Effects Of Attentional Focuses On The Accuracy Of Golf Putting Depending On The Putting Distance

Sunok Lim, Seokhwan Shin, Youngjun Kim, Taegyong Kwon

Abstract: The purpose of this study was to perform experiments with a golf-putting task to investigate the effect of the internal focus of attention and the external focus of attention, as well as the focus of attention of the control group, according to the difference in putting distance (1 m, 3 m, and 5 m). The subjects were composed of 20 male and 10 female college students with no experience in golf (all were right-handed). They were randomly assigned into three groups with 10 participants per group: the internal focus of attention, external focus of attention, and control groups. After the exercise was performed three times for each distance (1 m, 3 m, and 5 m) as a trial, it was performed 10 times for each single putting distance. The experiment was performed for a total of 300 times (100 times for each distance). The groups were analyzed by distance (1 m, 3 m, and 5 m) to measure the absolute error; the direction was analyzed to measure the accuracy of the variable error for measuring the consistency; and the average of the total error was obtained to determine the general trend. Moreover, the standard deviations of the differences were determined. To analyze the differences in the errors, a two-way ANOVA with repeated measures was performed. As a result, first, according to the differences found from the putting challenge. However, no differences between groups were found. Second, learning the exercise for beginners through to the external focus of attention seemed to be more effective than through the internal focus of attention.

Key Words: attentional focus, golf putting, distance

1.INTRODUCTION

In sports situations, the performer pays attention to different information in order to achieve effective outcomes. This concentration of attention or the focus of attention is divided by width and direction. The direction of attention is subdivided into the internal focus of attention, which concentrates on internal components such as the body of the performers themselves, and the external focus of attention, which concentrates on external components such as environments, equipment, or the opposite parties [7]. The internal focus of attention and the external focus of attention appear in complex mutual interaction in sports situations. It is impossible to play sports by using only one focus of attention, and the focus of attention needs to have an immediate interconversion depending on the situation during a sports performance. Multiple preceding studies on these two concepts of focus of attention have found that the effects of instructions and feedbacks were greatly dependent on the form of presentation of focus of attention in motor skill learning [14] [15] [5] [10] [13]. Wulf and Weigelt (1997) reported that the focus of attention induced by instructors could greatly affect the effects of instruction on the process of motor skill learning. Moreover, Wulf, Lauterbach and Tool (1999), in a study related to golf chip shot, reported that learners could have better results by focusing on the head of the club, an external component, rather than on their own body motions during the performance. A number of preceding studies reported that providing direct information on motion, and concentrating on their motions by learners were not effective for learning because of a conscious control process during the performance of sports motions, whereas instructions to lead the focus of attention of performers to environments, equipment, and results and effects of motions induced effective learning because of the absence of interference with an autonomous control process.

- *First author: Sun-Ok Lim, Department of physical education in Konkuk University, Korea*
- *Co-author: Seokhwan Shin, Department of physical education in Konkuk University, Korea*
- *Co-author: Youngjun Kim, Department of physical education in Konkuk University, Korea*
- *Corresponding author: Taegyong Kwon, Department of physical education in Konkuk University, Korea, E-mail: dragonty@hanmail.net*
- *Co-Author name is currently pursuing masters degree program in electric power engineering in University, Country, PH-01123456789. E-mail: author_name@mail.com*

Additionally, current studies related to the focus of attention have continuously attempted to clearly reveal the correlation between motor learning and focus of attention through connections with various additional variables, including instruction [16] [18] , simultaneous and visual feedback [11], motion effects related with or without technical motion [12], self-control and relative frequency, and all of these results supported the finding that the external focus of attention would be more beneficial to performance and learning than the internal focus of attention.For visual information among diverse variables in preceding studies, as accurate acquisition and processing of information about targets are important components of the motor control system in motion performance for spatial targets, the efficiency and speed of visual information processing could directly affect the successful and accurate performance in daily life or sports situations [1]. In particular, performers apprehend spatial variables, size and location of the hole, distance between the ball and the hole, and path for goal achievement based on visual information during the golf-putting motion, and this information is used for preplanning the process of motor commands to decide the direction and distance of putting [8]. This visual information on targets is continuously provided in a short-distance task, whereas it could be limited for a target located in a relatively long distance. Thus, it is considered that if external components are limited, meaning that if a visual feedback that is important to the provision and processing of information required for performance is limited, performers would be changed in a way that proprioceptive information takes precedence simultaneously and immediately in a target task performance. Thereby, the present study considered that although there would be no difference in performance affected by feedbacks on external focus of attention and internal focus of attention under the situation where visual information on the target is constantly available, the effects of the focus of attention would be different in the performance of a long-distance putting task, because the visual feedback on targets is limitedly provided. Therefore, in the present study, we aimed to investigate the effects of the internal focus of attention and external focus of attention on the accuracy of task performance depending on the distance of the putting task under the condition of limited visual feedback information. Investigating the effect of the limitation of visual information on the changes in the focus of attention would suggest the direction for a more effective feedback on the focus of attention and more effective learning.

2. MATERIAL & METHODS

2.1. Study participants

The participants of the present study were 30 male and female college students in their 20s, who were right-handed and had no previous experience in golf putting. The participants were randomly allocated to the internal focus of attention group, the external focus of attention group, or the control group with 10 participants per group.

2.2. Experimental task and tools

The present study employed a golf-putting task, in which a golf-putting mat with a 1.8-m width and 8-m length was used. The participants putt the ball to the hole with a 10.8-cm diameter, as close as possible at the spots 1 m, 3 m, and 5 m away from the hole, respectively, in which the dependent variables were errors in distance. The level of the mat was adjusted with a leveler in order to secure the accuracy of the mat lie, and a score board of 1.5 m width and 1.5 m length was made and used on the mat <Figure 1>. Clevett's putting test was adapted in the present study as a scoring system, and the performance errors of dependent variables were set to be distributed from 0 point to ±28 points. Thirty white balls and five putters (Ping Anser) were used as tools in the experiments.

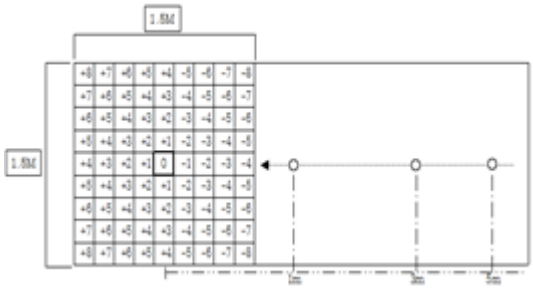

***Figure 1**. Experimental setting and score board*

2.3. Experimental procedure

Each participant signed a consent form before participation and was fully aware of instructions related to the experiments. The 30 participants were randomly divided into three groups: the internal focus of attention group, external focus of attention group, and control group. Thereafter, the participants from each group watched a video on lessons related to putting required for this study, under the same environment and similar conditions. Each participant performed a total of three practice putts, one time per distance, and then participated in the experiment. Each participant was tested by using a golf-putting task in a total of 30 times with 10 times for each distance (1 m, 3 m, and 5 m), which resulted in a total of 300 test results from a total of 100 times of putting task per group. To control the effects of repetitive practice, no instruction on distance for 30 times of performance was given before the experiment, the continuous performance of the task for the same distance was avoided, and the distances were randomly distributed on site. The internal focus of attention group was instructed to pay attention to their own bodies as a direct expression before the golf-putting task, whereas the external focus of attention group was asked to concentrate on metaphoric and figurative information related to performance, as well as to tool-related information

2.4. Data analysis

Data from the present study were analyzed by using the Excel 2010 program to identify the accuracy, directionality, consistency, and overall trend of errors, in which scores of absolute error, constant error, variable error, and total error were calculated, and mean values were also calculated according to distance. Data collected in this way were analyzed by using the SPSS Statistics 22 program, in which two-way ANOVA with repeated measures were performed to analyze the differences in absolute error, constant error, variable error, and total error depending on the distance in each group. All data that showed significant differences in each analysis were subjected to a post-hoc test (Tukey's HSD), and the statistical significance level was set at $p < 0.05$.

3.RESULTS

The mean values and standard deviations of absolute error were calculated to measure the accuracy constant error, in order to measure directionality, variable error to measure consistency, and total error to determine the overall trend of goal achievement by distance (1 m, 3 m, and 5 m) in each group. The results of the analysis are described below.

3.1. Absolute error

ANOVA analysis was performed to evaluate the effects of group and distance on absolute errors by the focus of attention, which resulted in $F(2,18) = 84.169$ ($p = .000$) for distance and $F(2,18) = 6.793$ ($p = .006$) for group. The major effects appeared at the $p < .05$ significance level, whereas there was no interaction effects between group and distance. A post-hoc test on the distances that had major effects identified that the absolute error increased as the distance increased from 1 m to 5 m ($p < .05$).

3.2. Constant error

ANOVA analysis was performed to investigate the differences in constant errors of group and distance according to the focus of attention, and no significant difference was found in constant error by group, as shown in <Table 3-1>. In contrast, major effects were found in constant error depending on distance ($F(2, 18) = 7.413$, $p = .004$), and interaction effects ($F(4, 36) = 4.301$, $p = .006$) were also found by group and distance ($p < .05$). A post-hoc test was performed by using the group and distance that showed an interaction, and no significant difference was found in the internal focus of attention group and the external focus of attention group depending on distance <Figure 2>. However, there were significant differences between the internal focus of attention group and the control group ($F(1. 9) = 27.520$, $p = .001$), and between the external focus of attention group and the control group ($F(1, 9) = 13.648$, $p = .005$) depending on distance. The external focus of attention group showed a significantly lower constant error in 5 m than in 1 m, and the control group also had a significant lower constant error in 5 m than in 1 m and 3 m ($p < .05$).

3.3. Variable error

ANOVA analysis was performed to investigate the differences in variable errors of group and distance, and no significant difference was found in variable errors by group at $p < .05$, as shown in <Table 4-1>. In contrast, a variable error depending on distance was $F(2, 18) = 58.821$ ($p = .000$), showing a significant difference and a major effect at $p < .05$. On the contrary, there were no interaction effects depending on group and distance. A post-hoc test was performed by using distances that showed major effects, and a significant difference and higher variable errors were found as the distance

increased from 1 m to 5 m ($p < .05$).

3.4. Total error

ANOVA was performed to investigate the differences in total errors of group and distance, and major effects depending on group and distance were found, as shown in <Table 5-1>. The total errors were $F(2, 18) = 6.000$ ($p = .010$) for group and $F(2, 18) = 98.081$ ($p = .000$) for distance, both of which showed a significant difference at $p < .05$. In contrast, there were no interaction effects depending on group and distance. A post-hoc test was performed by using distances that showed major effects, and the total error by distance showed a significant difference and a higher value as the distance increased from 1 m to 5 m ($p < .05$).

4. DISCUSSION

The present study was aimed at investigating the effects of internal focus of attention and external focus of attention on golf-putting task performance depending on distance, and the dependent variables were absolute error, variable error, constant error, and total error, by which the accuracy, consistency, and directionality of putting performance, and the overall trend of goal achievement were analyzed. There was no distinctive effect in absolute error related with accuracy between groups depending on distance. Newell, Carlton and Antoniou (1991) considered the environment, organism, and task as constraints that limit motor behaviors in humans and reported that humans would generate appropriate movements through the interaction between these constraints. Of the major variables in most studies on the focus of attention, the internal/external focus of attention is also affected by those constraints. The focus of attention could cause distinct results depending on various constraints, such as the difficulty and complexity of the task, and the proficiency and age of the performers. If instructors or coaches want to provide a particular focus of attention for the effective motor learning of performers, instruction on the focus of attention should be changed accordingly [6]. Therefore, according to these results, motor learning could be affected by various characteristics of learners, such as motive, character, and intelligence, in addition to cognitive style and environmental factors in a complex manner. A post-hoc test on distances that had major effects identified that the absolute error increased as the distance increased. In the motor control system, the vision plans the motor commands based on the condition of the four extremities and information about the task situation before starting the motion, and plays a controlling role during motion based on the changing task situations and continuous information about the positions of the four extremities after starting the motion. In other words, the visual system plays an important role as the source of sensory information by providing information about the characteristics of task situations and the positions and conditions of the four extremities working in motion during the performance of motion through a spatial target [3]. The human brain tends to highly rely on vision among the various sensory receptors of the body, and a series of information from other sensory receptors could be blocked or removed according to visual information. Therefore, the differences of error values that appeared as the distance increased regardless of the group supported the results of preceding studies, in which a consistent variable error was analyzed to determine the consistency and total error for obtaining the overall achievement. On the other hand, measurement of the constant error for directionality found a significant result. A post-hoc test was performed by using the groups and distances that showed interaction effects, and the error and deviation decreased more at the 5 m distance in the internal focus of attention group than in the external focus of attention group and the control group. These results were consistent with those of previous studies, in which the internal focus of attention group showed superior effects to those of the external focus of attention group [2] [9] [4], which reconfirmed the necessity for a differentiated provision of focus of attention depending on the proficiency and age of performers. Perkins-Ceccato et al. (2003) insisted that the external focus of attention should be more advantageous in learning for golfers with higher skill levels, whereas instruction by using the internal focus of attention could be more effective in learning for golfers with lower skill levels, in their study on instruction depending on the proficiency in golf depending on the internal/external focus of attention. Therefore, the present study could reconfirm the learning effects shown by preceding studies through experiments with beginners who had no previous experience on golf putting. On the other hand, the external focus of attention group exhibited no effects of instructions on the focus of attention compared with the other groups, while showing a similar pattern with the control group. These results indicate that as the provision of information about the external focus of attention increased the complexity of cognitive processes about the tasks for beginners without proficiency in motor tasks, it might not be effective but rather inhibitory. Therefore, we conclude that the performance levels of learners, and various variables, should be considered in the selection of instruction methods related to the focus of attention, for more effective learning.

5.CONCLUSIONS

In the present study, we investigated the differences between the internal focus of attention and external focus of attention depending on distance by using a golf-putting task. The results reconfirmed the learning effects of the internal/external focus of attention proposed in preceding studies, and the effects of visual information on task performance were analyzed according to dependent variables including absolute error, variable error, constant error, and total error. The results are summarized as follows: First, there was a difference in putting task depending on distance, whereas there was no difference by group. This supports the finding of preceding studies that visual information might interfere with learning with other sensory information, because of the preference for vision by the sensory system. Second, when inducing learning in beginners (nonexperts) through the focus of attention, the internal focus of attention could induce more effective learning than the external focus of attention. Thus, we conclude that the learning of nonexperts through the external focus of attention increases the complexity of the cognitive process, resulting in ineffective learning. Therefore, as the effects of the internal/external focus of attention are affected by various constraints, such as the difficulty and complexity of the task, as well as the proficiency of the performer, differentiated appropriate instructions depending on the learner would be required for motor learning, if a particular focus of attention is intended to be provided for the learners. As the human body is more dependent on vision than on other sensory receptors, the information obtained during the learning process might be blocked or removed by the visual information. Thus, further studies on the simultaneous processing of visual and proprioceptive information are deemed necessary.

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