Paper : Coaching

The Effects of Play Area Size as Task Constraints on Soccer Pass Skills

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The present study analyzed how task constraints affect the pass skills in young soccer players. The tasks were three-vs-one (3v1) ball possession in three different area sizes (8m× 8m, 10m×10m and 12m×12m square). The sizes were the task constraints in the study. The characteristic of the pass skill which is accomplished at the play area under each constraint appeared to be the following: 1. In the 12m area players had enough time and space to play. Therefore the ratio of 2-touch plays was higher. Also movement time was longer than others. 2. In the 10m area and the 8m area, there was no difference of ratio of 2-touch plays and ratio of pass success. 3. In the 8m area, the movement time of 2-touch plays was shortest. From these findings it was clear that size of the play area produced an effect on the pass skill which is shown with the respective environment. Coaches should make the purpose of practice clear in order to make passing an optimum task for players. To achieve that purpose, coaches should manipulate play area sizes.

Keywords: task constraints, pass skill, coaching

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1. Purpose

One role of soccer coaches is to set up practice tasks for better performance of players. Soccer practice tasks cover many contents and methods. Composing practice tasks effective for improvement of players, however, is not easy for many coaches because of the following reasons: for the same practice task, there are a variety of players who are engaged in it (i.e. physique, skill level) and a variety of task conditions (i.e. size of space, play constraints such as 1-touch play), which might bring great difference in aspect and quality of performed plays.

Recent studies on skill learning have examined promotion of learning using interaction between constraints (i.e. organism, environment, tasks) and learners (Williams & Hodges, 2005). Organismic constraints include both structural constraints such as height and weight and functional constraints such as strength of synaptic apposition in brain, cognition, motivation, and emotion. Environmental constraints are natural gravity, temperature, sound and light during exercising. Task constraints are targets of tasks and rules included in the tasks. It is considered that understanding individual organismic characteristics, designing environment, and devising tasks can let learners unconsciously tap out preferred behaviors (Newell, 1986).

Williams (2003) asserts that a soccer coach, by manipulating these constraints, should attempt to produce practice process and game situations so that players themselves can find and learn desired plays without any instructions from the coach. Similarly, as Nakayama (2004) mentioned, the Japan Foootball Association promotes the importance of coaching, in which a coach should devise situation settings, control the number of players, rules, and ball distribution from the coach in practice, and clarify skills to be developed. Further, Araújo, et al., (2005) examined differences in learning effect according to the quality of soccer ball as one task constraint as well as effect of learning decision making ability in ball games through practice tasks using the constraints. Button, et al., (2005) have reported change of kicking movement by task constraints, accuracy and speed at kicking, which were different emphatic points.

In this way, task constraints can be a useful

operational measure for soccer coaches to make effective instructions. Handford, et al., (1997) argues that many studies should be investigated in order to elucidate constraints associated with sport skill learning and to implement the findings. Because there are few empirical studies on how task constraints affect players' performing skills, ample data should be accumulated.

One important skill that soccer players should acquire is passing skill. There are a variety of practice tasks to learn this skill. Among them, ball possession is a practice task to enhance basic passing skill. This is the task of maintaining team possession of a ball by passing effectively and being careful not to allow the ball to be taken by the opponent. Nakayama (2007) reported that there is a difference in the passing skill between a triangle task without a defender and a three-vs-one (3v1) task with a defender. It suggests the effect of the task constraint of 'not allowing the ball to be taken by the opponent' on passing skill.

The constraint manipulatable by a coach in the ball possession task (3v1) is the size of play area. Rink (1993) notes that, in physical education, effective space use permits effective skill instructions. Also in 4v4, different shape and size of play area and goal setting can change game aspects (Matsumoto & Takii, 1997). Thus the space size is thought to affect skills.

The purpose of the present study was to examine the effect of the size of play area, which is one task constraint, on passing skill in 2-touch and 1-touch ball in a 3v1 ball possession task having the minimum number of players available for pass selection—three offenders vs. one defender (3v1).

2. Methods

2.1. Subjects

The subjects were 20 sixth-grade male elementary school students from three soccer clubs in N City, who had been practicing soccer for more than two years in their respective clubs (11 to 12 years of age) (**Table 1**). Clubs were practicing for three days a week almost throughout the year. The three clubs were consistently strong enough to be ranked near the top of their league in N City and had been chosen to go to prefectural games. One student had been chosen as a representative player of the prefecture.

Table 1 Attribute of the subjects

Subject	Age(year)	soccer experience (year)	Hight(cm)	Weight(kg)
1	11.5	3	138	3.0
2	12.2	6	155	4.1
3	12.3	3	155	4.3
4	12.2	6	143	3.4
5	11.8	3	148	3.6
6	12.1	5	148	4.3
7	11.8	6	145	3.5
8	12.0	4	150	3.2
9	12.2	8	146	3.7
10	12.4	6	150	3.6
11	12.2	8	150	3.5
12	12.0	4	143	3.6
13	12.1	7	145	4.2
14	12.1	6	142	3.0
15	12.1	8	155	4.0
16	12.3	2	156	4.2
17	11.9	6	145	3.4
18	12.3	2	141	3.4
19	12.0	7	140	2.9
20	11.5	6	141	3.2
mean	12.0	5.3	146.8	36.1
SD	0.25	1.95	5.49	4.47
Max	12.4	8	156	4.3
Min	11.5	2	138	2.9

2.2. Task and Procedure

The task was 3v1, in which three offenders tried to possess a ball while not allowing the ball to be taken by the opponent (defender). Thus four players forming a group played in three areas with different space of 8m×8m square (8m-area), 10m×10m square (10m-area), and 12m×12m square (12m-area). In accordance with some soccer play manuals, which presented 10-15 yards (approx. 9.15m - 13.7m) to be the play area in 3v1 training (i.e. Hargreaves, 1990; Luxbacher, 1991), the 10m×10m square area was set as our standard area along with the other two areas of narrower 8m×8m and wider 12m×12m.

First, one of four players was designated as the first optional defender. Then if a pass was not held by the next player, if a ball went outside the area, or if the defender touched the ball, the responsible offending player became the next defender. Offenders had to play within two ball touches.

All subjects played under all three conditions (8m-area, 10m-area, 12m-area). To offset the order

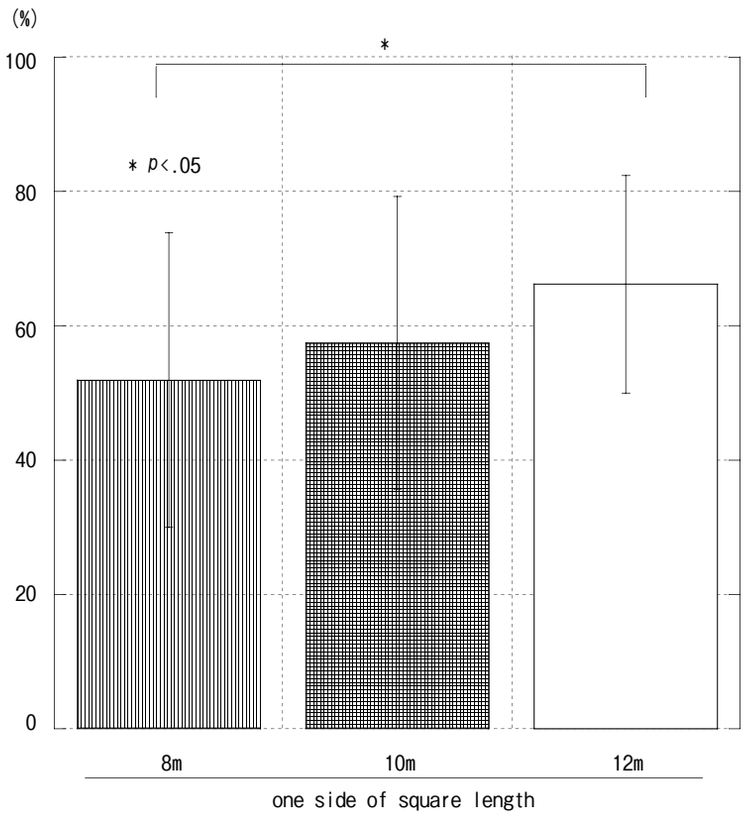

Figure 1 Percentage of the 2touch-play

effect, we changed the order of play according to the group. To reduce the effect of players' weariness, a play finished when pass exceeded 100 times or five minutes after the start of the task in each condition. Then after enough resting, the next condition took place.

All plays were filmed at a fixed camera angle by setting a video camera (DCR-HC96, SONY) at a high position like a field stand or a deck at the second floor of the building next to the ground so that all four players were onscreen.

2.3. Analysis Items

Filmed images, which accounted for a total of 1,460 passes (8m-area: 455, 10m-area: 477, 12m-area: 528), were summed into categories of "percentage of 2-touch play", "percentage of right foot play", " percentage of pass success", "percentage of pass failure", and "percentage of control failure" according to the subject. Pass failure was defined as the following: 1) if a pass was not sent to the next player; 2) if a pass went outside the area, 3) if the defender touched the passed ball; or 4) if the defender caught the passed ball. Control failure was defined as: 1) if the ball was touched or taken by the defender after a pass was received or before a pass was sent, or 2) if the controlled ball went out of the area.

Further, 855 2-touch plays were computed by 2-dimensional motion analysis software (siliconCOACH Pro, siliconCOACH Ltd.) by setting the time from the point when the ball was controlled until the ball was kicked as "2-touch play movement time".

2.4. Statistical Processing

Each analysis item conducted one-way repeated measures ANOVA in the three areas (8m-area, 10m-area, 12m-area). When significant difference was observed, LSD multiple comparison was conducted. Data expressed in percentage had a maximum limit and did not have a normal distribution so that numerals with angular transformation were used. All analyses had a significance level of 5%.

3. Result and Discussion

3.1. Play aspect in the 12m-area

The percentage of 2-touch play had means of 51.9% in the 8m-area, 57.5% in the 10m-area and 66.2% in the 12m-area. ANOVA found a significant difference between the conditions ($F(2,59)=5.06$, $p<.05$). In LSD post hoc test, the percentage of 2-touch play was significantly higher in the 12m-area than the 8m-area ($p<.05$). And there was no significant difference between the 12m-area and 10m-area, and between the 10m-area and 8m-area (**Figure 1**) in the percentage of 2-touch play.

The movement time in 2-touch play had means of 0.93 seconds (SD: 0.17) in the 8m-area, 1.05 seconds (SD: 0.16) in the 10m-area, and 1.21 seconds (SD: 0.15) in the 12m-area. As a result of ANOVA, there were significant differences between the conditions ($F(2,59)=25.66$, $p<.01$). In LSD post hoc test, the 12m-area had significantly longer 2-touch movement time than the 8m-area ($p<.01$). Further, between the 12m-area and 10m-area, the 12m-area had significantly longer movement time in

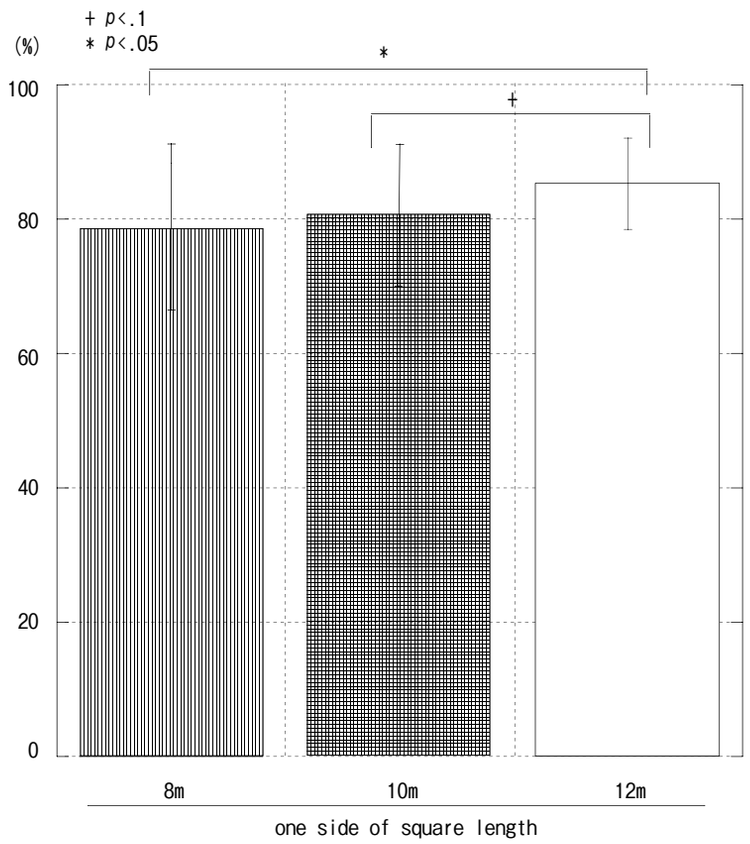

Figure 2 Percentage of pass success

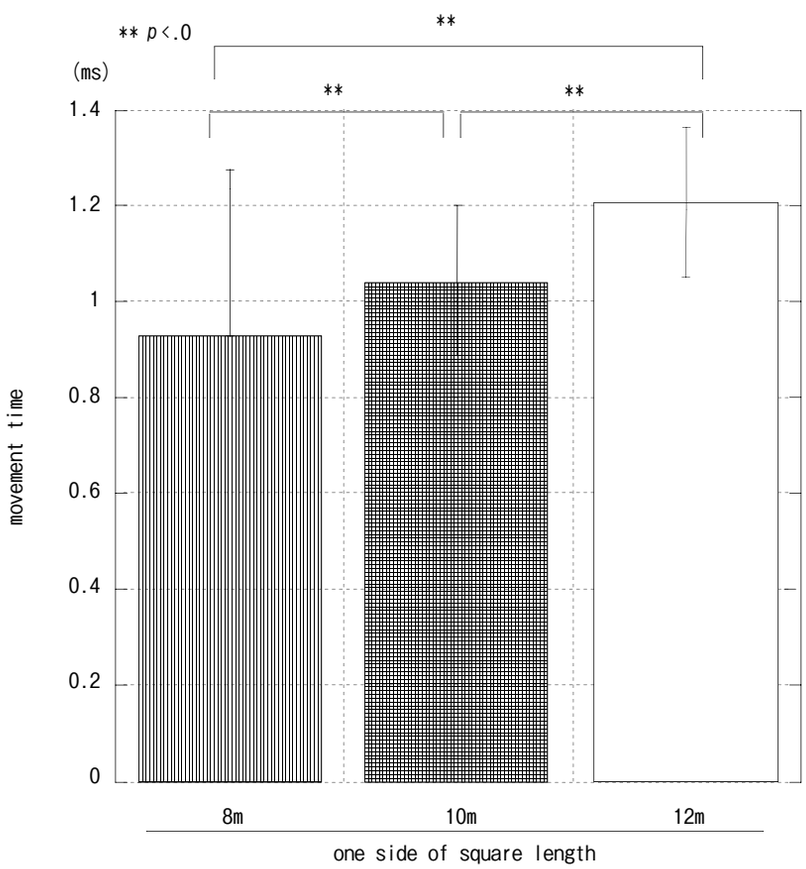

Figure 3 Movement time of 2-touch-play

2-touch play (p<.01). Also, between the 10m-area and 8m-area, the 8m-area was significantly longer in 2-touch movement time (p<.01)(**Figure 3**).

The percentage of pass success had means of 78.9% in the 8m-area, 80.6% in the 10m-area, and 85.3% in the 12m-area. In ANOVA, a significant difference was observed between the conditions (F(2,59)=3.49, p<.05). In LSD post hoc test, the percentage of pass success was significantly higher in the 12m-area than the 8m-area (p<.05). Further, between the 12m-area and the 10m-area, the 12m-area tended to observe a higher percentage in pass success (p<.10). There was no significant difference between the 10m-area and 8m-area (**Figure 2**).

The size of play area may affect spatial and time loads of players. The 12m-area, compared with the 10m-area and 8m-area, permits greater distance from the defender so that the player who possesses the ball has a smaller burden of space and time. The 12m-area having such an advantage yielded higher percentage in 2-touch play as a result of attempts for secure play so as not to allow the ball to be taken by the opponent. Longer time was required in 2-touch play than the other conditions. Its percentage of pass success was also higher than the others. This might be the task which allowed players to play relatively easily.

3.2. Difference between 10m-area and 8m-area

The percentage of right leg pass had the means of 86.7% in the 8m-area, 84.6% in the 10m-area, and 86.6% in the 12m-area. ANOVA did not recognize significant difference between the conditions (F(2,59)=1.73). In the percentage of pass failure, the means were 14.4% in the 8m-area, 13.2% in the 10m-area, and 10.3% in the 12m-area. No significant difference

was observed between the conditions in ANOVA ($F(2,59)=2.23$). The percentage of control failure had means of 6.7% in the 8m-area, 6.2% in the 10m-area, and 4.4% in the 12m-area. No significant difference was recognized between the conditions in ANOVA ($F(2,59)=0.86$). In addition, the 12m-area was notably different from the 8m-area and the 10m-area in the percentage of 2-touch play and pass success while there was no significant difference between the 8m-area and the 10m-area in these items.

In other words, the 10m-area and the 8m-area had similar play aspects. Nevertheless, the movement time of 2-touch play was significantly shorter in the 8m-area than the 10m-area. This suggests speedier plays in the 8m-area than the 10m-area.

The time of 2-touch play may be affected by ball control skill and decision making. Soccer passing skill cannot simply be evaluated by kicking skill. The element of ball control skill may comprise the passing skill. This is because development of ball control skill greatly affects subsequent kicking skill. Decision making elements (i.e. where, when, and what pass the player plays) also greatly affect the passing skill. What is required for soccer players is not the skill stylized with accurate repetition but the skill of breaking through the game situation to accomplish the goal of the game by utilizing skills in accordance with changing conditions on the field. Nakagawa (1984) has presented a conceptual model which incorporates techniques as well as the decision making ability as two primary elements comprising a ball game.

At 1-touch play in 3v1, a player often decides when and how he/she is going to pass before receiving a pass. In the meantime, in case of 2-touch play, a player often controls a received pass, observes the moment situation, and decides how to play. Of course, sometimes the player has decided judgment before receiving a pass, then executes the decided action of controlling and kicking. At that time, the player can change the decision making from controlling until kicking by observing the situation. Such observation of the decision making the play might result in greater loads for players in the 8m-area, which movement time in 2-touch play was shorter than the 10m-area. No difference in the percentage of ball control failure might explain that the players did not have too much technical burden.

3.3. The size of play area as a task constraint

Button, et al., (2005) have demonstrated that clear task instruction at kicking for players such as "kick accurately" or "maximize the ball speed", which were constraints, affected kicking movement. The relation of accuracy and speed is regarded as a trade-off. Accurate play suppresses speed. In soccer game situations, play should always be selected by considering this balance. Direct instructions relating to skill exertion from a coach in practice allow movement change and learning. Yet, emphasizing practice environment — a player's self selection and execution of a play — is also important. Self-judgment of the situation and selection of a skill or movement accordingly enable skill learning in environments similar to game situations. Yamamoto & Gohara (2000) reported that, in tennis strokes, only a task constraint of no verbal instruction differentiated acquisition of movement patterns. Thus the effect of practice independent from instructions might not be small.

The present study elucidated the effect of the size of play area, which is a task constraint in 3v1, on two aspects of skill and decision making of passing skill. It suggests that a coach can intentionally operate learning of the passing skill independent from direct coaching (instruction). A wide area is good for players to feel success and a narrow area is effective to experience 1-touch plays many times for reinforcing skill. An area too narrow, however, gives higher load in the skill, resulting in a smaller percentage of pass success. To enhance decision making ability, a narrow area is good for practicing play. Thus, a coach is advised to vary the size of play area appropriately to reduce the difference between intention and possible outcome of practice.

3.4. Limitation of the present study and future tasks

Both the outcome of pass (performance) and evaluation of biomechanical change in the movement are important for exploring the effect of task constraints (the size of play area in the present study) on passing skill. Yet, the present study did not analyze the change. Task constraints in 3v1 may include the size of play area as well as some other factors such as the number of ball touches and constraints of pass trajectory. Further, organismic

constraints should also be considered. The present study did not adequately consider the height, weight, and skill level of the subjects. In addition, environmental constraints have to be considered. Further research should be made in detailed examination of the relationship between constraints and passing skill.

4. Summary

The present study examined male soccer players less than twelve years of age in the effects of the size of play area in a 3v1 ball possession task, which is one practice task to enhance passing skill. The play area prepared three conditions of 12m×12m square, 10m×10m square, and 8m×8m square areas. The following characteristics were observed in passing skill executed in each play area:

1. The 12m-area had less time and spatial load for players possessing the ball and observed high percentage of 2-touch play and longer play time.
2. In the 10m-area, the percentages of 2-touch play and pass success were not different from the 8m-area.
3. The 8m-area yielded the shortest movement time in 2-touch play.

These findings elucidated that the size of play area affected the passing skill executed in each situation. Accordingly, a coach should be reminded that practice intention should be clarified in 3v1 task, and play area should be considered for better performance from practicing.

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