香港教育大學

The Education University of Hong Kong

A Project entitled

The applicability of sports imagery in teaching badminton in PE lessons for secondary students

Submitted by

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Declaration

I, Ma Siu Chung , declare that this research report represents my own work under the supervision of Prof. CHOW Hung Kay Daniel, the Chair Professor of Health and Sports Science, and that it has not been submitted previously for examination to any tertiary institution.

Signed _____

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The applicability of sports imagery in teaching badminton in PE lessons for secondary students

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Abstract

The applicability of sports imagery for learning badminton was investigated in Form.5 PE lesson. In this research design, two classed were being selected - one for experimental group and other for control group. Students' sports ability was classified as either high (IH) or low (IL) using a questionnaire. Skill tests of badminton forehand high clear were tested before and after the teaching period.

During the teaching period, sports imagery was used for the experimental group and conventional teaching was used for the control group. The data were analyzed to study the effects of group and sports imagery ability on students' performance. The result showed that hitting accuracy was significantly affected by sports imagery ability for both the IH and IL students. Better improvement in swing posture was found for IL students using sports imagery training that that of the conventional teaching. For the other performance, the two teaching methods got similar improvement.

In general, sports imagery was found to be a better tool for teaching badminton compared with the conventional teaching, especially for improving hitting accuracy and swinging posture for IL students. Teachers are worth to apply it in PE lesson to teaching badminton.

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Introduction

Sport imagery is a popular and well-established strategy used to improve performance (Cumming & Ramsey, 2009; Murphy, Nordin, & Cumming, 2008). It indicated that when the elite athletes were compared with those novices, they get a more frequency on sports imagery even they had never acknowledge what means by the term 'Sport imagery'. Besides, it determined that imagery influences the sports performance positively (Barrow, 2007). Thus, imagery can be implemented as the tool to enhance athletes' performance. A study suggested that imagery should be used differentially throughout the competition season in order to get better performance (Munroe, 1998). Also, it is found that elites got a higher imagery ability than the non-elite athletes (Craig, 1990). Moreover, some studies revealed that different sports got different level of benefit from sports imagery. It is not difficult to discover most of the researches focus on those elite athletes or for those who get better sports imagery ability. In other words, the direction of these papers promote elitism in sports which is to enhance the performance of those talented only. But there is rare discussion about its popularizing applicability, especially in school approach. If a research can find out that sports imagery actually can help all students' sports performance, no matter for those who get high or low sports imagery ability, it will be an innovative idea in Physical Education pedagogy.

Caeyenberghs (2009) expressed that the relationship between mental image and sport skill was shown to become stronger with age, especially the children with the age of 12 get a well-established imagery ability according to the sport imagery development research of primary children (i.e. 7-12 years old). Therefore, the secondary students are more suitable to be the target subject for this research since they developed better in forming mental image.

While, it is impossible to complete the research on every element in PE lesson, so one

sports is selected as the stepping stone. As badminton is a sport that requires muscle strength, eye-hand coordination and motor coordination. It is suitable to be implemented of this research.

Hence, the major research question is addressed in this research:

"Would sports imagery benefit the learning outcome of students in badminton performance in PE lessons, no matter the students got high or low sports imagery ability?"

In order to improve the PE teaching quality in HK, it is a worth and valuable topic to light up the concern of educators by deciding sports imagery as a popularized skill which is taught or introduced in PE lessons. Ultimately, it is important to strengthen the motivation of students in PE by gaining the sense of successful and contributing positive insights of the sports culture in HK at the same time.

Project objective

With the major research question "Would sports imagery benefit the learning outcome of students in badminton performance in PE lessons, no matter the students got high or low sports imagery ability?" the following are the project objective:

- To find out that whether sport imagery could help secondary students of high sports imagery ability to learn better in badminton.
- To find out that whether sport imagery could also help secondary students of low sports imagery ability to learn better in badminton.
- Ultimately, determine the applicability of sports imagery in teaching badminton in PE lessons for secondary students.

Methodology

Research design:

The research design was a two way design with mixed sample. The target participants included two classes (class A and class B) of the secondary students. Class A was the control group while class B was the experimental group. They participated in a sports imagery ability test, pre-assessment skill test, two different teaching methods (sport imagery for class B and conventional teaching for class A) and a post assessment skill test. Data of two tests was analyzed by SPSS for the significant difference.

Participants:

59 boys were selected to be the participants in this research (n=59). They were separated into two classes, class A and class B. Class A was the control group and class B was the experimental group. All of the participants came from Wa Ying College and all of them are Form 5 students.

Equipment:

1. Badminton Rackets

30 regular badminton rackets were used for the pre-test, post-test and practice during lessons in the whole period of this research. All were provided by the school.

2. Badminton

200 regular badminton were used for the pre-test, post-test and practice during lessons in the whole period of this research. All were provided by the school.

3. Consent Form

A consent form which acknowledged the purpose of this research, the participants' rights

and confidentiality were given before starting the survey.

4. Sports Imagery Ability Questionnaire (SIAQ)

The SIAQ was selected from 'The Sport Imagery Ability Questionnaire Manual' published by Cumming, J., & Williams, S. E. in 2015. 59 copies of SIAQ were printed out for testing the sports imagery level of the participants and 59 copies were returned for data analysis. SIAQ consisted of 15 questions to examine the participants' sports imagery abilities, including 1. Skill imagery ability 2. Strategy imagery ability 3. Goal imagery ability 4. Affect imagery ability 5. Mastery imagery ability. Each question of the questionnaire was given 7 choices of the imagery scale for participants to choose (1 = very hard to image, 2 = hard to image, 3 = somewhat hard to image, 4 = neutral (not easy or hard), 5 = somewhat easy to image, 6 = easy to image, 7 = very easy to image). In this research design, only skill imagery ability and strategy imagery ability were used as the measurement. Therefore, only items 1,3,6,8,12,13 were taken into calculation to distinguish their sports imagery ability.

5. Badminton racket intelligent smart sensor

Badminton racket intelligent smart sensor is a device that can efficiently collect data for the swinging speed. Thus, the sensor was used in the research. The sensor was placed under the racket during the pre-test and post-test with the connection of the app. Then, the data was recorded simultaneously.

6. Badminton serving machine

A 240 capacity badminton serving machine was used for the standard serving in both pre-test and post-test in the purpose of guaranteeing the accuracy of the tests. The badminton serving machine was provided by EdUHK.

Procedure

The whole data collection period took 4 weeks to finish, the procedure is shown below.

1. Sports Imagery Ability Questionnaire (SIAQ)

The questionnaire was given to the participants in the first lesson and the questionnaire was completed before the pre-test. Data related to their sports imagery ability was collected. By the calculation of the score in items 1,3,6,8,12,13 from the SIAQ, participants were classified to two level of sports imagery. They were the higher sport imagery ability (with score >=24,) and lower sport imagery ability (with score <24). Hence, the participants were accordingly divided into 4 groups, class A with high sport imagery ability and class A with low sport imagery ability; class B with high sport imagery ability and class B with low sport imagery ability. In the following paragraphs, students with high sport imagery ability will be named as IH students; students with low sport imagery ability will be named as IL students.

2. Pre assessment skill test

A badminton skill test (high clear) was completed after the questionnaire. The criteria of the skill test contained three elements:

a. The swinging speed of the high clear preformed.
b. The number of successful hit.
c. The swing posture of the high clear.

In the test, each student had 10 opportunities to hit the ball that served by the serving machine. During the 10 trials, the swinging speed of the 10 trials was recorded with the sensor and app, then all data was saved in the iPad. At the same time, the number of successful hits of each participant was recorded by the researcher in hard copy. The whole testing period was being recorded by the sports camera for further analysis of the swinging posture.

3. Teaching period

The teaching period started from the second half of the first lesson and ended in the third

lesson. Two different teaching methods were applied to the two classes separately, sports imagery for class B (the experimental group), while conventional teaching for class A (the control group). Besides the imagery part, the teacher kept the remained teaching content in constant which included the feedback frequency, activities and learning environment in order to ensure the accuracy of this research. The difference between the two groups' teaching methods were shown below:

3.1 Details of teaching of forehand high clear for students in experimental group

At the beginning of the teaching period, i.e. the second half of the first lesson, teacher, the researcher, introduced the idea of sport imagery. The content included informing the students that imagery was a skill that did the visual and mental rehearsal (did the whole process in mind for rehearsal) before learning a skill. After that, the procedure and the key points of operating the imagery training were introduced and repeated on every lesson for a better outcome as imagery was a new technique for students. According to *Imagery training: A guide for sports coaches and performers* (Hale, 2005), the key points mentioned above included:

a. Practice make perfect

At the beginning, the use of imagery may not good, it is a skill and all skill need practice. Trying more in visual and mental rehearsal to make imagery useful.

b. Put more focus on quality

During imagery, learner should focus on creating and controlling the image in mind. It is preferred to start with the image for a short period of time but in high quality and expand the time gradually.

c. Set the scene

During the imagery, it is better to generate the image as detail as possible in mind such as the opponent, the venue, the sound, the feeling when you hit the ball etc.

d. Plan the imagery

Planning the imagery well to fit the current needs. For example, when the students always fail to hit the ball, the students should plan to focus more on the hitting timing imagery rather than the posture.

The imagery practice was done before the physical practice in each section and after the direct teaching and demonstration. The teacher guided the students to work on the imagery practice. After that, the students practiced and teacher was responsible to give feedback.

3.2 Details of teaching of forehand high clear for students in control group

Direct teaching was used in the lessons. Every teaching section operated in the conventional way which included the direct teaching with verbal and demonstration, physical practicing and feedback. Because of the absence of the imagery practice, the control group got a relatively longer physical practicing time than the experimental group.

A detail unit plan for the four lesson can be found in the Appendix 6.

4. Post-assessment skill test

A post-assessment skill test was same as the pre-assessment skill test. It was done at the fourth lesson. Data was collected for further comparison.

5. Analysis the data

The three-way AONVA SPSS was adopted to analysis the data collected. There were eight groups of data. They were the data collected from students in pre-skill test of 1. high sport

imagery ability in class A, 2. low sport imagery ability in class A, 3. high sport imagery ability in class B, 4. low sport imagery ability in class B; the data collected from students in post-skill test of 5. high sport imagery ability in class A, 6. low sport imagery ability in class A, 7. high sport imagery ability in class B, 8. low sport imagery ability in class B. The data of each group of participants was analyzed to figure out whether there was significant difference between the improvements of class A and class B students.

After analyzing the data, the conclusion was drawn to imply the relationship between the imagery and sports performance. Furthermore, the limitations of the whole research process and suggestions of how to further extend the research direction in the corresponding area were indicated as well.

Result

In the whole research design, there are 59 subjects in total (n=59) and are divided into control and experimental group respectively. Besides, they are labeled with the imagery ability level. The scores of three elements of the pre- and post-skill test of the subjects, the swinging speed of the high clear preformed, the number of successful hit and the swing posture of the high clear, are input and analyzed by the three-way AONVA with repeated measures on the time factor and paired sample t-test for part of the elements. The results of the tests which are presented by three elements separately are as follow.

Swinging speed

The following table (Fig.1) shows the descriptive statistic of the swinging speed.

Descriptive Statistics

	Group	imageryability	Mean	Std. Deviation	N
prespeed	control	lower	105.5500	14.21586	16
		higher	133.2500	26.77162	14
		Total	118.4767	24.96744	30
	expermental	lower	103.9286	17.06131	14
		higher	127.7333	12.42611	15
		Total	116.2414	18.94476	29
	Total	lower	104.7933	15.35234	30
		higher	130.3966	20.44107	29
		Total	117.3780	22.05041	59
postspeed	control	lower	106.7813	15.00823	16
		higher	134.3500	27.10929	14
		Total	119.6467	25.33058	30
	expermental	lower	106.7786	17.71958	14
		higher	129.9667	16.50860	15
		Total	118.7724	20.52077	29
	Total	lower	106.7800	16.03927	30
		higher	132.0828	21.96465	29
		Total	119.2169	22.89769	59

Fig. 1

From the table (Fig.2), it is observed that there is no significant interaction with the time ($p=0.138$), time and groups ($p=0.578$), time and imagery ability ($p=0.880$), time, groups and imagery ability ($p=0.922$). From Fig.3, only the relation of swinging speed and the imagery ability ($p<0.001$) has the significant interaction.

Tests of Within-Subjects Effects

Measure:

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	101.050	1	101.050	2.268	0.138
	Greenhouse-Geisser	101.050	1.000	101.050	2.268	0.138
	Huynh-Feldt	101.050	1.000	101.050	2.268	0.138
	Lower-bound	101.050	1.000	101.050	2.268	0.138
time * Group	Sphericity Assumed	13.922	1	13.922	0.312	0.578
	Greenhouse-Geisser	13.922	1.000	13.922	0.312	0.578
	Huynh-Feldt	13.922	1.000	13.922	0.312	0.578
	Lower-bound	13.922	1.000	13.922	0.312	0.578
time * imageryability	Sphericity Assumed	1.028	1	1.028	0.023	0.880
	Greenhouse-Geisser	1.028	1.000	1.028	0.023	0.880
	Huynh-Feldt	1.028	1.000	1.028	0.023	0.880
	Lower-bound	1.028	1.000	1.028	0.023	0.880
time * Group * imageryability	Sphericity Assumed	0.433	1	0.433	0.010	0.922
	Greenhouse-Geisser	0.433	1.000	0.433	0.010	0.922
	Huynh-Feldt	0.433	1.000	0.433	0.010	0.922
	Lower-bound	0.433	1.000	0.433	0.010	0.922

Fig.2

Tests of Between-Subjects Effects

Measure:

Transformed Variable:

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	########	1	########	2479.111	0.000
Group	244.106	1	244.106	0.366	0.548
imageryability	19221.546	1	19221.546	28.827	0.000
Group * imageryability	125.890	1	125.890	0.189	0.666
Error	36673.852	55	666.797		

a. Computed using alpha = .05

Fig. 3

Hitting rate

In the effect of the hitting rate, it reveals that there is no significant interaction with the time and the imagery ability (p=0.642), and there is also no significant interaction for time, groups and imagery ability (p=0.144). However, significant difference is found between the time (p=0.000) and time interacting with groups (p=0.008).

Tests of Within-Subjects Effects

Measure:

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	29.532	1	29.532	35.817	0.000
	Greenhouse-Geisser	29.532	1.000	29.532	35.817	0.000
	Huynh-Feldt	29.532	1.000	29.532	35.817	0.000
	Lower-bound	29.532	1.000	29.532	35.817	0.000
time * Group	Sphericity Assumed	6.154	1	6.154	7.464	0.008
	Greenhouse-Geisser	6.154	1.000	6.154	7.464	0.008
	Huynh-Feldt	6.154	1.000	6.154	7.464	0.008
	Lower-bound	6.154	1.000	6.154	7.464	0.008
time * imageryability	Sphericity Assumed	0.180	1	0.180	0.219	0.642
	Greenhouse-Geisser	0.180	1.000	0.180	0.219	0.642
	Huynh-Feldt	0.180	1.000	0.180	0.219	0.642
	Lower-bound	0.180	1.000	0.180	0.219	0.642
time * Group * imageryability	Sphericity Assumed	1.808	1	1.808	2.192	0.144
	Greenhouse-Geisser	1.808	1.000	1.808	2.192	0.144
	Huynh-Feldt	1.808	1.000	1.808	2.192	0.144
	Lower-bound	1.808	1.000	1.808	2.192	0.144

Fig. 4

Further analysis of the variables is conducted. After operating the paired sample t-test from Fig.5, it shows that there was significant interaction between the score of pre-test of experimental group and post-test of the experimental group on the hitting rate ($p<0.001$, Pair 4). When paired sample t-tests are conducted again within the experimental group, it presents that the HIGHER imagery ability group has significant difference between the pre-test and post-test ($p=0.002$, Pair 7). Also, the LOWER imagery ability group ($p=0.005$, Pair 6) has significant difference.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Interval of the Lower	Upper			
Pair 1	controlprehit - experprehit	0.72414	3.34767	0.62165	-0.54925	1.99752	1.165	28	0.254
Pair 2	conposthit - expposthit	-0.20690	3.33144	0.61863	-1.47411	1.06032	-0.334	28	0.741
Pair 3	controlprehit - conposthit	-0.53333	0.81931	0.14958	-0.83927	-0.22740	-3.565	29	0.001
Pair 4	experprehit - expposthit	-1.44828	1.63851	0.30426	-2.07153	-0.82502	-4.760	28	0.000
Pair 5	prehit - posthit	-0.98305	1.35814	0.17681	-1.33698	-0.62912	-5.560	58	0.000
Pair 6	LIprehit - LIposthit	-1.78571	1.96815	0.52601	-2.92209	-0.64934	-3.395	13	0.005
Pair 7	LHprehit - LHposthit	-1.13333	1.12546	0.29059	-1.75659	-0.51007	-3.900	14	0.002

Fig.5

The below graph (Fig.6) shows the improvement of the IL students.

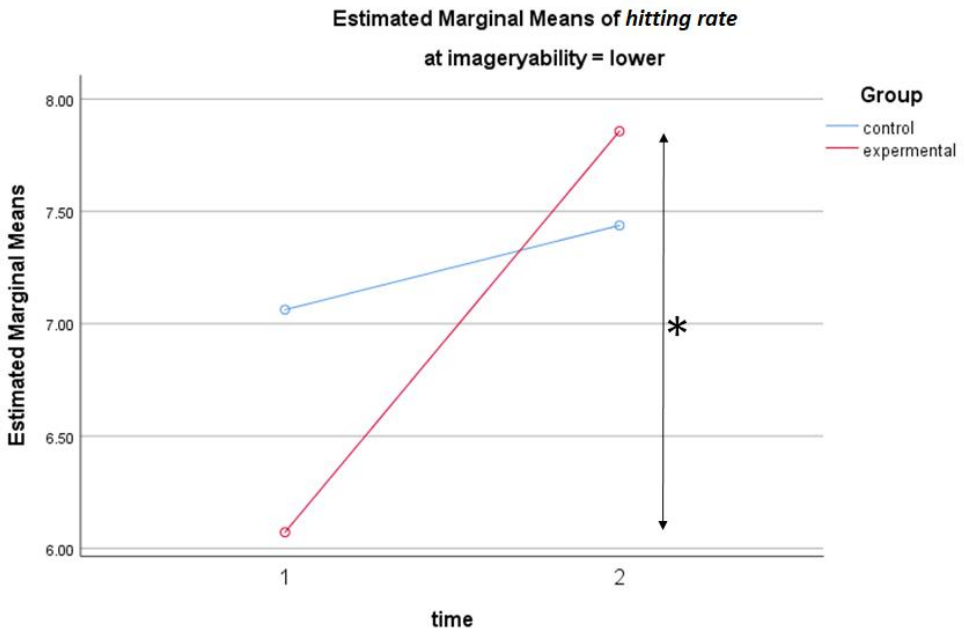
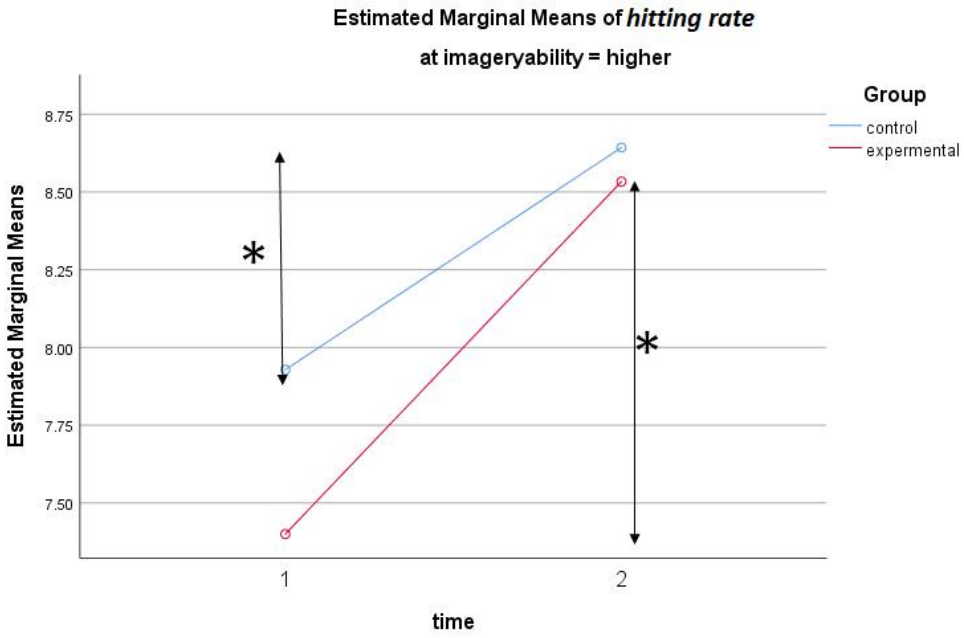


Fig.6

*Refers to significant difference

The below graph (Fig.7) shows the improvement of the IL students.



*Refers to significant difference

Posture

From the table which presents the effect of posture (Fig.8), it reflects that there is no significant difference with the time interacting with group (p=0.140), the time interact with the imagery ability (p=0.140) and the interaction of time, groups, imagery ability time (p=0.390). The significant interaction is found on the time only (p<0.001). Also, it reveals that there is significant interaction for the relation between the swinging speed and the imagery ability (p=0.001) from Fig. 9.

Tests of Within-Subjects Effects

Measure:

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	5.026	1	5.026	27.262	0.000
	Greenhouse-Geisser	5.026	1.000	5.026	27.262	0.000
	Huynh-Feldt	5.026	1.000	5.026	27.262	0.000
	Lower-bound	5.026	1.000	5.026	27.262	0.000
time * Group	Sphericity Assumed	0.299	1	0.299	1.624	0.208
	Greenhouse-Geisser	0.299	1.000	0.299	1.624	0.208
	Huynh-Feldt	0.299	1.000	0.299	1.624	0.208
	Lower-bound	0.299	1.000	0.299	1.624	0.208
time * imageryability	Sphericity Assumed	0.549	1	0.549	2.977	0.090
	Greenhouse-Geisser	0.549	1.000	0.549	2.977	0.090
	Huynh-Feldt	0.549	1.000	0.549	2.977	0.090
	Lower-bound	0.549	1.000	0.549	2.977	0.090
time * Group * imageryability	Sphericity Assumed	0.076	1	0.076	0.413	0.523
	Greenhouse-Geisser	0.076	1.000	0.076	0.413	0.523
	Huynh-Feldt	0.076	1.000	0.076	0.413	0.523
	Lower-bound	0.076	1.000	0.076	0.413	0.523

Fig. 8

Tests of Between-Subjects Effects

Measure:

Transformed Variable:

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3564.484	1	3564.484	720.895	0.000
Group	1.354	1	1.354	0.274	0.603
imageryability	63.083	1	63.083	12.758	0.001
Group * imageryability	0.059	1	0.059	0.012	0.913
Error	271.949	55	4.945		

Fig. 9

As the significant interaction is found, further analysis is conducted for the variables. After operating the paired sample t-test, refer to Fig. 10, it is observed that there are two significant interactions. One is observed between the score of pre-test of experimental group

and post-test of the experimental group on the posture (p<0.001, Pair 10), and the other one is observed between the score of pre-test of control group and post-test of the control group on the posture (p=0.005, Pair 9).

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Interval of the Lower	Upper			
Pair 8	preposture - postposture	-0.42373	0.62155	0.08092	-0.58571	-0.26175	-5.236	58	0.000
Pair 9	controlpre post - controlpost posture	-0.30000	0.53498	0.09767	-0.49977	-0.10023	-3.071	29	0.005
Pair 10	experprep osture - experpostp osture	-0.51724	0.68768	0.12770	-0.77882	-0.25566	-4.050	28	0.000

Fig. 10

Thus, paired sample t-tests are conducted again within the experimental group and control group. The below table (Fig. 11) shows the result.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Interval of the Lower	Upper			
Pair 11	controlpre post - experprep osture	-0.13793	2.37132	0.44034	-1.03993	0.76407	-0.313	28	0.756
Pair 12	controlpost posture - experpostp osture	-0.37931	2.58310	0.47967	-1.36187	0.60325	-0.791	28	0.436
Pair 13	ExlLprepos ture - ExlLostpos ture	-0.50000	0.75955	0.20300	-0.93855	-0.06145	-2.463	13	0.029
Pair 14	ExlHprepo sture - ExlHpostp osture	-0.60000	0.63246	0.16330	-0.95024	-0.24976	-3.674	14	0.003
Pair 15	ConlLprep osture - ConlLpost posture	-0.12500	2.36291	0.59073	-1.38410	1.13410	-0.212	15	0.835
Pair 16	ConlHprep osture - ConlHpost posture	-0.50000	0.51887	0.13868	-0.79959	-0.20041	-3.606	13	0.003

Fig. 11

Within the control group, it is observed that the difference for the score of the pre-test and post-test on the posture of LOWER imagery ability subjects is not significant (p=0.835, Pair 15) while the difference for the subjects with HIGHER imagery ability is significant (p=0.003, Pair 16).

For the experimental group, the result reveals that the difference for the score of the pre-test and post-test on the posture for LOWER imagery ability subjects (p=0.029, Pair 13) and HIGHER imagery ability subjects (p= 0.003, Pair 14) are both significant.

The below graph (Fig.12) shows the improvement of the IL students.

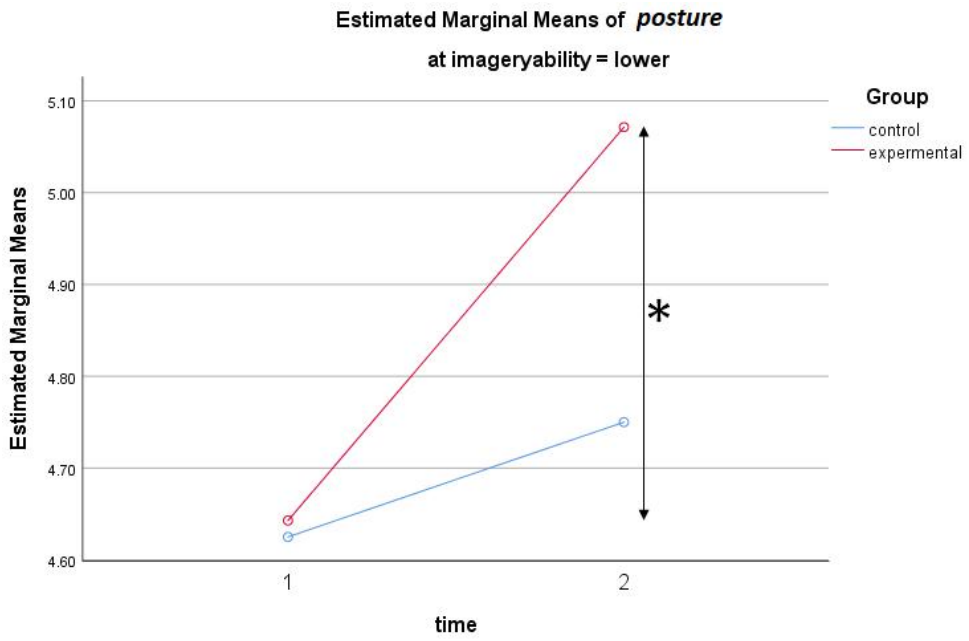


Fig. 12

Discussion

"Swinging Speed Aspect"

No significant change

Base on the result of this research, it finds that the swinging speed of the students does not improve during the teaching, neither the control group nor experimental group. The result shows both IL and IH students cannot benefit from imagery and conventional teaching in enhancing swinging speed. In badminton swinging, the strength of the muscles includes flexor carpi ulnalis, extensor carpi radialis, triceps brachii (lateral head), biceps brachii and trapezius (upper) (Sakurai, S., & Ohtsuki, T. ,2000) would positively related to the swinging speed. However, the teaching does not focus on the training of these muscles, so this can be the possible reason of the unchanged swinging speed during the teaching period.

"Hitting Accuracy Aspect"

All students' accuracy improve after the teaching period

It is shown from the data that the hitting accuracy of both the control group and experimental group students improved after the teaching. As hitting the badminton requires a skill that relates to the eye-hand coordination and EGGLESTON (1926) claimed that the physical and mental practice are both efficient in the skill requirement of performing eye-hand coordination task. Meanwhile, physical practice is more efficient than practice mentally. The physical practice is conducted throughout the whole teaching period. Hence, both experimental and conventional group can be benefit from the teaching.

Improvement of EXPERIMENTAL group > Improvement of CONTROL group

Experimental group shows the significant better improvement when comparing with the

control group. TRUSSELL (1952) claimed that different combinations of physical and mental practice can enhance the performance. Therefore, it echoes the result that the experimental group gets better improvement significantly.

IL students got a better improvement in experimental group

Further comparison of the difference of pre- and post- test between IL and IH students of experimental group is completed and it reveals that the difference of the improvement between IL and IH students is significant. Especially, IL students get a significant greater improvement. It is noteworthy that the current studies focused on the relationship between imagery and elite athletes but the result hereby presents that the people with low imagery ability also benefit significantly from imagery.

Teaching combines with imagery can help in enhancing the hitting accuracy

From the result of this research, teaching with imagery has the positive effect of the hitting accuracy. The hitting accuracy increases sharply, IL students can also benefit from the imagery and even get a better improvement when comparing with the IH students.

"Posture"

All students' accuracy improve after the teaching period

From the results presented from the three-way ANOVA, it demonstrates that time effect is the significant findings. It determines that the students' performance is improved after the lessons.

The imagery ability and swinging posture are positively related

Besides the analysis of the improvement, the imagery ability and swinging posture are

shown to be positively related. It shows that IH students always get better swinging posture than IL students.

IL students of EXPERIMENTAL group has significantly improved but those of CONTROL group has not

According to the analysis of the pre-and post- effect among four groups of students, the IH and IL students in control group and experimental group, the result discovers that only the IL students in control group has not significantly improved while the other three groups have improved significantly. Attention has been drawn to the significant improvement of the IL students when they practice imagery as their learning tool on the swinging posture. Yet, there is no significant difference on the improvement of IH students of the control and experimental group by using imagery from the result although they both have the improvement. Furthermore, the imagery ability and swinging posture are positively related is presented from the result. It may be the reason of the IL students get a better learning in imagery when their imagery ability has improved.

Imagery may be a better tool for teaching motor manipulation for IL students

The swinging posture is a kind of motor manipulation which has mentioned from the beginning of this study. The results may raise the awareness of expanding the use of imagery as one of the teaching tools to better improve IL students' motor manipulation ability in a wider area.

Limitation

Sample size is limit

In the whole research design, there were in total 59 participants and they were separated into 4 group (IL, IH in experimental group and IL, IH in control group), each group had 14-15 students. The limited sample size affects the usage of three-way ANOVA and representative of the research. Therefore, it would be better if the sample size could be enlarged.

The representative is not enough

All the participants in this research were F.5 students only. However, students have different learning behavior and ability at different ages. So, the results here might not represent for all secondary students.

The imagery ability of students after the teaching period were not measured

As it is found that imagery ability partly related to the badminton performance, especially for the swinging power and swinging posture, therefore, it is worth to discover whether the imagery ability of students also improved after the teaching.

The applicable category is limit

This research only focuses on teaching badminton in PE lesson, which is only a small part of PE. The research can better be repeated in different sports in PE lesson for the applicability, and ultimately apply it to the whole PE area.

Conclusion

In the badminton lessons, using sports imagery was shown to be a better tool compared with conventional teaching. For IH students, with the comparison with the conventional teaching, mixed with the use of sports imagery got no bad effect on the three element (including the swinging speed, accuracy and posture) and also IH students who used the sports imagery significantly improve greater in the hitting accuracy. For IL students, mixed with the use of sports imagery got no bad effect on the three elements too. Also IL students who used the sports imagery significantly improve greater in the hitting accuracy and swing posture. So, overall speaking, sports imagery in badminton could should be applied to secondary PE lessons for a better teaching outcome and hope that further research studies could be done with imagery in different aspects (in other sports) to discover the possibility of using imagery extensively in PE lesson.

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Appendix 1

Sports Imagery Ability Questionnaire (Source from : 'Cumming, J., & Williams, S. E. (2015).

The Sport Imagery Ability Questionnaire Manual. 10.13140/RG.2.1.1608.6565.')

Instructions: The purpose of this questionnaire is to obtain information about your ability to generate a number of images athletes use in relation to their sport. For each item, bring the image to your mind with your eyes CLOSED. Then rate how easy it is for you to form this image (1 = very hard, 4 = not easy or hard to 7 = very easy). Circle the appropriate rating based on the scale provided. For example, some athletes may find imaging themselves kicking a football neither easy nor hard and therefore select 4. Please be as accurate as possible and take as long as you feel necessary to arrive at the proper ratings for each image. There are no right or wrong answers, because we are simply interested in your response.

In relation to my sport, how easy is it for me to image…	Very hard to image	Hard to image	Somewhat hard to image	Neutral (not easy or hard)	Somewhat easy to image	Easy to image	Very easy to image
1. Making up new plans/strategies in my head	1	2	3	4	5	6	7
2. Giving 100% effort even when things are not going well	1	2	3	4	5	6	7
3. Refining a particular skill	1	2	3	4	5	6	7
4. The positive emotions I feel while doing my sport	1	2	3	4	5	6	7
5. Myself winning a medal	1	2	3	4	5	6	7
6. Alternative plans/strategies	1	2	3	4	5	6	7
7. The anticipation and excitement associated with my sport	1	2	3	4	5	6	7
8. Improving a particular skill	1	2	3	4	5	6	7
9. Being interviewed as a champion	1	2	3	4	5	6	7
10. Staying positive after a	1	2	3	4	5	6	7

setback							
11. The excitement associated with performing	1	2	3	4	5	6	7
12. Making corrections to physical skills	1	2	3	4	5	6	7
13. Creating a new event/game plan	1	2	3	4	5	6	7
14. Myself winning	1	2	3	4	5	6	7
15. Remaining confident in a difficult situation	1	2	3	4	5	6	7

Separate subscales of imagery ability

Items are averaged to form five separate subscales as follows:

Skill imagery ability = Item 3 + Item 8 + Item 12 /3

Strategy imagery ability = Item 1 + Item 6 + Item 13 /3

Goal imagery ability = Item 5 + Item 9 + Item 14 /3

Affect imagery ability = Item 4 + Item 7 + Item 11 /3

Mastery Imagery Ability = Item 2 + Item 10 + Item 15 /3

Appendix 2

Consent form (Parents ver.)

The Education University of Hong Kong

Department of Health and Physical Education

Consent to participate in research(For Parents)

The applicability of sports imagery in teaching badminton in PE lessons for secondary students

I _____ hereby consent to my child participating in the captioned research supervised by Prof. Chow Hung Kay Daniel and conducted by Mr. Ma Siu Chung, who are the students of Department of Health and Physical Education in Education University of Hong Kong.

I understand that the information (include the data being collected and the video being taken in the lessons) obtained from this research may be used in future research and published. However, our right to privacy will be retained, i.e. the personal information of my child will not revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My child's participation in the project is voluntary.

I acknowledge that we have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Name of participant: _____

Signature of participant: _____

Name of Parent or Guardian: _____

Signature of Parent or Guardian:_____

Date: _____

Appendix 3

Consent form (School ver.)

The Education University of Hong Kong

Department of Health and Physical Education

Consent to participate in research(For School)

The applicability of sports imagery in teaching badminton in PE lessons for secondary students

My school hereby consent to participate in the captioned research supervised by Prof. Chow Hung Kay Daniel and conducted by Mr. Ma Siu Chung, who are the students of Department of Health and Physical Education in Education University of Hong Kong.

I understand that the information (include the data being collected and the video being taken in the lessons) obtained from this research may be used in future research and published. However, our right to privacy will be retained, i.e. the personal information of my students will not revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My students' participation in the project are voluntary.

I acknowledge that we have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Signature: _____

Name of Principal/Delegate*: (Mr/Mrs/Ms/Miss)_____

Post: _____

Name of School: _____

Date: _____

(*Please delete as appropriate)

Appendix 4

Consent form (Student ver.)

The Education University of Hong Kong

Department of Health and Physical Education

Consent to participate in research(For Participants)

T The applicability of sports imagery in teaching badminton in PE lessons for secondary students

I _____ hereby consent to participate in the captioned research supervised by Prof. Chow Hung Kay Daniel and conducted by Mr. Ma Siu Chung, who are the students of Department of Health and Physical Education in Education University of Hong Kong.

I understand that the information (include the data being collected and the video being taken in the lessons) obtained from this research may be used in future research and published. However, our right to privacy will be retained, i.e. my personal information will not revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Name of participant: _____

Signature of participant: _____

Date: _____

Appendix 5

Information sheet

Information sheet

The applicability of sports imagery in teaching badminton in PE lessons for secondary students

You are invited to participate in a project supervised by Prof. Chow Hung Kay Daniel and conducted by Mr. Ma Siu Chung, who are the students of Department of Health and Physical Education in Education University of Hong Kong.

Introduction of the research

A) The aims of the research are to find out the effects when sports imagery is used to secondary students with different imagery ability, badminton forehand clear will be used as a mean in the research, hence determine the applicability of sports imagery in PE lessons.

B) As you are a secondary school student, and taking part in regular physical education lessons, so you are invited to participate in this study.

Methodology of the research

A) Research design

For this research design, it would be a three way ANOVA design. The target participants will be two classes (class A and class B) of secondary students. Class B will be the control group. They will participate in the following parts, including sports imagery ability test (done by questionnaire), pre-assessment forehand high clear test, two different kind of teaching methods (sport imagery for class A and conventional teaching for class B) and a post-assessment forehand high clear test. Data of two tests will then be analyzed by SPSS to see whether there will be significant improvement or not.

B) Procedure

1) Sports Imagery Ability Questionnaire

The questionnaire with 15 questions will be given to the participants just before the skill test and questionnaires will be returned. Participants will then be classified to two level of sport imagery (higher sport imagery ability and lower sport imagery ability).

2) Pre assessment skill test

A badminton skill test (high clear) will be done after the questionnaire. The skill test will make use of the first lesson. The students are required to perform high clear for 5 times continuously and teachers will serve the ball. The criteria of the skill test will contain three elements:

a. The quality (swinging speed and power) of the high clear preformed.
b. The number of successful hit.
c. The swing posture of the high clear.

3) Teaching period

Two different teaching way will be applied to the two classes, sports imagery for class

A, the experimental group, while conventional teaching for class B, the control group. Other than the imagery part, teacher would keep the remained teaching content constant, including the feedback frequency, time control and learning environment. The teaching period will last for 3 weeks.

4) Post assessment skill test
A skill test that exactly the same with the pre assessment skill test will be done after the two different teaching (having sport imagery and without sport imagery) Data will be collected for comparison

5) Post assessment SIAQ
After the teaching period, SIAQ will be conducted again for class A, the experimental group, to see whether the sports imagery ability of students improved or not after the introduce of sports imagery

6) Data analysis
SPSS will be used to analysis the data collected. Each group of participants will be analysis to see whether there are significant difference between the improvements of class A students and class B students. After the analysis is made, conclusion will be drawn, to conclude that whether the research topic established, discuss the limitation of the whole research process and finally suggest how to further extend the research direction in the corresponding area.

Potential risks of the research

A) No possible risks will be caused to your child during the study. Physical education teacher with first-aid qualification will monitor the whole data collection process.

B) If your child get injured accidentally, all process for your child will be stopped. Your child will be provided with immediate treatments. You will be informed immediately.

C) Please understand that your child participation is voluntary. He/She has every right to withdraw from the study at any time without negative consequences. All information related to your childs will remain confidential, and will be identifiable by codes known only to the researcher.

Dissemination of the study

All results of this study will be used for researchers dissertation.

If you would like to obtain more information about this study, please contact Mr. Ma Siu Chung at telephone number or his supervisor Prof. Daniel Chow at telephone number

If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

Mr. MA Siu Chung
Student of EdUHK

Appendix 6

The unit plan of the teaching

Unit Plan

Class : 5AB, 5CD **Teacher :** Ma Siu Chung

Unit : Badminton

Previous Knowledge / Skill /Attitude : Basic knowledge of badminton

Expected Learning Outcomes : Students can be able to perform a standard forehand high clear with an improved swinging power, hitting accuracy and swinging posture

Lesson	Themes	Key Progressions	Remarks
1	Warm up activities ~ 15 minutes	Students divided in three groups: -one required to do the swinging practice -one group required to do the footwork practice and -the remaining group required to practice on performing the high clear with the ball served by the teacher. Each part last for 5 minutes and then the groups rotate, until all the three group switched.	The shading words refer to the imagery part for experimental students while students in control group do not need to follow, they will get more time for the physical practice for compensation
	Pre-test and questionnaire ~ 30 minutes	Students required to done the questionnaire before the pre-test. After that, pre-test will begin. The criteria of the skill test will contain three elements: a. The swinging speed of the high clear preformed. b. The number of successful hits. c. The swing posture of the high clear. In the test, each student had 10 chances to hit the ball that served by the serving machine. During the 10 trials, the swinging speed of the 10 trials were recorded with the sensor and app, the data were them saved in the iPad; the number of successful hits was recorded; the whole testing period was being recorded by the sport camera for further analysis of the swinging posture.	
	Introducing the sports imagery ~ 5 minutes	Introducing what is sports imagery, the guideline to apply sport imagery and how to practice sports imagery.	

	1st teaching part --- Learn how to change the centre of gravity from the back leg (usually on the right leg) to the front leg (usually on the left leg) during the swinging. ~ 15 minutes	Demonstrate how the centre of gravity can be changed Students required to do the imagery practice before physically practicing Practice in game After know the how to change the centre of gravity, students would then play a game like Dodgeball but using the badminton, students are required to focus on the application of changing the centre of gravity	
2	Warm up activities and recall ~ 10 minutes	Dynamic warm up will be done Recall the concept of the change of gravity	
	2nd teaching part --- Learn the process of changing from ready position to pre-hitting position (i.e. 引拍) ~10 minutes	Teacher do the demonstration for students Students required to do the imagery practice before physically practicing Students required to pair up, one student do the practice and the partner need to observe and get feedback	
	3rd teaching part --- Learn the full swinging ~15 + 25 minutes	Teacher do the demonstration for students Activity 1: Students required to do the imagery practice (about the swinging posture) before physically practicing Students required to pair up, one student do the practice and the partner need to observe and get feedback Repeated with progression: 1. Focus on power	

		2. Focus on the angle of hitting 3. Focus on having the changing of centre of gravity Activity 2: Students required to do the imagery practice (about the timing of hitting the ball with a good posture) before physically practicing Students divided into five groups In each group, one will be the coach who need to serve the ball While other practice the high forehand clear one by one
3	Warm up activities and recall ~ 10 minutes 4th teaching part --- Learn the footwork ~10 + 10 + 10 minutes	Dynamic warm up will be done Recall the concept of the full swinging Teacher demonstrate the standard footwork used in badminton Activity 1: Practice with throwing the ball Students required to do the imagery practice (about the swinging posture and swinging power) before physically practicing Students required to pair up, one will be the observer and the other will be the performer. Students change position when 10 trials done. Activity 2: Practice the swinging with racket Students required to do the imagery practice (about the swinging posture and swinging power) before physically practicing Students required to pair up, one will be the observer and the other will be the performer. Students change position when 10 trials done. Activity 3: Practice with performing the high clear Students required to do the imagery practice (about the swinging posture, hitting time and swinging power) before physically practicing Students divided into 5 groups, one will be the coach who serve the ball for group mates and the others will do the high clear practice.

4	Competition ~15 minutes Conclusion Warm up activities ~ 15 minutes Pre-test and questionnaire ~ 30 minutes	Students required to apply the learnt elements in the three lessons in the competition. Sum up the learnt technique before. Students divided in three groups: -one required to do the swinging practice -one group required to do the footwork practice and -the remaining group required to practice on performing the high clear with the ball served by the teacher. Each part last for 5 minutes and then the groups rotate, until all the three groups switched. The criteria of the skill test will contain three elements: a. The swinging speed of the high clear preformed. b. The number of successful hits. c. The swing posture of the high clear. In the test, each student had 10 chances to hit the ball that served by the serving machine. During the 10 trials, the swinging speed of the 10 trials were recorded with the sensor and app, the data were them saved in the iPad; the number of successful hit was recorded; the whole testing period was being recorded by the sport camera for further analysis of the swinging posture.	