Original Article

Study on the concept of learning by elementary school students in physical education classes in Japan

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Abstract

Problem Statement: Designing a learning strategy in physical education is essential. An important learning strategy in physical education is the notion of “conceptions of learning,” which are considered to be possessed by the learner himself/herself. Combined with the uniqueness of physical education as an academic subject, where learning methods are directed toward motor learning, it can be assumed that conceptions of learning specific to physical education have been developed in learners’ minds.

Purpose: The aim of this study was to develop a “physical education learning concept scale for elementary school students” and reveal Japanese elementary school students’ views on learning in physical education.

Approach: A pilot survey was conducted, followed by the main survey with 1,403 public elementary school students across Japan using the questionnaire survey method.

Results: 1) The exploratory factor analysis revealed that the physical education learning concept scale comprises five factors: “motor skills learning,” “mind and body improvement,” “cultivation of communication skills,” “perceived attraction of physical activity,” and “acquisition of knowledge on physical body and movements.” 2) Reliability and a certain degree of validity of the physical education learning concept scale was confirmed by its internal consistency. Further, confirmatory factor analysis demonstrated factor invariance. 3) The analyses on grade and gender differences revealed that 6th graders had significantly higher scores than 5th graders on “motor skills learning” and “acquisition of knowledge on physical body and movements,” and that girls had a significantly higher score than boys on “cultivation of communication skills.”

Conclusion: Lessons based on active learning on the part of learners should be keenly promoted. We must seek to develop independent learners while paying close attention to viewpoints that could promote such a form of learning.

Key Words: metacognitive, course of study, active learning, scale development

Introduction

In the new Course of Study,¹ which begins in 2020, the implementation of “proactive, interactive and authentic learning” (Ministry of Education, Culture, Sports, Science and Technology, 2018a) based on active learning has been announced, and the enhancement of a learning strategy has been called anew. This educational direction in the new Course of Study is strongly reflected in the objectives laid out for physical education.

In each subject’s objectives in the new Course of Study, there is a statement on “the way of understanding and thinking” about things in accordance with the characteristics of each subject. The “way of understanding and thinking” for physical education in elementary school is summarized as: “focusing on the value and special traits of exercise and sports, highlighting its role in creating fun and happiness and improving physical strength, and relating it to diverse ways of ‘doing, seeing, supporting, and knowing’ as suits each person’s aptitude” (Ministry of Education, Culture, Sports, Science and Technology, 2018b, p. 19). In other words, in the future of physical education in Japan, the way in which a learning strategy can be designed, which is concerned with how learners learn on the basis of the aforementioned “way of understanding and thinking,” vis-à-vis physical education, has been deemed an essential point of discussion.

“Conceptions of learning,” which are possessed by the learner himself/herself, is important when thinking about learning strategies in physical education. Conceptions of learning are an essential aspect of meta-cognition which shape the direction of the attainment and utilization of knowledge (Fujimura, 2008), and are considered to be important modes of thinking that affect learning strategy (Shinogaya, 2008; Suzuki, 2013; Ueki, 2002;

¹In Japan, the Ministry of Education, Culture, Sports, Science and Technology provides nationwide standards for the organization of educational curricula based on the School Education Act. These standards are termed “the Course of Study,” wherein objectives for each academic subject, as well as rough educational content, are defined for each educational stage, from elementary school to junior high school and high school.

Uesaka, 2010). These considerations suggest that, to explore how a learning strategy could be designed, it is necessary to first consider the conceptions of learning possessed by learners, rather than simply implementing a learning strategy in isolation. A review of studies on the conceptions of learning finds that they can take one of the following two positions.

First is the position that treats the conceptions of learning as a concept that represents a general idea about learning (Marton et al., 1993; Peterson et al., 2010; Purdie et al., 1996; Purdie & Hattie, 2002). In these studies, conceptions of learning were understood in terms of “what is learning?” and the scale for assessing the conceptions of learning was developed. Based on these studies, in Japan, Suzuki (2013) investigated elementary school and junior high school students and developed the “learning concept scale.” It consists of four factors: “understanding,” “role learning,” “obligation,” and “dependence on school,” derived from the question: “what are the words or situations that can be associated with the word ‘learning’?”

Second is the position that treats the conceptions of learning as “a belief in effective learning methods,” as exemplified by the notion of “epistemological beliefs.” Epistemological beliefs are learners’ beliefs about effective learning and knowledge attainment (Schommer, 1990), and many previous studies have indicated their relevance to learning strategies (Dahl et al., 2005; Neber & Schommer, 2002). In Japan, the conceptions of learning associated with epistemological beliefs have been situated as “the narrow conceptions of learning” (Uesaka, 2010, p. 175), and several studies have been conducted on this (Horino et al., 1990; Ichikawa et al., 2009; Ueki, 2002).

In light of these considerations, in this study, we adopted the “idea about learning” as the conceptions of learning. This is because the conceptions of learning as “a belief about effective learning methods” is, in principle, focused on effective learning methods, and hence, is inappropriate for understanding the learners’ idea about learning itself. Thus, in this study, we began our discussion with a focus on the question “what should be learned in physical education?” to reveal the learners’ views on learning in physical education. This enabled us to identify the learners’ ideas of physical education.

Meanwhile, the importance of the conceptions of learning, specific to each subject, has been brought forth in Japan. For example, the conceptions of learning in the study of arithmetic and mathematics (Hirose et al., 2012; Teranishi, 2008) and in the study of the English language (Akamatsu & Fujioka, 2015; Akamatsu et al., 2017; Nakayama, 2005) have been explored. Of them, Akamatsu et al. (2017) revealed that the process through which a learning strategy and academic achievements are determined marks a difference between general conceptions of learning and the conceptions specific to the study of English, and that the latter leads to more effective learning of the English language. Considering these findings, combined with the uniqueness of physical education as an academic subject where learning methods are mainly for motor learning, it can be assumed that a conception of learning, specific to physical education, has been developed in the learners’ minds.

Accordingly, we reviewed previous studies that dealt with conceptions of learning in physical education and found that a study by Ono et al. (2018) offered important propositions. Ono et al. (2018) developed the “physical education learning concept scale for junior high school students,” and revealed the structure of the conceptions of learning of junior high school students in Japan. This scale is composed of five factors—“motor skills learning,” “cultivation of communication skills,” “acquisition of knowledge on physical body and movements,” “perceived attraction of physical activity,” and “improvement of physical capacity”—and 22 items. On the scale, a higher grade is directly proportional to a higher score for the view of learners.

Meanwhile, since the learning environment largely differs between elementary school and junior high school, it has been suggested that the conceptions of learning also differ between elementary school students and junior high school students (Suzuki, 2013). For instance, in elementary school, physical education in Japan is taught as a part of a coeducational program by a classroom teacher, whereas in junior high school, it is taught as a single-sex program by a subject-specific teacher. By considering these differences in the learning environment, we can assume that elementary school students and junior high school students form different views about learning in physical education. To understand the characteristics of learners’ views on learning more accurately and to utilize them for appropriate educational guidance, the development of a finer scale, in accordance with the learners’ educational stage and their developmental stage, may be vital. In particular, since learning in physical education at elementary schools creates a huge impact on the formation of lifelong positive attitudes toward sports, a careful discussion is needed.

Thus, the aim of this study is to understand the students’ views on learning in physical education in Japanese elementary schools through the development of “the physical education learning concept scale for elementary school students,” and to identify the characteristics of conceptions of learning based on grade and gender.

Material and methods

Pilot study

An initial pilot survey was conducted which was aimed at collecting and further, carefully selecting responses of elementary school students about learning physical education.

The survey was conducted in January 2018 in three public elementary schools in Tokyo, Japan. This involved a total of 309 fifth- and sixth-grade elementary school students (150 boys and 159 girls). Students were asked to respond to the open-ended question, “What do you think you learn in physical education lessons?” All classes were set up in coeducational settings.

The questionnaire was anonymous and it was clearly indicated that the anonymity of the participants' answers was guaranteed. We obtained consent for the survey by explicitly stating that all questions were voluntary and that no student was required to answer any question that he or she could not or did not wish to answer. After the pilot study, regarding the free-form responses, we first excluded any answers that were unrelated to the question and then extracted statements at the clause level. In total, we collected 303 statements on elementary school students' physical education learning concept.

Next, we worked with a rater (an elementary school teacher) to categorize these statements based on similarity in content. We discussed it until the research team, consisting of ..., agreed on the following five constructs of physical education learning concept among elementary school students: "motor skills learning," "mind and body improvement," "cultivation of communication skills," "perceived attraction of physical activity," and "acquisition of knowledge on physical body and movements."

We created the scale items based on the content of the statements that we had categorized into the abovementioned constructs. While doing so, we tried to clarify the statements, for example, by aggregating the statements with similar content. We reviewed the items created through this process with the cooperation of eight current elementary school teachers and revised the statements so that they were easy for the students to understand. Next, we verified the validity of the content. We did this by presenting eight graduate students specializing in physical education studies with a list of 18 items related to feelings of competence and asked them to categorize the items according to the abovementioned five constructs. We determined validity according to the rate of agreement and deleted any items that had a rate of less than 60 percent. Following this verification, we finally selected 18 items for measuring physical education learning concept in elementary school students. We asked current elementary school teachers to revise the wording of the items so that they would be easily understood by elementary school students. This pilot survey was conducted with the approval of the research ethical committee of the university to which the first author of this article belonged.

Main survey

The study was conducted in January 2019 and involved fifth- and sixth-grade elementary school students from 13 public schools in Tokyo, Kanagawa, and Saitama. The sample population comprised 731 fifth-grade students (338 boys and 349 girls) and 672 sixth-grade students (342 boys and 330 girls), with a total of 1,403 students (680 boys and 679 girls). Of these, excluding omissions and mistakes, the responses of 1,317 students (634 boys and 683 girls) were deemed valid and were included in the analysis. The participants took the survey in class during class hours.

We used SPSS (version 25.0) for statistical analysis. All classes were taken in coeducational settings. As with the pilot study, we obtained consent for the survey by explicitly stating that all questions were voluntary and that no student was required to answer any question that he or she could not or did not want to. We used the same method with both grades.

As for the survey's content, students were asked to fill out their grade and gender in the face sheet and respond to whether they like or dislike physical education classes. Their responses were used to verify the validity of the scale. Previous studies demonstrated, albeit on different subjects, that the learner's diverse views on learning are directly proportional to how much they like the subject. Another study demonstrated that learners who dislike physical education classes tend to have a negative or an evasive attitude toward physical education classes (Sasaki & Suko, 2016). Considering these studies' findings, the learner's like or dislike of physical education classes may lead to differences in his/her conceptions of learning in physical education. Hence, the hypothesis that requires verification here is the positive correlation between the learner's liking of physical education classes and the scores in items that measure his/her conceptions of learning in physical education.

The students were asked to answer 18 items on "the elementary school students' views on learning in physical education" selected from the pilot survey, and to choose the answer that best describes their view on a 4-point scale (Strongly agree: 4 points; Agree: 3 points; Somewhat agree: 2 points; Strongly disagree: 1 point).

This survey was conducted with the approval of the research ethical committee of the university to which the first author of this article belonged.

Results

An exploratory factor analysis

First, we analyzed the 18 items for measuring elementary school students' physical education learning concept. To examine the items for bias, we looked at items with an average value of no more than 1.5 and those with at least 3.5, items whose standard deviation was extremely small, and items whose normal frequency distribution had a concentration of 70 percent in a particular frequency.

The results showed that no such items were biased. We also calculated the correlation between items, but did not find any with a value that exceeded 70. We conducted an exploratory factor analysis (maximum-likelihood method with promax rotation) of the remaining 18 items, which resulted in the extraction of five factors (Table I).

Table I “Physical education learning concept scale for elementary-school students” promax rotation and factor correlation

Items	I	II	III	IV	V
I Motor skills learning ($\alpha = .87$)					
In physical education classes, students acquire movement skills using various goods.	.84	.01	-.02	-.01	.00
In physical education classes, students acquire various kinds of movements.	.78	.06	.01	-.09	.13
In physical education classes, students acquire know-how for proper movements.	.73	-.04	.08	.02	.04
In physical education classes, students acquire movements in accordance with tactics.	.69	-.11	.15	-.01	.10
In physical education classes, students learn teamwork.	.49	.19	.28	.13	-.25
II Mind and body improvement ($\alpha = .83$)					
In physical education classes, students develop strength.	.17	.91	-.21	-.05	-.09
In physical education classes, students develop a healthy body.	.06	.87	-.08	-.09	.07
In physical education classes, students develop a never-quit spirit.	-.19	.55	.23	.16	.08
In physical education classes, students develop a tough spirit.	-.27	.55	.28	.08	.10
III Cultivation of communication skills ($\alpha = .78$)					
In physical education classes, students learn how to convey their feelings.	-.06	-.04	.80	-.04	.06
In physical education classes, students learn the importance of listening to others' opinions.	.15	-.03	.71	-.04	.06
In physical education classes, students learn the importance of having sympathy for others.	.20	-.01	.63	-.01	-.11
IV Perceived attraction of physical activity ($\alpha = .81$)					
In physical education classes, students experience the joy and pleasure of physical activity.	.05	.04	-.11	.83	-.05
In physical education classes, students experience the sense of achievement	.01	.02	.00	.76	-.02
In physical education classes, students learn the pleasure of playing a competitive game.	-.08	-.07	.04	.73	.08
V Acquisition of knowledge on physical body and movements ($\alpha = .76$)					
In physical education classes, students acquire knowledge associated with health and safety.	.08	.07	.07	-.08	.75
In physical education classes, students learn the mechanism of body and movements.	.18	-.02	-.03	.13	.49
In physical education classes, students learn the rules of movements and sports.	.27	.01	-.15	.18	.42
	I	—	.33	.40	.42
	II		—	.47	.23
	III			—	.09
	IV				—
	V				—
Factor correlation					

We then named the five factors extracted from the items' characteristics. The first factor included items like, “in physical education classes, students acquire movement skills using various goods,” and was termed “motor skills learning” as it indicated items associated with the acquisition of motor skills. The second factor included items like, “in physical education classes, students develop strength,” and was termed “mind and body improvement,” as it indicated items associated with the improvement of the mind and body. The third factor included items like, “in physical education classes, students learn how to convey their feelings,” and was termed “cultivation of communication skills,” as it indicated items associated with the nurturing of communication skills with others. The fourth factor included items like, “in physical education classes, students experience the joy and pleasure of physical activity,” and was termed “perceived attraction of physical activity,” as it indicated items associated with the perception of the attraction of physical activity. The fifth factor included items like, “in physical education classes, students acquire knowledge associated with health and safety,” and was termed “acquisition of knowledge on physical body and movements,” as it indicated items associated with the acquisition of knowledge concerning the physical body and movements.

Next, we examined the internal consistency of the scale by calculating Cronbach's alpha as a coefficient of reliability for these five factors. The results were $\alpha = .87$ for the first factor, $\alpha = .83$ for the second factor, $\alpha = .78$ for the third factor, $\alpha = .81$ for the fourth factor, and $\alpha = .76$ for the fifth factor. All factors yielded an alpha of at least .70, thus confirming a level of internal consistency. Furthermore, we named the scale developed in this study the “Physical education learning concept scale for elementary school students (PE learning concept scale).”

A confirmatory factor analysis

To verify the invariance of the factor structure of the scale, a confirmatory factor analysis was performed using the same data based on the results of the exploratory factor analysis.

With respect to the PE learning concept scale, a model that hypothesized the effects of five potential factors on their relevant items, as well as the existence of covariance between all of these factors, was used for analysis. As a result, the goodness of fit of the model was GFI=.90, AGFI=.87, CFI=.90, and RMSEA=.06, showing a good fit overall. These results confirmed the invariance of scale factors.

Validity verification To verify the validity of the scales, one-way ANOVA was performed on subscales of each scale by dividing the samples into three groups (Like, Neither, Dislike) based on the like and dislike of physical education classes

Table II Verifying the validity of the constructs: Physical education learning concept differences based on the like and dislike towards physical education classes

	(A) Like (N = 883)		(B) Neither (N = 347)		(C) Dislike (N = 87)		F Value	Multiple comparisons
	M	SD	M	SD	M	SD		
Motor skills learning	3.17	.74	2.96	.75	2.46	.81	41.48 ***	A > B, C B > C
Mind and body improvement	2.92	.80	2.82	.72	2.41	.80	17.51 ***	A, B > C
Cultivation of communication skills	2.58	.72	2.37	.71	2.07	.77	26.53 ***	A > B, C B > C
Perceived attraction of physical activity	3.09	.85	2.79	.74	2.27	.84	48.63 ***	A > B, C B > C
Acquisition of knowledge on physical body and movement	2.93	.79	2.77	.76	2.56	.80	12.91 ***	A > B, C

*** $p < .001$

As a result, main effects were noted in “motor skills learning” ($F(2, 1317) = 41.48, p < .001$), “mind and body improvement” ($F(1, 1317) = 17.41, p < .001$), “cultivation of communication skills” ($F(1, 1317) = 26.53, p < .001$), “perceived attraction of physical activity” ($F(1, 1317) = 48.63, p < .001$), and “acquisition of knowledge on physical body and movements” ($F(1, 1317) = 12.91, p < .001$). Multiple comparison tests revealed that, in every case, the scores in the “Like” group were significantly higher than those in the “Dislike” group or “Neither” group ($p < .001$). Moreover, the scores on the “motor skills learning,” “cultivation of communication skills,” and “perceived attraction of physical activity” were significantly higher in the “Neither” group than in the “Dislike” group ($p < .001$).

These results revealed that the scores in items that measure the conceptions of learning in physical education are directly proportional to the learner’s liking of physical education classes. These results agreed with our anticipated results and verified the hypothesis.

Examination of fundamental statistics, grade difference, and gender difference included in the scale

To examine the fundamental statistics, grade difference, and gender difference included in the PE learning concept scale, we conducted a two-way analysis of variance on grade level (fifth- and sixth-year) and gender (boys and girls) (Table III).

Table III Fundamental statistics for grade and gender differences

	Fifth-year (N =686)		Sixth-year (N =631)		F Value			Multiple comparisons
	Boys (N =313)	Girls (N =373)	Boys (N =321)	Girls (N =310)				
	M	M	M	M	Years	Sex	Interaction	
	SD	SD	SD	SD				
Motor skills learning	3.04	2.98	3.17	3.10	8.98 **	2.53	.00	6 > 5
	.77	.79	.76	.75				
Mind and body improvement	2.84	2.86	2.87	2.87	.17	.03	.07	
	.80	.80	.79	.76				
Cultivation of communication skills	2.53	2.40	2.61	2.42	1.60	16.12 ***	.52	Boys > Girls
	.74	.76	.69	.73				
Perceived attraction of physical activity	2.91	2.92	3.03	2.97	3.33	.23	.50	
	.84	.88	.85	.84				
Acquisition of knowledge on physical body and movement	2.85	2.78	2.96	2.89	6.18 **	2.49	.01	6 > 5
	.82	.79	.75	.78				

** $p < .01$, *** $p < .001$

At first, the interaction effect was not reflected in either factor. The subsequent main effect test revealed the significant main effects of grade in “motor skills learning” ($F(1,1317)=8.98, p<.01$) and “acquisition of knowledge on physical body and movements” ($F(1,1317)=6.18, p<.01$). In all subscales of these two scales, the scores of 6th graders were significantly higher than those of 5th graders ($p<.01$). As for gender, a significant main effect was noted in “cultivation of communication skills” ($F(1,1317)=16.12, p<.001$), and the girls’ score was significantly higher than the boys’ score.

Discussion

The factor structure of the physical education learning concept scale for elementary school students

It was found that the PE learning concept scale could be understood in terms of five factors, including “motor skills learning,” “mind and body improvement,” “cultivation of communication skills,” “perceived attraction of physical activity,” and “acquisition of knowledge on physical body and movements,” with 18 items. Since confirmatory factor analysis yielded a permissible goodness of fit, the scale is believed to have a relatively stable factor structure.

With respect to the four factors, “motor skills learning,” “cultivation of communication skills,” “acquisition of knowledge on physical body and movements,” and “perceived attraction of physical activity,” the results were similar to those of the previous study on the views of junior high school students about learning in physical education (Ono et al., 2018). It could be speculated that the similarity of the results for these four factors in elementary school students and junior high school students are affected by the PE curriculum in Japan². Briefly, “motor skills learning” corresponds to “techno-motor learning” in the curriculum, which has to do with the acquisition of individual or collective motor skills for exercise and sports. Likewise, “cultivation of communication skills” corresponds to “social learning,” which has to do with the normative or evaluative content and attitude formation with regard to exercise and sports; “acquisition of knowledge on physical body and movements” corresponds to “cognitive learning,” which has to do with scientific knowledge of physical education, and “perceived attraction of physical activity” corresponds to “affective learning,” which has to do with the fostering of preference and affection toward exercise and sports. In this way, factors corresponding to the physical education curriculum were extracted for elementary school students.

On the other hand, “mind and body improvement” bears superficial resemblance to “improvement of physical capacity” in junior high school students, but they are distinct in substance. While “improvement of physical capacity” in junior high school students is an item specifically related to physical abilities, such as stamina, muscle strength, flexibility, and instantaneous force (Ono et al., 2018), “mind and body improvement” in elementary school students indicates the acquisition of a healthy body through the improvement of basic physical and mental strength. According to the current Course of Study for elementary schools, the objective of physical education is “to develop basic qualities and the abilities to participate in enjoyable physical activity throughout their lives, maintain and improve their health and fitness, and cultivate an appropriate attitude toward leading a pleasant and happy life through proper exercise experience and understanding of health and safety, and by considering physical and mental aspects in an integrated manner” (Ministry of Education, Culture, Sports, Science and Technology, 2011, p. 1). “Mind and body improvement” might be situated as a conception of learning that accommodates this objective of physical education.

Grade and gender differences

In the analysis of grade difference, scores in “motor skills learning” and “acquisition of knowledge on physical body and movements” were significantly higher in 6th graders than in 5th graders. The previous study on junior high school students (Ono et al., 2018) showed that upper graders had significantly higher scores in all factors of conceptions of learning in physical education; in elementary school students, grade difference was observed only with two factors.

These two factors are “motor learning” and “acquisition of knowledge,” indicating that grade difference arises in factors associated with the learning content of physical education. According to Pintrich and Zusho (2002), the frequency of use of metacognitive skills in learning and learning strategy increases as a result of the accumulation of learning. They explained that learning tasks generally become progressively more difficult to complete, both qualitatively and quantitatively, as the grade advances, and hence, the learners must frequently exercise metacognitive skills, such as self-monitoring and self-control, at their own levels of comprehension. In case of physical education in upper elementary grades in Japan, learning content remains the same between the 5th graders and 6th graders (Ministry of Education, Culture, Sports, Science and Technology, 2008), so the difference in the period of learning by 1 year is considered to cause the difference in the retention rates of learning content. These considerations gave rise to the assumption that the accumulation of learning at each grade led to the differences in scores of the two factors related to learning content in physical education.

The subsequent analysis of gender differences revealed that girls had a significantly higher score in the “cultivation of communication skills” than boys. Since no gender differences were observed in the previous

²The physical education curriculum in Japan is divided roughly into four areas: “techno-motor learning,” “cognitive learning,” “social learning,” and “affective learning.”

study on junior high school students (Ono et al., 2018), these results are understood to be characteristic of elementary school students.

One possible explanation for this is the difference in characteristics of communication among upper elementary school students. According to Rose and Rudolph (2006), girls' friendships in upper elementary grades are characterized by the prioritization of "prosocial behavior" such as cooperative engagement, whereas boys' friendships are characterized by their engagement in "competition" and "ranking." These findings seem to indicate that boys have a greater tendency to perceive physical education classes as a site of nurturing communication compared to girls, who have more opportunities to communicate with their peers in daily life.

Thus, the difference in characteristics of friendship between the two genders is seen to affect the gender difference in the conceptions of learning in physical education. Since physical education provides more opportunities to learn in cooperation with others through motor learning, it seems to serve as the site of learning how to convey one's own feelings as well as cultivating sympathy for others.

Conclusions

The aim of this study was to develop the physical education learning concept scale for elementary school students, and further, reveal Japanese elementary school students' views on learning in physical education. To this end, in this study, a pilot survey was conducted, followed by the main survey on 1,403 public elementary school students across Japan using the questionnaire survey method. An overview of the results is presented below.

- 1) The exploratory factor analysis revealed that the PE learning concept scale comprises five factors: "motor skills learning," "mind and body improvement," "cultivation of communication skills," "perceived attraction of physical activity," and "acquisition of knowledge on physical body and movements."
- 2) The reliability and a certain degree of validity of the PE learning concept scale was confirmed from its internal consistency. Furthermore, confirmatory factor analysis demonstrated factor invariance.
- 3) The analyses on grade and gender differences revealed that 6th graders had significantly higher scores than 5th graders on "motor skills learning" and "acquisition of knowledge on physical body and movements," and that girls had a significantly higher score than boys on the "cultivation of communication skills."

Lastly, to summarize this study, since physical education is mainly composed of motor learning through physical activity, acquisition of "skills" and "knowledge" concerning movements, as well as the attainment of "healthy body" and "physical strength," are considered essential components in securing uniqueness of physical education learning. These items naturally manifested themselves as factors for the PE learning concept scale.

On the other hand, the PE learning concept scale included "cultivation of communication skills" and "perceived attraction of physical activity." Traditionally, Arnold (1979) emphasized the existence of "education in movement" and mentioned "improvement in communication skills," "formation of identity" and "self-awareness of social responsibility" as its outcomes. Thus, this learning content is significant in terms of being values that are inherent in PE learning. Our findings pointed to the possibility that Japanese elementary school students recognize physical education not only as a site for acquiring motor skills and knowledge, but also as a site for learning social modes of behavior and senses of value, and thus, entertain the pedagogical significance of physical education in various ways.

As long as the conceptions of learning play an essential part in meta-cognition that propels students into acquiring and utilizing knowledge, the formation of diverse views on learning in physical education among learners is undoubtedly key to the implementation of quality physical education learning. In the future, lessons based on active learning on the part of learners will be keenly promoted in physical education in Japan. Thus, we must seek to develop independent learners while paying close attention to the views on learning that could promote such a form of learning.

In the future, we would like to construct a model of causal learning for physical education through analysis, in conjunction with other confounding factors, such as learning strategy and academic motivation.

Conflicts of interest

No conflict of interest.

References

- Akamatsu, D. (2017). Relation between high school students' beliefs and learning strategies, and their academic achievement in learning English. *The Japanese Journal of Educational Psychology*, 65(2), 265-280.
- Akamatsu, D. & Fujioka, H. (2015). The relationship between beliefs about English learning and English word learning strategies. *Journal of Educational Research*, 15, 153-162.
- Arnold, P. J. (1979). *Meaning in movement, sport, and physical education*. London: Heinemann.
- Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' belief about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology*, 75, 257-273.
- Fujimura, N. (2008). Knowledge acquisition/use and metacognition. In M. Sannomiya (eds.), *Metacognition* (pp. 39-54). Kyoto: Kitaohji Publishing.

- Hirose, Y., Nakamoto, K., & Hiruta, M. (2012). Relationships between beliefs about mathematics learning and learning strategies. *Annual Report of the Faculty of Education, Bunkyo University*, 46, 45-56.
- Horino, M., Ichikawa, S., & Nasu, M. (1990). An attempt to measure fundamental concept of learning: positive attitude toward failure and preference to thinking process. *Educational Information Research*, 6(2), 3-7.
- Ichikawa, S., Haebara, T., Sugisawa, T., Seo, M., Kiyokawa, S., Inuzauka, M., Murayama, K., Uesaka, Y., Kobayashi, H., & Shinogaya, K. (2009). Development of COMPASS: Componential assessment for basic competence and study skills in mathematics. *Cognitive Studies*, 16(3), 333-347.
- Marton, F., Dall'Alba, G., & Beaty, E. (1993). Conceptions of learning. *International Journal of Educational Research*, 19, 277-300.
- Ministry of Education, Culture, Sports, Science and Technology. (2011). Course of study for elementary schools: Physical education edition (English version). https://www.mext.go.jp/component/a_menu/education/micro_detail/_icsFiles/afieldfile/2009/04/21/1261037_10.pdf.
- Ministry of Education, Culture, Sports, Science and Technology. (2018a). Course of study for elementary schools. Tokyo: Toyokan Publishing.
- Ministry of Education, Culture, Sports, Science and Technology. (2018b). Explanation of the course of study for elementary schools: Physical education edition. Tokyo: Toyokan Publishing.
- Nakayama, A. (2005). Testing a hypothesized model of English language learning: Japanese University Students' goal orientation, beliefs, and learning strategies. *Japanese Journal of Educational Psychology*, 53(3), 320-330.
- Neber, H. & Schommer-Akins, M. (2002). Self-regulated science learning with highly gifted students: The role of cognitive, motivational, epistemological, and environmental variables. *High Ability Studies*, 13, 59-74.
- Ono, Y., Tomozoe, H., Tahakashi, S., Fukami, E., Yoshinaga, T., & Nemoto, S. (2018). Conceptions of learning and learning strategies of students in junior high school physical education. *Japan Journal of Physical Education, Health and Sport Sciences*, 63(1), 215-236.
- Peterson, E. R., Brown, G. T. L., & Irving, S. E. (2010). Secondary school students' conception of learning and their relationship to achievement. *Learning and Individual Differences*, 20, 167-176.
- Pintrich, P. R. & Zusho, A. (2002). The development of academic self-regulation: The role of cognitive and motivational factors. In A. Wigfield and J. S. Eccles (eds.), *Development of achievement motivation* (pp. 249-284). San Diego: Academic Press.
- Purdie, N. & Hattie, J. (2002). Assessing students' conceptions of learning. *Australian Journal of Educational & Developmental Psychology*, 2, 17-32.
- Purdie, N., Hattie, J., & Douglas, G. (1996). Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison. *Journal of Educational Psychology*, 88(1), 87-100.
- Rose, A. J. & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*, 132(1), 98-131.
- Sasaki, B. & Suko, R. (2016). The factorial concept of inferiority complexes and their relationship to students' personal characteristics regarding physical education. *Japan Journal of Physical Education, Health and Sport Sciences*, 61(2), 663-680.
- Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82, 498-504.
- Shinogaya, K. (2008). Effects of preparation on learning: interaction with beliefs about learning. *The Japanese Journal of Educational Psychology*, 56(2), 256-267.
- Suzuki, G. (2013). Grade-Level Differences in Elementary and Middle School Students' Conceptions of Learning: Correlation with Learning Strategy Use. *The Japanese Journal of Educational Psychology*, 61(1), 17-31.
- Teranishi, Y. (2008). How high-school students think of formulas and theorem in mathematics: correlation with learning beliefs, strategies, and performance. *The Bulletin of the Graduate School of Education of Waseda University*, 16(1), 1-13.
- Ueki, R. (2002). Structure of High-School Students' Beliefs About Learning. *The Japanese Journal of Educational Psychology*, 50(3), 301-310.
- Uesaka, Y. (2010). Meta-cognition, learning concept, learning strategy. S. Ichikawa (eds.) *Theories and applications of cognitive psychology* (pp. 172-200), Kyoto: Kitaohji Publishing.