiosity. Teachers regard children as being totally absorbed in play when they exhibit trials and errors, involvement, and harmonized cooperation in play activities (Kindergarten attached to Joetsu University of Education [K-JUE], 2014). This study also is to integrate small-sample longitudinal data and qualitative data acquired in field studies as part of the larger, ongoing research project at the K-JUE (2014, 2015, 2016) using an embedded design (Creswell, & Clark, 2007).

1.1 Self-Regulation, Foresight, and Curiosity as Fundamental Abilities for Preschoolers' Cooperative Problem-Solving

Cooperative problem-solving abilities can be developed in preschool years (Ramani, 2012). The present study considers toddlers' self-regulation, foresight, and curiosity as fundamental abilities for cooperative problem solving. Children's positive attitudes toward learning should be encouraged during the preschool years. Desirable qualities include curiosity, self-assertion, cooperativeness, self-regulation, and persistence (Benesse Educational Research and Development Institute, 2016). Self-regulation is a fundamental ability that influences later school adjustment and school performance (Deci & Ryan, 2013; Duckworth & Carlson, 2013; Józsa & Molnár, 2013; Posner & Rothbart, 2012; Thompson, Lewis, & Calkins, 2008; Thompson, Virmani, Waters, Raikes, & Meyer, 2013). Self-regulation involves intrinsic and adaptive behavior to satisfy individual desires and purposes (Holodynski, Seeger, Hartmann, & Wörmann, 2013) and includes the ability to control intense emotions, compromise with friends during interactions, and manage negative emotions and act appropriately to achieve goals (Sumiya, Umekawa, Watanabe, & Kameyama, 2016).

Intrinsic motivation, leveraged by curiosity and interest, is necessary for increasing self-regulation (Deci & Ryan, 2013). In an experiment on cooperative problem-solving using pictures of animals and insects (Fujioka, 2014), toddlers' interest in the animals and insects was an important factor in accomplishing the experimental tasks.

In order to achieve goals in the process of solving problems, it is first necessary to set the goals and to foresee what must be done (Ramani, 2012). It is also necessary to foresee and to control one's inner state and external environment. Thus self-regulation, curiosity, and foresight are necessary for cooperative problem-solving.

1.2 "Totally Absorbed Play" as High-Quality Play in Early Childhood

High-quality early childhood education encourages later development (La Paro, Rimm-Kaufman, & Pianta, 2006; Lee & Goh, 2012; OECD, 2011; Sylva, 2010). Quality of education and quality of play are related to each other in early childhood education. Under the experimental conditions that require children's cooperative problem-solving, "playful and child-driven tasks can better support and promote problem-solving skills in younger children than can more structured settings and tasks" (Ramani, 2012, p. 183).

1.3 "Totally Absorbed Play" and Cooperative Problem-Solving at K-JUE (2014, 2015, 2016)

The purpose of the ongoing research project at K-JUE is to understand what kind of play teachers usually think of as "totally absorbed play" (K-JUE, 2014), how totally absorbed play can be promoted (K-JUE, 2014), and what abilities can be developed through totally absorbed play (K-JUE, 2015).

In 2013, a group of teachers measured toddlers' totally absorbed play based on their own practical knowledge (K-JUE, 2014). They observed children during free play, assessed their play on a five-point scale from one (*never*) to five (*totally absorbed play*), and made monthly graphs of the children's degree of absorption in play. They made detailed records of play episodes that were rated five (*totally absorbed play*) and four (*somewhat absorbed play*), and categorized and wrote down key words describing the children's attitudes during these episodes. Three common key words were found for totally absorbed play: "being involved in," "trial and error," and "cooperation." Episodes rated as "somewhat absorbed play" included only two of these three key words. In other words, when descriptions of play episodes contained "being involved in," "trial and error," and "cooperation," teachers considered

these episodes to represent totally absorbed play.

In 2015, the teachers were asked to identify the toddlers' abilities that were fostered by totally absorbed play (K-JUE, 2016). Weekly graphs of the degree of absorption in play were made, and episodes of totally absorbed play were determined in the same way as in 2013. These episodes were recorded in detail, and key words describing the children's abilities exhibited during play were identified. These included "the ability of persistence," "the ability to think deeply," "the ability to interact constructively," and "the ability of verbal expression." The children demonstrated these abilities in harmonious, cooperative, and autonomous ways. From April 2013 to March 2016, the number of episodes of totally absorbed play was 24 for the 3-year-old and 4-year-old classes and 20 for the 5-year-old class.

The purpose of the present study was to integrate the results of these field studies with those data collected by a questionnaire study with the K-JUE kindergarten teachers in January from 2014 to 2016. In addition, the study also examined the relationship between toddlers' self-initiated play and their cooperative problem-solving abilities. Lastly, the feasibility or viability of using a mixed method that combines quantitative data and field studies.

2. Method

2.1 Procedures

Every January from 2014 to 2016, six teachers filled out a self-administered questionnaire about the children in their classrooms. Two teachers in each class responded about the same group of children. When the responses of the teachers differed, each pair of teachers discussed their responses to reach a consensus. The teachers selected items that represented important abilities that should be acquired during early childhood. The number of items selected was limited by the amount of time the teachers had to respond to the questionnaire (approximately 10 minutes for each child).

2.2 Participants

The numbers of children evaluated were 59, 57, and 47 in 2014 (T1), 2015 (T2), and 2016 (T3), respectively. In order to examine the longitudinal causal relationships between totally absorbed play and other variables, three samples were used in the analyses of the follow-up phases, as shown in Tables 1: sample T1T2 (N = 32), from T1 to T2; sample T2T3 (N = 27), from T2 to T3; and sample T1T3 (N = 11), from T1 to T3.

Table 1 Number of Students in Each Sample

Sample		Boys	Girls	Total
T1T2	3-4 year olds	1	11	12
	4-5 year olds	12	8	20
	Total	13	19	32
T2T3	3-4 year olds	5	6	11
	4-5 year olds	1	15	16
	Total	6	21	27
T1T3	3-5 year olds	1	10	11

2.3 Measures

Teachers responded to a questionnaire (shown in Appendix A) about each child in their classrooms. The questionnaire included three to five items on each of the eight abilities that teachers considered important for willingness to learn: for self-regulation, emotional regulation and persistence; for social skills, self-assertion and self-control; curiosity; foresight; musical self-expression; physical capability; and degree of absorption in play (K-JUE, 2014). All responses were answered on a scale of 1 (never) to 4 (very often).

2.4 Data Analyses

SPSS Statistics 22 and Amos 22.0 were used for the analysis. First, for each hypothesized scale of the eight abilities, factor analysis was used with the

maximum-likelihood method for factor extraction with Varimax rotation. Because only three to five items were presented for each ability, the same analysis was repeated for T1, T2, and T3, and Cronbach's alphas were for each scale. Second, zero-order correlations among the key variables were calculated, and the relations among the degree of absorption in play and the eight key variables were examined.

Third, longitudinal path analyses were conducted to examine the causal relationships between the degree of absorption in play and the key variables. Models including the auto-regression of the degree of absorption in play and the key variables were used, because the auto-regression coefficients were predicted to be high and the other path coefficients, small. Figures 1–5 show the significant longitudinal path coefficients resulting from the auto-regressive models for the degree of absorption in play and the key variables. The path coefficients are the standardized regression weights, and only the significant paths are shown in the figures. The comparative fit index (CFI) and the root mean square of approximation (RMSEA) of sample T1T3 were adopted as the model fit indices.

3. Results

3.1 Descriptive Statistics of the Study Variables

Factor analysis of self-regulation as emotional regulation was conducted with the maximum-likelihood method and Varimax factor rotation. One factor was observed with the T1, T2, and T3 data. The same analyses were conducted and one factor was found for the items of self-regulation as persistence, self-assertion, self-control, curiosity, foresight, musical self-expression, physical capability, and degree of absorption in play. Cronbach's alphas for these scales ranged from .59 to .92. For self-assertion, Cronbach's alphas for self-assertion were .69 (T1), .59 (T2), and .66 (T3); the initial three items were used as its scale. The scores of these composite variables were computed by calculating the arithmetic mean of the scores for the factor configuration items. Table 2 shows the descriptive statistics for the study variables.

3.2 Correlations between Absorption in Play and the Key Variables

Table 3 shows the zero-order correlations among the key variables in T1, T2, and T3. When toddlers showed a high degree of absorption in play, they also showed high self-regulation as persistence (rs = .65, .54, and .59 in T1, T2, and T3, respectively; ps < .001), self-assertion (rs = .81, .51, and .42; ps < .01), self-control (rs = .64, .31, and .32; ps < .05), curiosity (rs = .79, .68, and .76; ps < .001), foresight (rs = .67, .44, and .52; ps < .001), and musical self-expression (rs = .46, .36, and .31; ps < .05).

3.3 Longitudinal Causal Relationships between the Degree of Absorption in Play and the Key Variables

3.3.1 Longitudinal Causal Relationships from the Degree of Absorption in Play

Figure 1 shows that a high degree of absorption in play (T1) fostered a high score for foresight (T2) (β = .42, p < .001). The CFI (1.00) and RMSEA (0.00) indicate that our hypothesized model fits the data reasonably well. With the sample T2T3, a high degree of absorption in play (T2) also fostered foresight (T3) (β = .31, p < .05). Table 4 shows the zero-order correlations among the variables of the model in Figure 1.

Figure 2 shows the relationship of a high degree of absorption in play (T2) and high scores for self-regulation as persistence (T3) (β = .41, p < .01). Again, the CFI (1.00) and RMSEA (.00) show that our hypothesized model fits the data reasonably well. Table 5 shows the zero-order correlations among the variables of the model in Figure 2. For sample T2T3, a high degree of absorption in play

Table 2 Means and Standard Deviations of Each Sample

	Sample T1T2 (N = 32)		Sample T2T3 (N = 27)		Sample T1T3 (N = 11)		Total (N = 59(T1), 56(T2),47(T3))	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Self-regulation: Emotional regulation T1	3.24	.85	—	—	2.97	.91	3.29	.79
Self-regulation: Persistence T1	2.97	.84	—	—	2.70	.84	3.03	.76
Self-assertion skill T1	2.58	.74	—	—	2.30	.46	2.79	.78
Self-control skill T1	2.05	.85	—	—	1.24	.30	2.38	.94
Curiosity T1	2.21	.89	—	—	1.82	.69	2.46	.99
Foresight T1	2.10	.87	—	—	1.42	.50	2.43	.93
Musical self-expression T1	2.67	.65	—	—	2.42	.73	2.76	.73
Physical capabilities T1	2.63	.69	—	—	2.73	.68	2.77	.72
Degree of absorption in play T1	2.65	.69	—	—	2.15	.51	2.82	.72
Self-regulation: Emotional regulation T2	3.33	.75	3.15	.76	3.09	.88	3.21	.81
Self-regulation: Persistence T2	3.01	.67	2.72	.74	2.85	.69	2.87	.72
Self-assertion skill T2	2.83	.66	2.63	.57	2.64	.50	2.73	.67
Self-control skill T2	2.49	.87	1.84	.45	1.91	.47	2.20	.81
Curiosity T2	2.57	.74	2.48	.82	2.21	.62	2.54	.79
Foresight T2	2.53	.84	1.81	.59	2.00	.65	2.23	.80
Musical self-expression T2	2.84	.77	2.32	.85	2.82	.77	2.55	.82
Physical capabilities T2	2.63	.70	2.68	.78	2.86	.64	2.59	.77
Degree of absorption in play T2	2.72	.56	2.42	.65	2.60	.50	2.56	.66
Self-regulation: Emotional regulation T3	—	—	3.53	.45	3.48	.60	3.22	.84
Self-regulation: Persistence T3	—	—	3.10	.58	3.18	.52	2.86	.69
Self-assertion skill T3	—	—	3.00	.57	3.09	.56	2.90	.66
Self-control skill T3	—	—	2.38	.57	2.39	.68	2.10	.73
Curiosity T3	—	—	2.73	.80	2.64	.81	2.80	.79
Foresight T3	—	—	2.36	.65	2.42	.76	2.12	.72
Musical self-expression T3	—	—	2.91	.77	3.24	.70	2.65	.82
Physical capabilities T3	—	—	2.88	.76	3.05	.59	2.59	.81
Degree of absorption in play T3	—	—	2.69	.65	2.76	.54	2.69	.64

Table 3 Correlations Among the Key Variables

		1	2	3	4	5	6	7	8
1. Degree of absorption in play	T1								
	T2								
	T3								
2. Self-regulation: Emotional regulation	T1	.29 *							
	T2	.04 n.s.							
	T3	.16 n.s.							
3. Self-regulation: Persistence	T1	.65 ***	.31 *						
	T2	.54 ***	.33 *						
	T3	.59 ***	.49 ***						
4. Self-assertion skill	T1	.81 ***	.17 n.s.	.57 ***					
	T2	.51 ***	.08 n.s.	.35 **					
	T3	.42 **	.07 n.s.	.40 **					
5. Self-control skill	T1	.64 ***	.64 ***	.50 ***	.53 ***				
	T2	.31 *	.64 ***	.39 **	.45 ***				
	T3	.31 *	.75 ***	.59 ***	.12 n.s.				
6. Curiosity	T1	.79 ***	.11 n.s.	.54 ***	.69 ***	.42 ***			
	T2	.68 ***	.03 n.s.	.57 ***	.51 ***	.19 n.s.			
	T3	.76 ***	−.03 n.s.	.52 ***	.40 **	.14 n.s.			
7. Foresight	T1	.67 ***	.58 ***	.58 ***	.58 ***	.84 ***	.51 ***		
	T2	.44 ***	.54 ***	.52 ***	.41 **	.73 ***	.25 †		
	T3	.52 ***	.60 ***	.71 ***	.36 *	.80 ***	.38 **		
8. Musical self expression	T1	.46 ***	−.21 n.s.	.36 **	.45 ***	.16 n.s.	.36 **	.20 n.s.	
	T2	.36 **	−.22 †	.24 †	.17 n.s.	.06 n.s.	.24 †	.02 n.s.	
	T3	.31 *	.35 *	.43 **	.38 **	.24 n.s.	.07 n.s.	.29 *	
9. Physical capabilities	T1	.27 *	−.05 n.s.	.34 **	.43 ***	.05 n.s.	.40 **	.12 n.s.	.24 †
	T2	−.06 n.s.	−.03 n.s.	.34 *	.11 n.s.	.04 n.s.	.06 n.s.	−.10 n.s.	.19 n.s.
	T3	.22 n.s.	.11 n.s.	.58 ***	.38 **	.22 n.s.	.12 n.s.	.35 *	.33 *

Note. N = 59 (T1), 57 (T2), 47 (T3).
†p < .10. *p < .05. **p < .01. ***p < .001.

(T2) was also related to high scores for self-regulation as persistence (T3) (β = .29, p < .05). The CFI (1.00) and RMSEA (.11) suggest that the model of sample T2T3 is not a strong fit to the data.

Figure 3 shows no significant path from the degree of absorption in play to curiosity in the sample T1T3

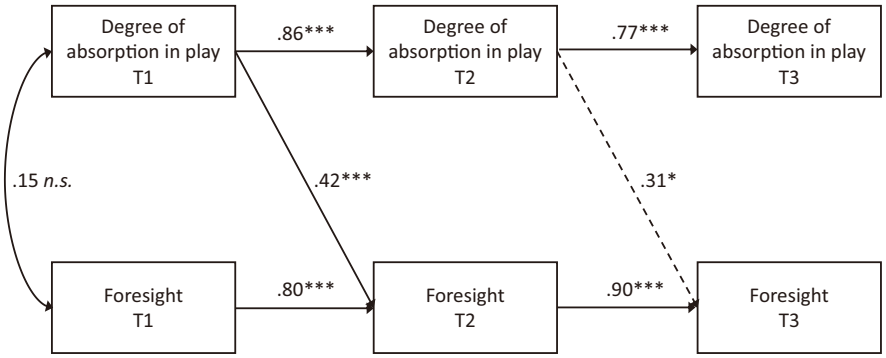

Figure 1 Final cross-lagged autoregressive model for Degree of absorption in play and Foresight. Solid path coefficients are standardized regression weights for Sample T1T3 (only significant paths are shown). Dashed path coefficients are for Sample T2T3.
*p < .05. ***p < .001.

Table 4 Correlations Between Degree of Absorption in Play and Foresight

		1	2	3	4	5
1. Degree of absorption in play T1	Sample T1T3					
	Sample T1T2					
2. Foresight T1	Sample T1T3	.15				
	Sample T1T2	.57				
3. Degree of absorption in play T2	Sample T1T3	.86	.05			
	Sample T1T2	.70	.29			
4. Foresight T2	Sample T1T3	.55	.86	.41		
	Sample T1T2 (T2T3)	.47	.79	.39 (.33)		
5. Degree of absorption in play T3	Sample T1T3	.70	.21	.74	.50	
	Sample T2T3	—	—	.86	.35	
6. Foresight T3	Sample T1T3	.45	.83	.46	.90	.60
	Sample T2T3	—	—	.51	.77	.63

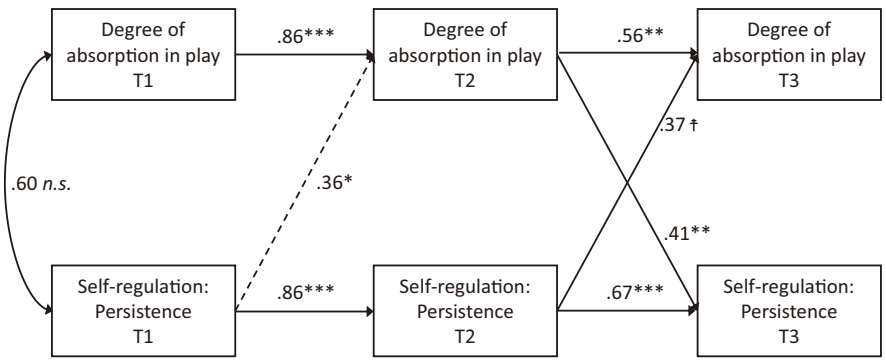

Figure 2 Final cross-lagged autoregressive model for Degree of absorption in play and Self-regulation: Persistence. Solid path coefficients are standardized regression weights for Sample T1T3 (only significant paths are shown). Dashed path coefficients are for Sample T1T2.
†p < .10. *p < .05. **p < .01. ***p < .001.

model. The CFI (1.00) and RMSEA (.08) indicate that our hypothesized model fits the data well. Table 6 shows the zero-order correlations among the variables of the sample T1T3 model. As with the results for sample T2T3, a high degree of absorption in play (T2) was related to high curiosity (T3) ($\beta = .26$, $p < .01$).

Figure 4 shows that only autoregressive paths were significant in the sample T1T3 model. As with the results for sample T2T3, a high degree of absorption in play (T2) was related to high self-regulation as emotional regulation (T3) ($\beta = .26$, $p < .01$). The CFI (1.00) and RMSEA (.00) show that

Table 5 Correlations Between Degree of Absorption in Play and Self-regulation: Persistence

		1	2	3	4	5
1. Degree of absorption in play T1	Sample T1T3					
	Sample T1T2					
2. Self-regulation: Persistence T1	Sample T1T3	.60				
	Sample T1T2	.61				
3. Degree of absorption in play T2	Sample T1T3	.86	.58			
	Sample T1T2	.70	.66			
4. Self-regulation: Persistence T2	Sample T1T3	.47	.86	.47		
	Sample T1T2 (T2T3)	.43	.71	.66 (.40)		
5. Degree of absorption in play T3	Sample T1T3	.70	.66	.74	.63	
	Sample T2T3	—	—	.86	.45	
6. Self-regulation: Persistence T3	Sample T1T3	.59	.87	.72	.85	.74
	Sample T2T3	—	—	.56	.79	.67

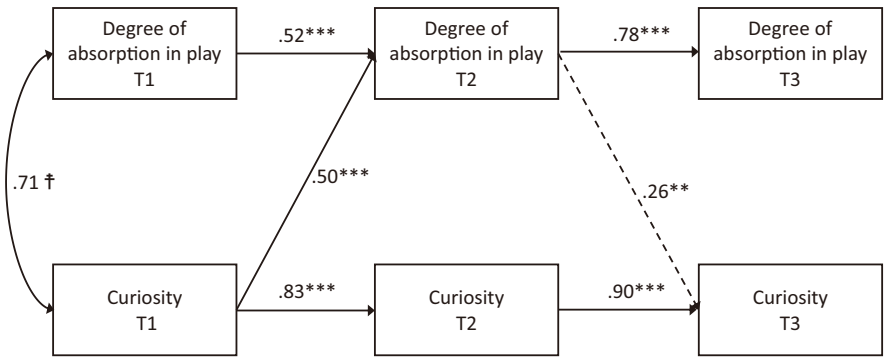

Figure 3 Final cross-lagged autoregressive model for Degree of absorption in play and Curiosity. Solid path coefficients are standardized regression weights for SampleT1T3 (only significant paths are shown). The dashed path coefficients are for SampleT2T3.
† $p < .10$. ** $p < .01$. *** $p < .001$.

Table 6 Correlations Among Degree of Absorption in Play and Curiosity

		1	2	3	4	5
1. Degree of absorption in play T1	Sample T1T3					
	Sample T1T2					
2. Curiosity T1	Sample T1T3	.71				
	Sample T1T2	.72				
3. Degree of absorption in play T2	Sample T1T3	.86	.89			
	Sample T1T2	.70	.59			
4. Curiosity T2	Sample T1T3	.70	.83	.76		
	Sample T1T2 (T2T3)	.56	.69	.72 (.65)		
5. Degree of absorption in play T3	Sample T1T3	.70	.67	.74	.81	
	Sample T2T3	—	—	.86	.64	
6. Curiosity T3	Sample T1T3	.58	.75	.76	.90	.91
	Sample T2T3	—	—	.72	.91	.74

our hypothesized model fits the data reasonably well. Table 7 shows the zero-order correlations among the variables of the sample T2T3 model.

Figure 5 shows that only autoregressive paths were significant in the sample T1T3 model. As with the results for sample T2T3, a high degree of absorption in play (T2) was related to high self-control (T3) (β = .29, p < .10). The CFI (.99) and RMSEA (.09) show that our hypothesized model fits the data to an acceptable degree. Table 8 shows the zero-order correlations among the variables of the sample T2T3 model. Models with other variables had no significant paths from the degree of absorption in play

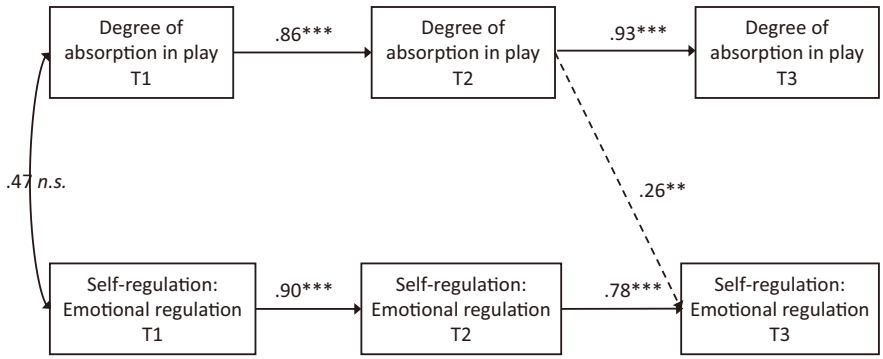

Figure 4 Final cross-lagged autoregressive model for Degree of absorption in play and Self-regulation: Emotional regulation. Solid path coefficients are standardized regression weights for Sample T1T3 (only significant paths are shown). Dashed path coefficients are for Sample T2T3.
**p < .01. ***p < .001.

Table 7 Correlations Between Degree of Absorption in Play and Self-regulation: Emotional Regulation

	1	2	3
1. Degree of absorption in play T2			
2. Self-regulation: Emotional regulation T2	−.03		
3. Degree of absorption in play T3	.86	.06	
4. Self-regulation: Emotional regulation T3	.24	.63	.26

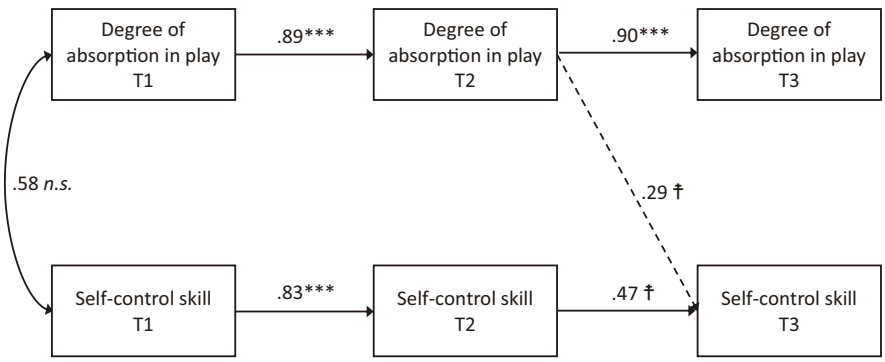

Figure 5 Final cross-lagged autoregressive model for Degree of absorption in play and Self-control skill. Solid path coefficients are standardized regression weights for Sample T1T3 (only significant paths are shown). Dashed path coefficients are for Sample T2T3.
†p < .01. ***p < .001.

Table 8 Correlations Between Degree of Absorption in Play and Self-control Skills

	1	2	3
1. Degree of absorption in play T2			
2. Self-control skill T2	.27		
3. Degree of absorption in play T3	.86	.38	
4. Self-control skill T3	.41	.52	.43

3.3.2 Longitudinal Causal Relationships with the Degree of Absorption in Play

Figure 2 shows that high self-regulation as persistence (T2) was related to high scores for the degree of absorption in play (T3) ($\beta = .37$, $p < .10$). As with the results for sample T1T2, high self-regulation as persistence (T1) was related to high scores for the degree of absorption in play (T2) ($\beta = .36$, $p < .05$). Figure 3 indicates that high curiosity (T1) was related to high scores for the degree of absorption in play (T2) ($\beta = .50$, $p < .001$). The CFI (1.00) and RMSEA (.00) suggest that our hypothesized model fits the data well. Models with other variables had no significant paths to the degree of absorption in play.

4. Discussion

4.1 Development of Cooperative Problem-Solving Abilities through Absorption in Play: Integrating Small-Sample Longitudinal Data and Field Studies in Classrooms

Many previous examinations of children's cooperative problem-solving abilities are often based on experimental studies. In these studies, pairs or small groups of children usually were assessed as they performed tasks (Ashley & Tomasello, 1998; Fujioka, 2014; Ramani, 2012). The methodological framework of the present study differs from the previous research studies in that teachers' evaluations of children's daily free play were also included in a mixed-method approach. The field data acquired at K-JUE (2014, 2015, 2016) are based on participant observations of free play. This study also differs from previous studies by considering self-regulation, curiosity, and foresight as fundamental abilities for problem-solving, and examining whether these abilities were developed through children's totally absorbed play. Although eight factors were analyzed, the results show that only three abilities appear longitudinally related to the degree of absorption in play. The three abilities overlapped with the "development caused by the accumulation of absorption in play" (K-JUE, 2016) and attitudes about learning (Benesse Educational Research and Development Institute, 2016).

High curiosity and self-regulation as persistence are also related to a greater degree of absorption in play. Curiosity, as a factor contributing to children's absorption in play, was perhaps reflective of children's psychological states of "awareness and wonder" and "continuous enthusiasm" that support their absorption in play (K-JUE, 2015). Self-regulation as persistence was also exhibited with "continuous enthusiasm" that supports children's absorption in play (K-JUE, 2015).

The K-JUE staff (2014, 2015, 2016) discussed the characteristics of totally absorbed play that are important for the development of the three abilities. First, children's sense of security should be assured. Second, child-initiated play should also be ensured. In child-initiated play, children should maintain "awareness and wonder," "continuous enthusiasm," "confidence and a sense of accomplishment," and "a sense of comfort from keeping relationships with friends." Teachers' abilities to cope effectively with unexpected occurrences help children to experience these four psychological states. Third, as the result of these four states, children exhibit trials and errors, involvement, and cooperation in

play that teachers regard as totally absorbed play. Finally, through this play, children can develop competencies that will extend beyond their day-to-day school experiences.

4.2 Evidence-based Research and Practice in Kindergarten Classrooms

Results based on large-sample, quantitative data may not be sufficient for designing and implementing evidence-based practice in kindergarten classrooms. Systematic and comprehensive reviews of reliable research in the literature are also necessary (e.g., Liamputtong, 2010). In field research involving classrooms and other contexts, it is often very difficult to accomplish either rigorous data analysis or systematic reviews of educational practice. Much data relevant to educational practice or interventions that teachers may collect or review are not necessarily random, but are grounded in teachers' own individual schools or classes. When effects of an educational intervention are evaluated, the meaning and definition of the effect itself and intervention approaches can differ across studies addressing similar interventions and effects.

What could be suggested to address the complexity of field studies in education? Several related issues could be raised to answer this question. Longer timeframes are needed in order to examine the effects of educational practices and interventions. Unanticipated intervening events or factors may creep in to obscure the relations between interventions and effects during the period under examination. Longitudinal research ought to be considered whenever possible especially when looking at interventions with small children. Also, even when rigorous evidence is revealed, it is difficult to implement an intervention effectively in a specific school setting. Individual schools have different and unique characteristics related teachers, administrators, students, school climates, and parents. Even when running a longitudinal project from year to year, school contexts change from year to year, thereby making intervention effects questionable.

The present study attempted to integrate data from a qualitative research project and statistical analyses based on non-random quantitative survey. The following three points can be made about the practicality and feasibility of using mixed methodology. First, ideally, a perfect fit of quantitative data with teachers' practical knowledge should enrich the practical and contextual values of the quantitative data. Teachers' awareness of the consistency between their practical knowledge and quantitative data (in spite of a small sample) gave them confidence in their daily teaching. For example, when the teachers were informed about the results of the study and asked to reflect on their own participation, some of their comments showed their own sense of validation and more confidence. Second, the use of mixed methodology can address the complex relations between some educational interventions, children's psychological states, and performance. Third, even with a small sample, using accumulated quantitative data from individual schools can be of great practical value in promoting children's development over the span of several years.

In order to enhance the validity of data interpretations in field settings, large-sample quantitative data would be needed; however, they are not sufficient in toto. Often, purposeful sampling (Creswell & Clark, 2007) would be appropriate and realistic in examining educational practices. When sizable amounts of data even in a single individual school would be accumulated and integrated, some high quality suggestions with sufficient validity can be a reasonable assumption to make about evidence-based education research and practice.

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Appendix A Factor Configuration Items

Name of Factors	Items
	Gender Birthday
Self-regulation: Emotional regulation	She/he loses her/his temper easily. She/he can control her/his emotions, such as sadness, mortification, anger. She/he vents her/his anger on somebody or something when things don't go her/his way.
Self-regulation: Persistence	She/he makes an effort without seeking help when she/he cannnot do something easily. She/he can endure a slight injury withohut crying. She/he easily gives up when she/he has a little trouble.
Self-assertion skill	She/he invites friends to a variety of activities. She/he joins in play without teachers' instructions. She/he express disagreement with unfair rules in approptiate ways.
Self-control skill	She/he responds to unpleasant statements in appropriate ways. She/he accepts criticisms willingly. She/he changes her/his ideas and comes to an agreement when she/he has a conflict with friends.
Curiosity	She/he wonders why. She/he makes inquiries and repeats by trial and error. She/he is sensitive in noticing changes in nature and objects.
Foresight	She/he sets her/his sights and acts appropriately She/he acts with a time perspective. She/he acts without being overwhelmed by temporary emotion and desire.
Musical self expression	She/he dances using the entire body. She/he is able to dance and move to the rhythm of the song and musical accompaniment. She/he hums the tunes of songs or other music when she/he feels good.
Physical capabilities	She/he plays outside and takes open-air exercise. She/he is agile. Her/his body is supple. She/he has physical strength.
Degree of absorption in play	She/he is totally absorbed in play. She/he concentrates on play. She/he figures out good ways to play. She/he interacts with friends constructively and develops play. She/he gives up on play and does not stick to it.